Final Evaluation of Southern California Edison's Dynamic Rate Pilot

Daniel G. Hansen
Michael Ty Clark
Corey Goodrich

February 28, 2025

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

800 University Bay Dr #400
Madison, WI 53705-2299

608.231.2266
www.CAEnergy.com

Table of Contents

List of Figures

List of Tables

EXECUTIVE SUMMARY

The California Public Utilities Commission approved two dynamic rate pilots in Decision (D.)21-12-015 (Phase 2 Decision) to be implemented during a three-year period from 2022 through 2024. The Decision required mid-term and final evaluations of each pilot. This document represents the final evaluation of Southern California Edison's (SCE's) Dynamic Rate Pricing Pilot (Pilot).[1]

The Phase 2 Decision ordered SCE to "conduct a mid-term and final evaluation of its dynamic rate pilot…to assess the costs and benefits of real-time rates, including required infrastructure, manufacturer interest, and customer impacts...The evaluations shall include the following elements:"[2]

1. An evaluation of load responsiveness.
2. The monthly bill impacts of the Pilot dynamic rate in comparison to a customer's otherwise applicable tariff (OAT).
3. An evaluation of the cost recovery to assess the impact of any under-collection of revenues associated with the Pilot.

The dynamic rate design in the Pilot employed a "two-part" pricing method, in which the customer is provided a subscription of a fixed quantity of electricity (the "subscription" load) priced at an OAT equivalent rate and based on historical customer usage from the year prior. The subscription method provides the customer with protection, flexibility, and predictability. Customers in the Pilot stayed on their current OAT and were converted to monthly calendar billing cycles to align with the subscription energy load profiles. A customer "shadow bill" was then calculated each month, reflecting the amount that would be owed or saved under the Pilot pricing method.

SCE bundled customers participated in the Pilot via Automation Service Providers (ASPs) who have installed automated technologies to manage selected electrical end uses at customer sites. SCE did not market the Pilot to customers or directly enroll them into the Pilot and participants were often customers of the ASPs prior to enrollment. This minimized SCE's recruitment costs. Multiple ASPs were engaged during the Pilot's development and deployment, but only three ASPs actively enrolled customers in the Pilot, with that customer data contributing to this report.

Southern California Edison (SCE) partnered with TeMix, Inc., a third-party market consultant and application software platform services provider, to host their software-as-a-service (SaaS) transactive platform (TeMix Platform™) for delivering the Pilot's dynamic pricing to ASPs. TeMix also provided analytical design support, application reviews, and operational services for various technical aspects of the Pilot. Their consulting services included collaborating with SCE's Rate Design Team on dynamic price designs and determining hourly price values. These values were calculated by the TeMix Platform and

[1] The other dynamic pricing pilot in the Decision relates to agricultural pumping customers served by Valley Clean Energy and Pacific Gas and Electric Company.

[2] Phase 2 Decision, Ordering Paragraph (OP) 62.

transmitted to the ASPs on a day-ahead schedule so that the ASPs could manage the end uses on behalf of their customers.

SCE contracted with another third-party consultant, GridX, to provide TeMix dynamic circuit load forecast models published daily for the SCE distribution circuits that serve the specific participants in the pilot. This information was used in the calculation of the hourly dynamic prices.

SCE directly contracted with the customer ASPs, who developed machine learning Agents to manage customer loads in response to the day-ahead dynamic prices communicated by TeMix using its protocols. The ASPs interact with the TeMix Platform to manage electric end-use technologies at customer sites, while integrating dynamic rates into the end-use technology operating schedules. TeMix and the ASPs managed the Agents to schedule the operation of devices based on the hourly dynamic prices, weather inputs, other data, and the devices' physical constraints. This schedule is then used to manage the hourly pricing transactions during each day to optimize the customer's electrical costs.

During the Pilot, participating customers continue to receive and pay their OAT bill each month on a calendar basis. Additionally, the TeMix platform calculates a "shadow bill" each month, reflecting the customer's energy costs associated with the Pilot pricing method. However, this shadow bill is not settled with the customer's OAT bill each month. Instead, at the end of a full year of Pilot participation[3], the total OAT bill over twelve months is compared to the total shadow bill over the same period for settlement. If the shadow bills are lower than the OAT bills, the customer receives an incentive payment for the difference. Conversely, if the shadow bills are higher than the OAT bills, the customer does not owe any additional payment to SCE.

There were 38 Pilot participants that participated at some point through September 2024 (one opted out in 2024). July 2023 was the first month in which a customer became eligible to receive shadow bill credits after one year of Pilot participation, though most of the customers' eligibility began later in 2023. Twenty-two of the enrolled customers had validated shadow bills available for inclusion in this report, with 4 to 15 months of available data within the July 2023 through September 2024 timeframe.

The Pilot framework is based on an innovative dynamic rate design that required the creation of new hourly pricing models with interfaces to the CAISO; GridX for circuit load forecasts; SCE for current and historical meter data, OAT billing data, and OAT-based subscription costs; and ASPs and SCE for customer enrollment information. While many of the early challenges of developing these unique and unprecedented Pilot processes are now substantially resolved, their resolution contributed to schedule delays as the Pilot evolved, resulting in the smaller data set of active customers available for this report than may have been expected when the Pilot was originally executed.

[3] Net Energy Metering customers will receive their shadow bill after the end of their relevant period.

Findings

Our study examines customer outcomes during their participation in the Pilot in the following ways:

- Comparisons of peak-period energy usage shares before and during the Pilot.
- A comparison of usage and prices on high-price days and comparison days.
- Statistical estimates of the effect of changes in the dynamic hourly price ratios (peak to off-peak) on the share of peak-period usage.
- Comparisons of shadow bills and OAT bills.
- Feedback from the three active ASPs and TeMix.
- Feedback from SCE.

The key takeaways we have from the Pilot are described below.

- The evaluation of load responsiveness found the following:
  - The ASPs in the Pilot reported the ability to successfully respond to the hourly dynamic price signals from TeMix. ASPs were able to integrate technologies (primarily smart thermostats) in the Pilot that responded to the ASP Agent schedules based on the day-ahead price signals without customer intervention.
  - The analysis did not find evidence of consistent and/or large changes in hourly energy usage due to customer price response. Possible explanations for this finding include:
    - Extended time required to set up and implement Pilot activities, including time for the ASPs to refine their response algorithms, time to acclimate customers to the Pilot (e.g., ensure they understand the kinds of changes they can expect to experience as their AC units respond to prices), and time to produce information that provides ASPs and customers with feedback to understand the value of their participation and evaluate how they can improve performance.
    - The shadow bill credit methodology gives customers an incentive to simultaneously pay attention to OAT rates and dynamic prices. It is possible that the ASPs prioritized reducing costs from the OAT during the Pilot period as those were more visible monthly to customers (shadow bills were not). Because of the "dual incentives" issue, the Pilot was not designed to obtain statistically valid estimates of customer response to dynamic prices.

        - Hourly price differences from the dynamic rates may not have been high enough to induce significant price responses. At a given time, ASPs and customers may have prioritized maintaining comfort over the possible shadow bill savings available from shifting air conditioning loads.

- The monthly bill impacts of the Pilot dynamic rate (shadow bill) in comparison to a customer's OAT showed 41% (9 of the 22) of the customers evaluated in this report saved money on the Pilot. At the time of this evaluation:[4]

    - 4 of 13 residential customers were on track to receive a credit averaging 2.1% of their OAT bill.

    - 9 of 13 residential customers had shadow bills that were, in aggregate, 6.1% higher than their OAT bills.

    - 5 of 9 commercial customers were on track to receive a credit averaging 4.7% of their OAT bill.

    - 4 of 9 commercial customers had shadow bills that were, in aggregate, 8.3% higher than their OAT bills.

- The evaluation of cost recovery concluded that the customer's subscription load profiles were the most important factor in determining whether a customer was due a shadow bill credit. The optimal method of subscription pricing (e.g., whether/how to update quantities over time, how to deal with NEM and electric vehicle adoption) is a topic worthy of in-depth research that is beyond the scope of this study.

- The ASPs reported that they did not receive timely information on shadow bills and credits as expected for customer communications. The Pilot experienced significant delays in providing information to ASPs due to implementation issues and a largely manual infrastructure (e.g., customer-specific shadow bill spreadsheets).

- ASPs suggested that customer engagement could be improved by providing closer to real-time feedback and the ability to set preferences (e.g., desired temperature ranges) in a smartphone application (or something similar).

[4] Note that the Pilot credit summaries presented here in the evaluation are based on all available months for each customer. For the actual shadow billing, the shadow bill credit calculation for customers was conducted at the end of their relevant period for NEM customers and at the end of the 12 months of participation for non-NEM customers, with the months in the following period being included in a subsequent shadow bill credit calculation. This change in the timing of the calculation may affect whether a customer received a credit, as the calculation is cumulative over the shadow bill period.

- ASPs report that intra-day price variation needs to be higher to provide sufficient incentives to shift loads. It appears that the existing TOU rates in the customer OATs often provided higher incentives to shift.[5]

- Consider implementing a formal testing algorithm (i.e., the randomized treatment days used by one of the ASPs) on a more widespread basis to assist in evaluating the efficacy of the Pilot tariff in shifting loads enrolled in the program from peak to off-peak periods, compared to non-participant loads.

[5] Even if one assumes that the Pilot provides the "correct" incentive to shift loads and the TOU rates provide bill reductions that are larger than the avoided costs, a customer will be likely to choose the TOU rate if it provides a higher reward for their usage changes.

1. INTRODUCTION AND PURPOSE OF THE STUDY

1.1 Regulatory Background

On November 19, 2020, the California Public Utilities Commission (Commission) initiated Phase 1 of Rulemaking (R.)20-11-003 (Reliability OIR) to establish policies, processes, and rules to ensure reliable electric service in California in the event of an extreme weather event in 2021. This rulemaking was designed to identify the near-term actions the Commission proposes to prepare for a possible extended heat storm, setting forth the process for obtaining stakeholder and respondent input on the proposed actions, and establishing a schedule that would allow it to adopt relevant changes to its processes, programs and rules in advance of the summer of 2021.

On March 25, 2021, the Commission issued D.21-03-056, directing the three California electric investor-owned utilities (IOUs) to take specific actions to decrease peak and net peak demand and increase peak and net peak supply to avert the potential need for rotating outages during the summers of 2021 and 2022, similar to what occurred in summer 2020. The actions included increased media outreach, modifications to existing demand response programs, the creation of new demand response pilots, and other guidance.[6]

On May 25, 2021, the Energy Division (ED) staff held a public workshop entitled, "Forward Looking Vision: Advanced Distributed Energy Resources (DERs) & Demand Flexibility Management."[7] During the workshop, ED outlined a six-step roadmap to establish a unified, universal, dynamic economic signal (UNIDE) to help meet similar goals as defined in the OIR but through enhanced customer demand flexibility response to market-based dynamic pricing. The UNIDE roadmap presentation by ED staff was not part of an official proceeding but rather it requested voluntary industry input on how to best use flexible devices and decentralized DERs to assist in meeting goals highlighted in the Reliability OIR and other proceedings.

On July 30, 2021, Governor Newsom signed an emergency proclamation to "free up energy supply to meet demand during extreme heat events and wildfires that are becoming more intense and to expedite deployment of clean energy resources this year and next year."[8] In response to the Governor's emergency proclamation, on August 2, 2021, the assigned Administrative Law Judge initiated Phase 2 of the Reliability OIR. On December 6, 2021, the Commission issued D.21-12-015 (Phase 2 Decision), which directed the IOUs to take additional actions to prepare for potential extreme weather in the summers of 2022 and 2023.

---

[6] D.21-03-025: https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M372/K335/372335522.PDF

[7] Presentation available at: https://www.dret-ca.com/wp-content/uploads/2022/02/UNIDE-Presentation-5-2021.pdf

[8] See Press Release from the Office of Governor Gavin Newsom available at: https://www.gov.ca.gov/2021/07/30/governor-newsom-signs-emergency-proclamation-to-expedite-clean-energy-projects-and-relieve-demand-on-the-electrical-grid-during-extreme-weather-events-this-summer-as-climate-crisis-threatens-western-s/

The Phase 2 Decision authorized SCE to conduct a demonstration pilot of the TeMix "RATES" platform (or the TeMix proposed "Pilot UNIDE Program") for a three-year period (2022 to 2024) and approved SCE's requested $2.5 million budget for the Pilot.[9] The CPUC authorized the Pilot so SCE could "conduct comprehensive studies that fully assess the costs and benefits of real-time rates, including required infrastructure, manufacturer interest, and customer impacts."[10] The Pilot was to be administered under SCE's Demand Response (DR) Emerging Markets and Technologies program authorized in D.17-12-003.[11]

Ordering Paragraph (OP) 63 of the Phase 2 Decision directed SCE to submit a Tier 2 advice letter (AL) within 30 days of the issuance of the Decision that included, but was not limited to, the following elements: (1) Pilot scope, (2) Pilot partners, (3) shadow bill implementation, (4) Pilot dates, and (5) Pilot tariff design. SCE submitted ALs 4684-E and 4684-E-A (Pilot ALs) to meet the requirements of OP 63, which were approved on April 29, 2022.[12] The Pilot officially started on May 1, 2022.

On June 22, 2022, ED issued the white paper and staff proposal entitled "Advanced Strategies for Demand Flexibility Management and Customer DER Compensation", that elaborated on a comprehensive policy roadmap generally referred to as the California Flexible Unified Signal for Energy (CalFUSE) framework.[13] On July 14, 2022, the CPUC initiated R.22-07-005 "Order Instituting Rulemaking to Advance Demand Flexibility Through Electric Rates" (Demand Flexibility OIR or DFOIR) to, among other things, "advance demand flexibility pursuant to strategies identified in the Demand Flexibility Whitepaper or by a working group."[14]

Since initiating the Pilot in May 2022, SCE has been moving forward in accordance with the Pilot scope as outlined in its Pilot ALs. SCE has engaged Pilot partners who have been enrolling customers and has also been developing internal processes for streamlining how the ASPs and their enrolled customers interconnect with the TeMix dynamic pricing platform. In addition, SCE and TeMix also developed the dynamic price parameters and subscription functions, implemented the process to provide shadow bills for customers enrolled in the Pilot, and calculate the bill credits as the Pilot progresses.

1.2 Purpose of the Evaluation

As directed by the Phase 2 Decision, SCE was required to submit a mid-term evaluation report no later than December 31, 2023 that presented a mid-term review of the Pilot, which assessed the "costs and benefits of real-time rates, including required

[9] Phase 2 Decision, p. 96, OPs 59 and 60

[10] TeMix UNIDE proposal: temix-opening-testimony-phase-2.pdf (ca.gov)

[11] Phase 2 Decision, p. 96

[12] SCE Advice Letters 4684-E and 4684-E-A are provided as an appendix to this report.

[13] CalFUSE white paper available at: https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/demand-response/demand-response-workshops/advanced-der---demand-flexibility-management/ed-white-paper---advanced-strategies-for-demand-flexibility-management.pdf

[14] Demand Flexibility OIR, p. 7

infrastructure, manufacturer interest, and customer impacts."[15] The final evaluation report is to be released no later than March 1, 2025. This study covers pilot activities through September 30, 2024.

Specifically, the Phase 2 Decision requires the evaluation to include:[16]

1. An evaluation of load responsiveness. SCE should evaluate the efficacy of the Pilot tariff in shifting loads enrolled in the program from peak to off-peak periods and should be compared to non-participant loads.
2. The monthly bill impacts of the Pilot dynamic rate in comparison to a customer's OAT.
3. An evaluation of the cost recovery which assess(es) the impact of any under-collection of revenues associated with the Pilot, similar to the evaluation required of the Valley Clean Energy dynamic rate pilot.

SCE bundled customers participated in the Pilot via ASPs who have installed automated technologies to manage selected electric end uses at the customer's site. SCE did not market the Pilot to customers or directly enroll them into the Pilot, and participants were often customers of the ASP prior to enrollment. This minimized SCE's recruitment costs. Multiple ASPs were engaged during the Pilot's development and deployment, but only three ASPs actively enrolled customers in the Pilot, with that customer data contributing to this report.

Southern California Edison (SCE) partnered with TeMix Inc., a third-party market consultant and application software platform services provider, to host their software-as-a-service (SaaS) transactive platform (TeMix Platform™) for delivering the Pilot's dynamic pricing to ASPs. TeMix, Inc., also provided analytical design support, application reviews, and operational services for various technical aspects of the Pilot. Their consulting services included collaborating with SCE's Rate Design Team on dynamic price designs and determining hourly price values. These values were calculated by the TeMix Platform and transmitted to the ASPs on a day-ahead schedule so that the ASPs could manage the end uses on behalf of their customers.

SCE contracted with another third-party consultant, GridX, to provide TeMix dynamic circuit load forecast models published daily for the SCE distribution circuits that serve the specific participants in the pilot. This information was used in the calculation of the hourly dynamic prices.

SCE directly contracted with the customer ASPs, who developed machine learning Agents to manage customer loads in response to the day-ahead dynamic prices communicated by TeMix using its protocols. The ASPs interact with the TeMix Platform to manage electric end-use technologies at customer sites, while integrating dynamic rates into the end-use technology operating schedules. TeMix and the ASPs managed the Agents to schedule the operation of devices based on the hourly dynamic prices, weather inputs, other data, and the devices' physical constraints. This schedule is then used to manage

[15] Phase 2 Decision, OP 62

[16] Phase 2 Decision, OP 62.

the hourly pricing transactions during each day to optimize the customer's electrical costs.

During the Pilot, participating customers continue to receive and pay their OAT bill each month on a calendar basis. Additionally, the TeMix platform calculated a "shadow bill" each month, reflecting the customer's energy costs associated with the Pilot pricing method. However, this shadow bill is not settled with the customer's OAT bill each month. Instead, at the end of a full year of Pilot participation[17], the total OAT bill over twelve months is compared to the total shadow bill over the same period for settlement. If the shadow bills are lower than the OAT bills, the customer receives an incentive payment for the difference. Conversely, if the shadow bills are higher than the OAT bills, the customer does not owe any additional payment to SCE.

There were 38 Pilot participants that participated at some point through September 2024 (one opted out in 2024). July 2023 was the first month in which a customer became eligible to receive shadow bill credits after one year of Pilot participation, though most of the customers' eligibility began later in 2023. Twenty-two of the enrolled customers had validated shadow bills available for inclusion in this report, with 4 to 15 months of available data within the July 2023 through September 2024 timeframe.

The Pilot framework is based on an innovative dynamic rate design that required the creation of new hourly pricing models with interfaces to the CAISO; GridX for circuit load forecasts; SCE for current and historical meter data, OAT billing data, and OAT-based subscription costs; and ASPs and SCE for customer enrollment information. While many of the early challenges of developing these unique and unprecedented Pilot processes are now substantially resolved, their resolution contributed to schedule delays as the Pilot evolved, resulting in the smaller data set of active customers available for this report than may have been expected when the Pilot was originally executed.

The report is organized as follows: Section 2 contains a description of the Pilot; Section 3 contains an evaluation of customer load response; Section 4 contains the Pilot and OAT bill comparisons; Section 5 discusses Pilot cost recovery issues; Section 6 contains a summary of stakeholder comments on the Pilot; and Section 7 provides a summary and conclusions.

2. DESCRIPTION OF THE DYNAMIC PRICING PILOT

2.1 Pilot Description

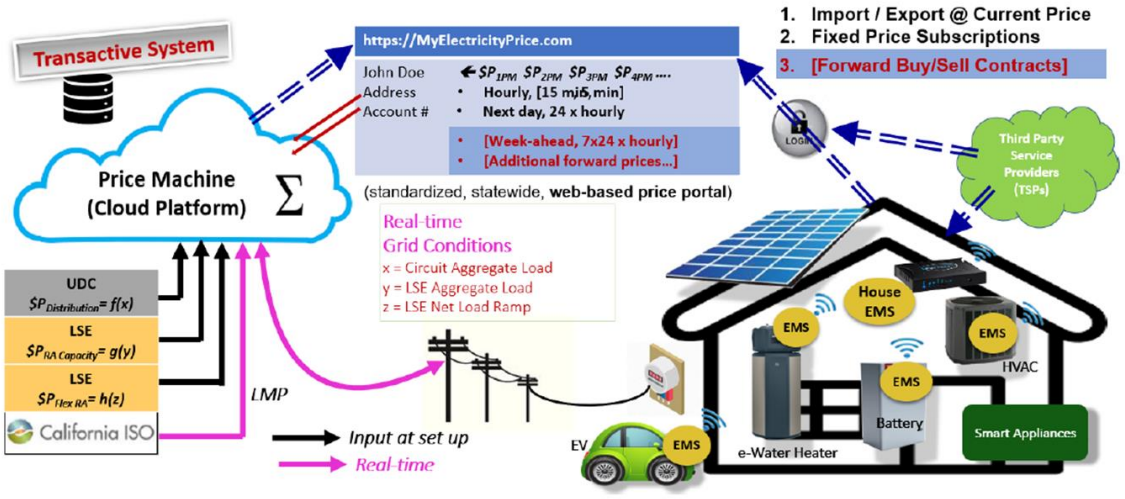
According to the Phase 2 Decision, the CPUC adopted a dynamic rate pilot that "uses TeMix's technology to facilitate the use of dynamic rates as an incentive to shift load for customers using electric vehicles, behind the meter energy storage, and similar flexible technologies."[18] The Decision ordered SCE "to conduct a dynamic rate pilot for the

[17] Net Energy Metering customers will receive their shadow bill after the end of their relevant period.
[18] Phase 2 Decision, p. 85.

purpose of studying how price responsive pilot projects can enhance system reliability in 2022 and 2023.[19]

The Pilot is described on the Demand Response and Emerging Technologies Website.[20] Figure 2.1[21] illustrates the components of the CalFUSE framework. Inputs to the price machine are provided by the utility distribution company (UDC) and load serving entity (LSE), which in this Pilot are both SCE. A third-party vendor, GridX, was used to provide circuit load forecasts. ASPs provide the technology that receives the Pilot prices and determine how devices are managed in response to those prices.

Figure 2.1: Graphical Illustration of the CalFUSE Framework



The dynamic rate design in the Pilot employs a "two-part" pricing method, in which the customer first subscribes to a fixed quantity of electricity (the "subscription" load) priced at an OAT equivalent rate and based on the customer's historical usage from the year prior, with separate usage profiles for weekends and weekdays.[22]

During intervals when a customer's usage differs from the subscription quantity, the customer will be billed (or will be credited) the ex-post price for the difference.[23] These

[19] Phase 2 Decision, Ordering Paragraph (OP) 59

[20] https://www.dret-ca.com/dynamic-rate-pilot/

[21] The figure is taken from page 6 of the June 22, 2022 Energy Division white paper entitled "Advanced Strategies for Demand Flexibility Management and Customer DER Compensation".

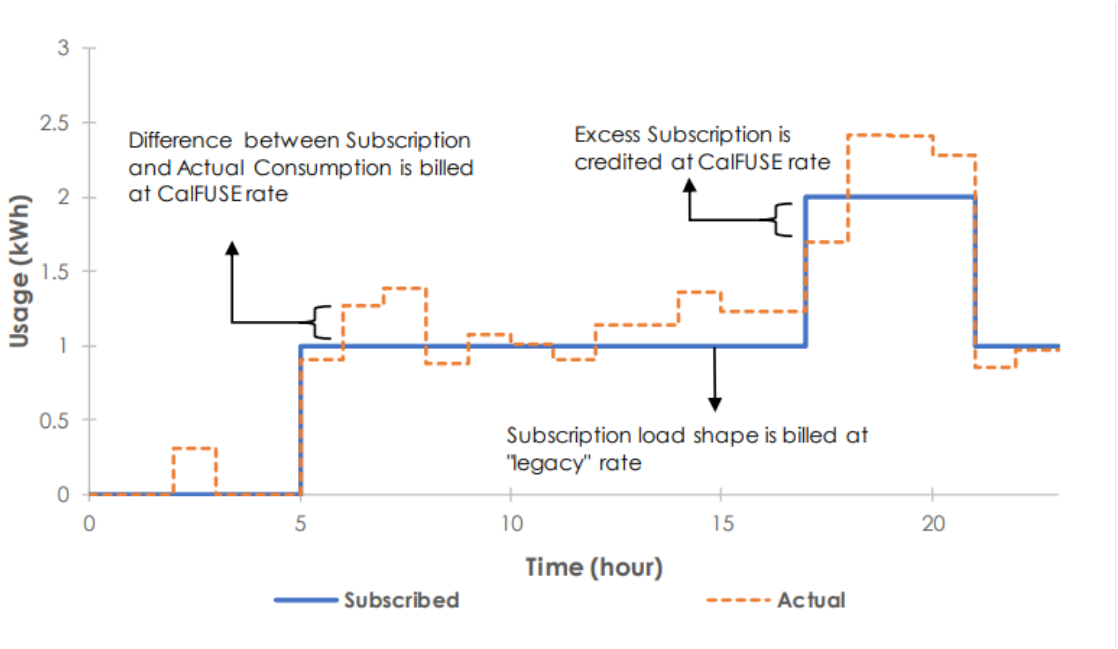
[22] SCE also considered basing the subscription on the average of three years to normalize for year-over-year changes in weather. For expediency, the Pilot opted to use only the most recent year because the effect of COVID on usage in 2020 and 2021 was adding more interpretive distortion than benefit.

[23] Initially, the Pilot platform allowed for day-ahead and hour-ahead bi-lateral transactions as well, but none of the customers active during the analysis period took advantage of that feature. However, the day-ahead and hour-ahead prices were available for the ASPs to plan the customers' load response. The day-ahead and hour-ahead prices are binding offers at which customers may transact for fixed quantities. For example, an ASP could direct the customer's thermostat to pre-

settlements were conducted for every five-minute interval of the day. For example, a customer whose load is declining over the course of an hour may be purchasing energy above its subscription early in the hour and selling (credited) its excess subscription load later in the hour. Beginning in May 2024, the Pilot transitioned to conducting settlements at the hourly level using day-ahead tenders.

The settlement process is illustrated in Figure 2.2 below, which is taken from the CalFUSE white paper.[24] In the figure, the "CalFUSE rate" is synonymous with the dynamic settlement price used in SCE's Pilot.

Figure 2.2 Example Showing the Subscription as a Hedging Product



The dynamic price tenders are set to recover the marginal energy costs, which reflect CAISO locational marginal prices (LMPs), long-run generation capacity marginal costs as vetted in Phase 2 of SCE's General Rate Case (GRC), long-run distribution capacity marginal costs also as vetted in Phase 2 of the SCE GRC, and other non-marginal revenue components and policy costs currently included in the tariffed retail rate.

The shadow bill calculation for month *m* can be represented with the equation below (where *i* indexes all 5-minute intervals during the month):

$$\text{Shadow Bill}_m = \Sigma_i \{(P^{Sub}_i \times Q^{Sub}_i) + P^{Dyn}_i \times (Q^{Obs}_i - Q^{Sub}_i)\}$$

cool during inexpensive hours for a fixed quantity above the subscription quantity and then sell back the excess subscription quantity for the later (presumably more expensive) hours in which the thermostat's temperature is allowed to rise.

[24] CalFUSE White Paper, page 67, available at: ED-White-Paper-Advanced-Strategies-for-Demand-Flexibility-Management-June-2022.pdf (dret-ca.com)

Table 2.1: Variables in the Shadow Bill Calculation

Variable	Description
P^{Sub}_i	Subscription price during time interval *i* in $/kWh
Q^{Sub}_i	Subscription quantity during time interval *i* in kWh
P^{Dyn}_i	Dynamic price during time interval *i* in $/kWh
Q^{Obs}_i	Observed (metered) usage during time interval *i* in kWh

Table 2.2 replicates a table from the CalFUSE white paper that highlights the benefits of fixed load shape subscription pricing.

Table 2.2: Benefits of Fixed Load Shape Subscriptions

Protection	Flexibility	Predictability
• Protect customers against bill volatility by allowing a forward contract based on predictable prices. • Ease customers' transition to real-time prices.	• Accommodate changed home conditions. • Encourage opportunistic load shift.	• Stabilize revenue recovery for utility distribution companies (UDCs), load serving entities (LSEs), etc.

The subscription component of the Pilot pricing structure serves two purposes. First, it reduces the customer's exposure to the potential variability of "pure" dynamic prices, with the customer only being billed (or being paid) those prices for usage on the margin that deviates from their subscription load.[25] In the extreme, a customer who uses exactly its subscription load during an hour will not be billed for the dynamic price at all. This risk mitigation can be especially important during extended periods of highly dynamic prices. Second, it provides a means of linking the overall bill level to the retail rate and the authorized revenue requirement used when establishing the retail rate. If dynamic prices are designed to reflect the utility's marginal cost, in theory, the deviations of the bill from the OAT-based subscription level should be matched by the avoided costs associated with the customer's load response. If dynamic prices are designed to reflect the utility's marginal cost and set to recover the utility's authorized revenues, deviations of a customer's electricity use from the subscription ensures that the customer bill changes are held in parity with the OAT.

[25] In contrast, under a "one-part" real-time pricing program, the customer pays the hourly price for all usage in the hour.

2.2 Participant Summary

Customers participated in the Pilot via ASPs who installed and managed enabling technologies at the customer's site. These Pilot participants may have been customers of the ASP prior to the Pilot. Three ASPs were active in the Pilot, which we will refer to as ASP A, ASP B, and ASP C to anonymize their names.

The 22 of 38 Pilot participants for which we have validated shadow bill data for some part of the period from July 2023 through September 2024 are shown in Table 2.3. Thirteen are residential customers served by ASP C, two of which are net energy metered (NEM) customers. These customers are distributed across five rates: Domestic, TOU-D-A, TOU-D 4-9PM, TOU-D 5-8PM, and TOU-D-PRIME.

ASP A serves seven commercial customers in the education sector, all of which are NEM customers, with six served on TOU-GS-2-R and one served on TOU-GS-3-R (legacy TOU rates with a noon to 6 p.m. summer on-peak period). ASP B serves the remaining two commercial customers, one of which is a NEM customer served on TOU-GS-2-D (the default rate for the 20 to 200 kW class), with the other customer served on TOU-GS-3-D.

Table 2.3: Pilot Participant Characteristics

ID	Dates Available	NEM Type	Rate	Customer Type	Circuit Name
A-001	8/23 to 9/24	NEM 1.0	TOU-GS-2-R	Commercial	[redacted]
A-002	8/23 to 4/24	NEM 1.0	TOU-GS-2-R	Commercial	
A-005	10/23 to 9/24	NEM 1.0	TOU-GS-3-R	Commercial	
A-006	12/23 to 9/24	NEM 1.0	TOU-GS-2-R	Commercial	
A-007	10/23 to 9/24	NEM 1.0	TOU-GS-2-R	Commercial	
A-008	10/23 to 9/24	NEM 1.0	TOU-GS-2-R	Commercial	
A-009	10/23 to 5/24	NEM 1.0	TOU-GS-2-R	Commercial	
B-004	8/23 to 9/24	NEM 2.0	TOU-GS-2-D	Commercial	
B-005	7/23 to 9/24		TOU-GS-3-D	Commercial	
C-002	10/23 to 9/24		TOUD-4-9PM	Residential	
C-004	8/23 to 9/24		TOUD-5-8PM	Residential	
C-024	10/23 to 9/24		TOUD-5-8PM	Residential	
C-030	10/23 to 9/24		TOUD-4-9PM	Residential	
C-043	10/23 to 9/24		TOUD-4-9PM	Residential	
C-044	3/24 to 9/24		TOUD-4-9PM	Residential	
C-045	10/23 to 9/24	NEM 1.0	DOMESTIC	Residential	
C-051	12/23 to 4/24		TOUD-5-8PM	Residential	
C-052	12/23 to 4/24	NEM 2.0	TOU-D-A	Residential	
C-053	12/23 to 9/24		TOUD-4-9PM	Residential	
C-054	12/23 to 9/24		DOMESTIC	Residential	
C-055	1/24 to 9/24		TOU-D-PRIME	Residential	
C-056	1/24 to 4/24		TOU-D-PRIME	Residential	

As of this writing, SCE has a total 37 enrolled customers that are receiving shadow bills, plus a 38th participant that de-enrolled from the Pilot. There are 18 Pilot participants in addition to those listed in Table 2.3 for which we did not receive validated shadow bill information in time for the analysis to be conducted.

3. EVALUATION OF LOAD RESPONSIVENESS

3.1 Methodological Overview

In this section, we present information about customer response to Pilot prices. Five sub-sections follow, including the following:

- A summary of the dynamic price tenders during the analysis period.
- A comparison of average price tenders and OAT rates by TOU pricing period.
- A comparison of usage and prices on high-price days and comparison days.

- Estimates of changes in on-peak usage relative to the pre-Pilot period.
- Estimates of within-Pilot response to prices.

It is important to note that customers simultaneously face OAT and Pilot prices, making it difficult to distinguish which prices are driving any observed price responsive behavioral changes. That is, the customer continues to pay its OAT bill during the Pilot and only receives a Pilot credit if its cumulative shadow bill after 12 months is less than its cumulative OAT bill during the same period. Therefore, the customer has an incentive to continue to be mindful of its OAT rates during the Pilot. For example, ASP interviews confirmed that they continued to consider the effect of OAT demand charges when evaluating whether/how to shift usage across hours.

In the analyses of load changes in response to price signals, the focus is on customer-specific estimates to explore the variation in response across customers. Because our sample of customers is small and heterogeneous (i.e., the 22 customers range from small residential customers to larger commercial customers), program-level summaries are not emphasized due to their lack of representativeness. That is, the program-level results would be dominated by the largest customers and those customers ([redacted]) may not be representative of the response that would be obtained if the rate was deployed at scale.

3.2 Hourly Tender Price Summaries

This section summarizes the hourly day-ahead tenders (as corrected), which were transmitted to ASPs and devices. Beginning in May 2024, the day-ahead prices were used in settlement. Prior to that time, settlement occurred at 5-minute ex-post prices, but the day-ahead hourly tenders would have been the prices that were used when determining whether and how to change customer usage in response to prices.

For a given hour, the tender can vary across circuits and according to the customer's OAT rate (which serves as the basis for adders). Therefore, there isn't a single set of tenders we can summarize that reflects the experience of all Pilot customers. We present a series of figures that show how tenders varied across customers and time.

Figure 3.1 shows the variability in average and maximum day-ahead tenders across customers. We select February 2024 because it is a month in which all included customers have data, allowing us to examine the variability in prices across all customers. Maximum tender prices in this figure are between $0.80 and $0.90. Figure 3.2 shows the same information for September 2024, for which a few customers do not have data, but the maximum prices are higher. You can see some variability in the maximum price across customers, ranging from $1.50 to $2.04 per kWh.

Figure 3.1: Average and Maximum Tender Prices by ID, February 2024

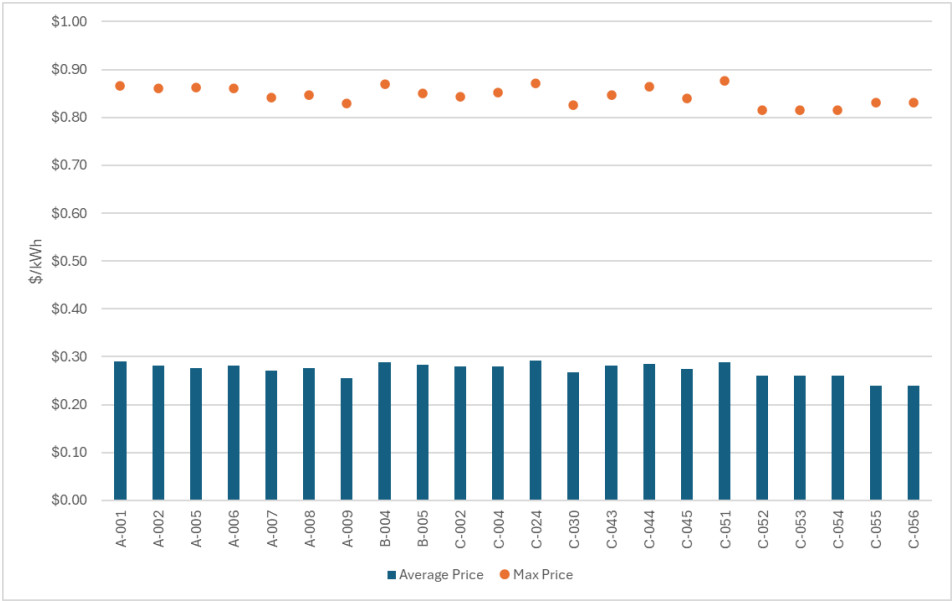
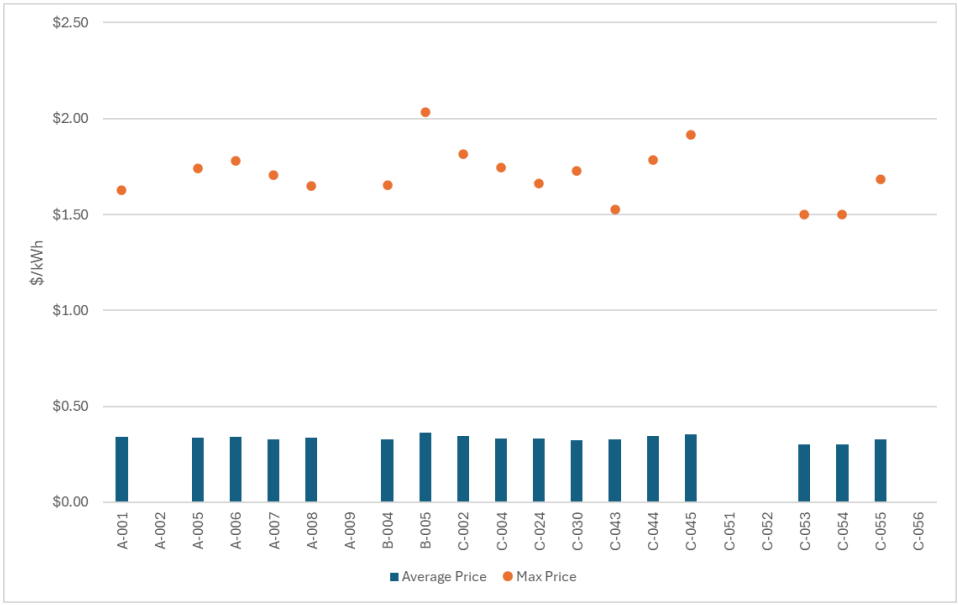


Figure 3.2: Average and Maximum Tender Prices by ID, September 2024



We selected a representative residential customer (C-004) to serve as the basis for a more in-depth exploration of the variability of tenders. This customer experienced average prices that were typical of other customers and had validated bills for almost all months included in the study (August 2023 through September 2024).

Figure 3.3 shows the monthly maximum tender and the average tender price in all hours and peak hours (5 to 8 p.m.) for C-004. Recall that the mid-term evaluation examined an August 2023 price spike ($2.35 per kWh for customer C-004), finding little evidence of response from the five customers enrolled at the time. The next highest price spike occurred in September 2024, at $1.75 per kWh. We will examine customer behavior during that time later in this section.

Figure 3.3: Average and Maximum Tender Prices by Month, C-004

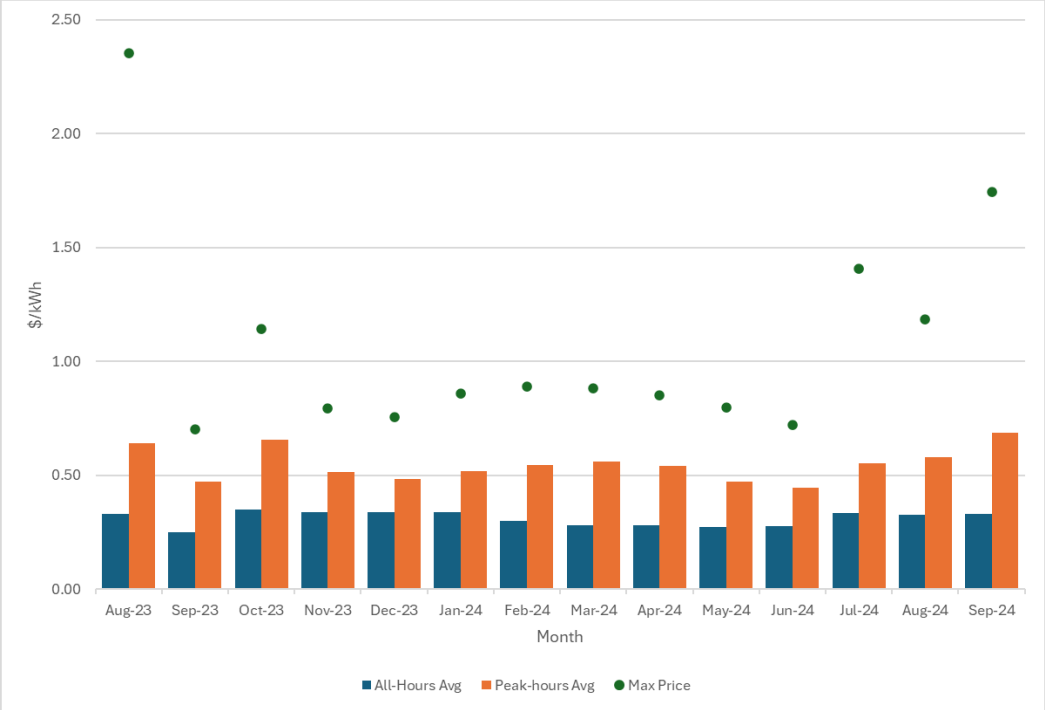
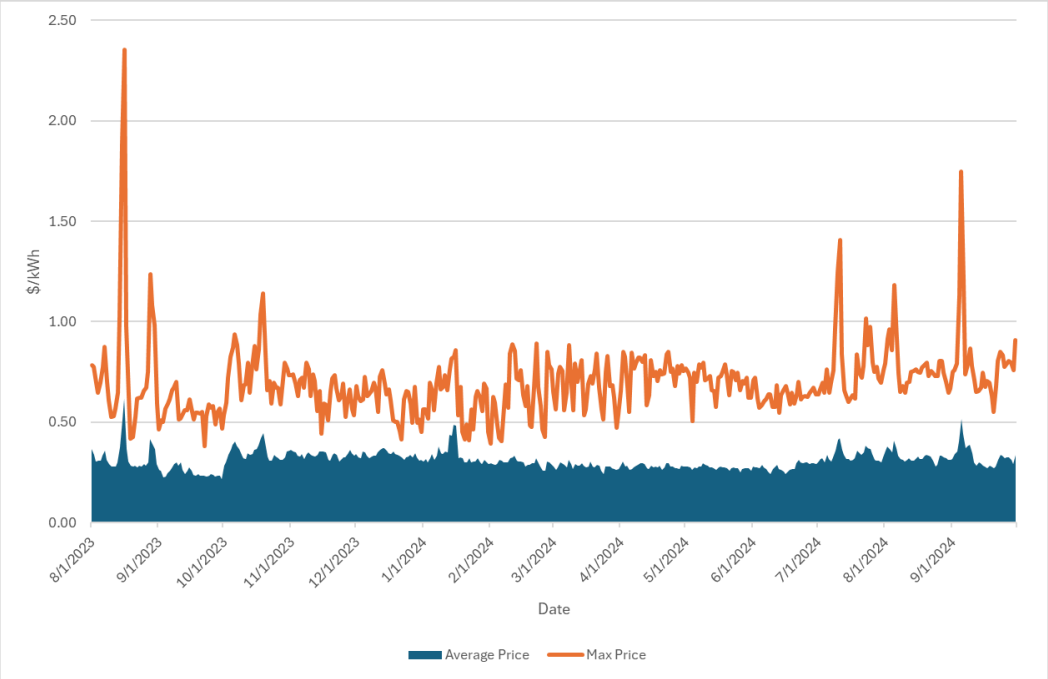


Figure 3.4 expands on Figure 3.3 by providing daily detail on the all-hours average and maximum tender prices. Price levels were fairly flat from November 2023 through June 2024, with some higher-priced days appearing later in the summer of 2024.

Figure 3.4: Average and Maximum Tender Prices by Date, C-004



Figures 3.5 and 3.6 change the focus from variability across dates to the variability across the hours of the day. Each figure shows a box-and-whisker plot[26] of the hourly tender prices, with Figure 3.5 representing winter months and Figure 3.6 representing summer months.[27]

Notice that the highest prices tend to occur during TOU on-peak hours, with hours-ending 17 through 20 (4 to 8 p.m.) having the highest winter prices and hours-ending 19 through 21 having the highest summer prices. The daily pattern of typical prices (looking at the means) tends to follow the pattern of the highest outlier prices, with the highest outlier prices limited to the same hours in which the highest average prices occur.

[26] In a box-and-whisker plot, the line in the middle of the box represents the median value, the bottom and top of the box reflect the 25th and 75th percentile values (respectively), and the highest and lowest lines represent the outlier values, excluding "outside values", which are defined as values above or below 1.5 x the interquartile range (the 25th – 75th percentile).

[27] For this customer, the available winter data is November 2023 through May 2024. The available summer data is August to October 2023 and June through September 2024.

Figure 3.5: Winter Hourly Tender Price Distributions, C-004

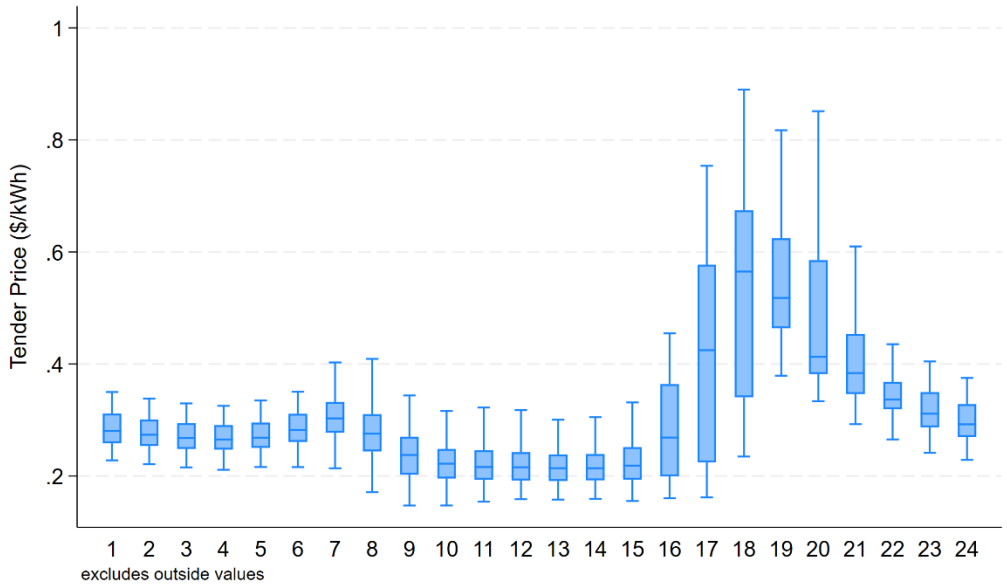
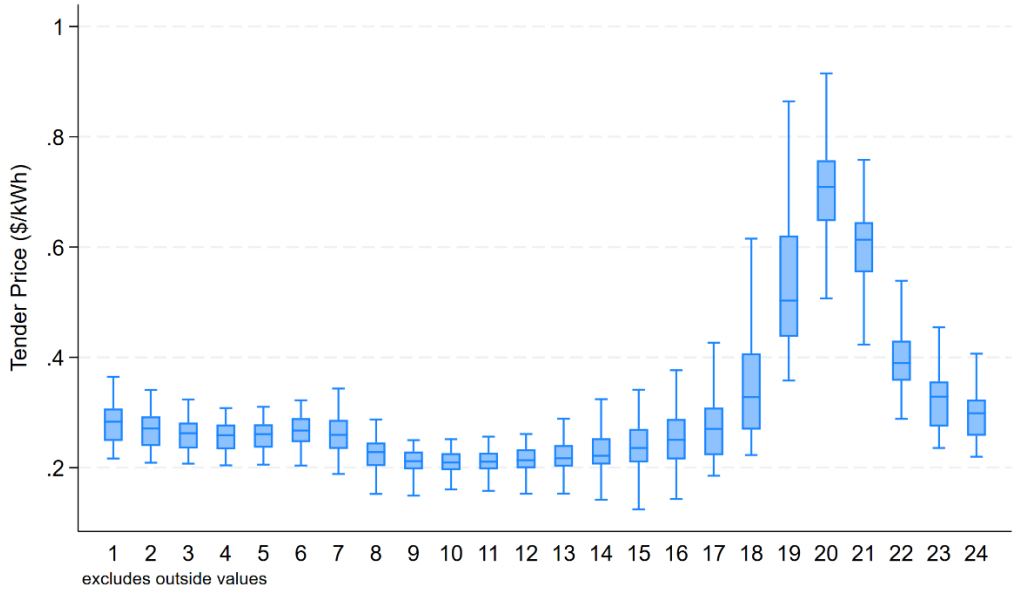


Figure 3.6: Summer Hourly Tender Price Distributions, C-004



3.3 Pilot Versus Otherwise Applicable Tariff Prices

As discussed later in Section 6, ASPs reported that the prices from the Pilot and subsequent motivation to shift load were often not as high an incentive as those offered by available TOU rates. In this section, we provide comparisons of OAT and Pilot prices for each customer.

In each table below, we summarize the average day-ahead tender price and OAT rate by TOU pricing period. (Only seasons for which we have data are included.) The average pilot price is the simple average of the hourly day-ahead tender prices within the pricing period, where the tenders have been adjusted for the fixed adders as appropriate. The tariff rate is the energy prices from the tariff, with the following caveats:

- Baseline credits (where applicable) are not included.
- Fixed $/kWh charges (e.g., Fixed Cost Recovery Charge and Modified Cost Allocation Mechanism (MCAM)[28] Charge) across all hours are not included.
- Peak-period (or Mid-peak period in winter) demand charges are included by dividing the demand charge by 100 (the approximate number of peak hours in a month) to convert it to a $/kWh effective energy charge. This is only relevant for TOU-GS-2-D and TOU-GS-3-D.[29]

While these comparisons are illustrative of average price differences, the values do not necessarily represent those that algorithms compare when determining a customer's load response. For example, ASP B reported that their method looks at prices during four-hour windows. If the average price during the first two hours is low enough relative to the average price during the second two hours, the thermostat will be instructed to pre-cool the customer's facility during the first interval so that usage can be curtailed in the second interval. As shown in Figure 3.6, price differences during various four-hour windows are likely to be smaller than the price differences across entire TOU pricing periods (i.e., 5 to 8 p.m. on-peak prices are quite a bit higher than off-peak prices on average, but the difference between 5 to 8 p.m. prices and those of the immediately preceding hours is smaller). In contrast, TOU rates are both known in advance and do not vary within pricing period. This leads to more discrete changes in incentives across TOU pricing periods relative to the dynamic prices.

The relationship between Pilot and OAT prices varies across rates. For residential rates, it is often the case that OAT rates are higher than Pilot prices (see Table 3.1a). It is common for the OAT rate to provide a higher incentive to shift from the summer On-Peak period to the Mid-Peak period than the Pilot rate for residential and commercial rates.

In Table 3.1b, which shows prices for TOU-D 5-8 PM, the dynamic prices are uniformly lower than the tariff rates. As we will show in Section 4, all three customers on this rate saved money on the Pilot. However, Table 4.2 shows that the customers had relatively little net usage to transact at dynamic prices, and their savings appear to be due to their subscription prices being lower than their average OAT prices paid.[30]

---

[28] The MCAM charge recovers the net cost associated with system reliability procurement ordered by the CPUC that SCE has procured on behalf of customers whose generation services are provided by certain Electric Service Providers or Community Choice Aggregators.

[29] Omitting this "effective energy charge" (the conversion of the on-peak demand charge into an on-peak $/kWh charge) and including only the TOU energy charge would make usage in the on-peak period appear to be less costly than it is. In practice, the demand charge results in different effective energy charges depending on a customer's load factor during the pertinent billing period.

[30] The potential causes of differences between the subscription price and average OAT price paid include a) changes in customer usage relative to the historical period that were due to customer

Table 3.1a: Average Energy Prices for TOU-D 4-9 PM

ID	Period	Avg. Pilot Price ($/kWh)	Tariff Rate ($/kWh)	Pilot – OAT* ($/kWh)
C-002	Summer On-Peak	$0.563	$0.603	-$0.040
	Summer Mid-Peak	$0.526	$0.489	$0.037
	Summer Off-Peak	$0.276	$0.377	-$0.100
	Winter Mid-Peak	$0.516	$0.532	-$0.016
	Winter Off-Peak	$0.306	$0.403	-$0.097
	Winter Super Off-Peak	$0.255	$0.366	-$0.111
C-030	Summer On-Peak	$0.520	$0.603	-$0.083
	Summer Mid-Peak	$0.498	$0.489	$0.009
	Summer Off-Peak	$0.259	$0.377	-$0.117
	Winter Mid-Peak	$0.461	$0.532	-$0.071
	Winter Off-Peak	$0.277	$0.403	-$0.126
	Winter Super Off-Peak	$0.214	$0.366	-$0.152
C-043	Summer On-Peak	$0.514	$0.603	-$0.089
	Summer Mid-Peak	$0.493	$0.489	$0.004
	Summer Off-Peak	$0.268	$0.377	-$0.108
	Winter Mid-Peak	$0.494	$0.532	-$0.038
	Winter Off-Peak	$0.292	$0.403	-$0.111
	Winter Super Off-Peak	$0.245	$0.366	-$0.121
C-044	Summer On-Peak	$0.554	$0.603	-$0.049
	Summer Mid-Peak	$0.515	$0.489	$0.026
	Summer Off-Peak	$0.281	$0.377	-$0.095
	Winter Mid-Peak	$0.472	$0.532	-$0.060
	Winter Off-Peak	$0.255	$0.403	-$0.148
	Winter Super Off-Peak	$0.206	$0.366	-$0.160
C-053	Summer On-Peak	$0.478	$0.603	-$0.125
	Summer Mid-Peak	$0.460	$0.489	-$0.029
	Summer Off-Peak	$0.241	$0.377	-$0.135
	Winter Mid-Peak	$0.432	$0.532	-$0.101
	Winter Off-Peak	$0.255	$0.403	-$0.149
	Winter Super Off-Peak	$0.200	$0.366	-$0.166

*Differences in the Pilot and Tariff rates may not be exact due to rounding.

responses to Pilot prices; b) changes in customer usage relative to the historical period due to non-Pilot factors (e.g., weather differences or structural changes to the customer's facilities); or c) errors in the subscription pricing method. We did not find evidence of errors in the subscription pricing method, but we were not provided with the subscription calculations for all Pilot participants.

Table 3.1b: Average Energy Prices for TOU-D 5-8 PM

ID	Period	Avg. Pilot Price ($/kWh)	Tariff Rate ($/kWh)	Pilot – OAT* ($/kWh)
C-004	Summer On-Peak	$0.580	$0.754	-$0.174
	Summer Mid-Peak	$0.524	$0.564	-$0.040
	Summer Off-Peak	$0.272	$0.375	-$0.103
	Winter Mid-Peak	$0.536	$0.624	-$0.089
	Winter Off-Peak	$0.302	$0.410	-$0.107
	Winter Super Off-Peak	$0.248	$0.356	-$0.108
C-024	Summer On-Peak	$0.577	$0.754	-$0.177
	Summer Mid-Peak	$0.547	$0.564	-$0.017
	Summer Off-Peak	$0.288	$0.375	-$0.087
	Winter Mid-Peak	$0.546	$0.624	-$0.078
	Winter Off-Peak	$0.307	$0.410	-$0.103
	Winter Super Off-Peak	$0.264	$0.356	-$0.092
C-051	Summer On-Peak	N/A	N/A	N/A
	Summer Mid-Peak	N/A	N/A	N/A
	Summer Off-Peak	N/A	N/A	N/A
	Winter Mid-Peak	$0.544	$0.624	-$0.081
	Winter Off-Peak	$0.306	$0.410	-$0.104
	Winter Super Off-Peak	$0.254	$0.356	-$0.102

*Differences in the Pilot and Tariff rates may not be exact due to rounding.

Table 3.1c: Average Energy Prices for TOU-D-A

ID	Period	Avg. Pilot Price ($/kWh)	Tariff Rate ($/kWh)	Pilot – OAT* ($/kWh)
C-052	Summer On-Peak	N/A	N/A	N/A
	Summer Off-Peak	N/A	N/A	N/A
	Summer Super Off-Peak	N/A	N/A	N/A
	Winter On-Peak	$0.378	$0.539	-$0.161
	Winter Off-Peak	$0.254	$0.436	-$0.182
	Winter Super Off-Peak	$0.257	$0.200	$0.057

*Differences in the Pilot and Tariff rates may not be exact due to rounding.

Table 3.1d: Average Energy Prices for TOU-D-PRIME

ID	Period	Avg. Pilot Price ($/kWh)	Tariff Rate ($/kWh)	Pilot – OAT* ($/kWh)
C-055	Summer On-Peak	$0.543	$0.612	-$0.068
	Summer Mid-Peak	$0.513	$0.386	$0.126
	Summer Off-Peak	$0.261	$0.260	-$0.001
	Winter Mid-Peak	$0.440	$0.583	-$0.143
	Winter Off-Peak	$0.253	$0.240	$0.014
	Winter Super Off-Peak	$0.156	$0.240	-$0.084
C-056	Summer On-Peak	N/A	N/A	N/A
	Summer Mid-Peak	N/A	N/A	N/A
	Summer Off-Peak	N/A	N/A	N/A
	Winter Mid-Peak	$0.445	$0.583	-$0.138
	Winter Off-Peak	$0.259	$0.240	$0.020
	Winter Super Off-Peak	$0.164	$0.240	-$0.075

*Differences in the Pilot and Tariff rates may not be exact due to rounding.

Table 3.1e: Average Energy Prices for TOU-GS-2-D

ID	Period	Avg. Pilot Price ($/kWh)	Tariff Rate ($/kWh)	Pilot – OAT* ($/kWh)
B-004	Summer On-Peak	$0.512	$0.587	-$0.075
	Summer Mid-Peak	$0.487	$0.169	$0.317
	Summer Off-Peak	$0.267	$0.127	$0.141
	Winter Mid-Peak	$0.491	$0.230	$0.261
	Winter Off-Peak	$0.287	$0.139	$0.147
	Winter Super Off-Peak	$0.238	$0.097	$0.141

*Differences in the Pilot and Tariff rates may not be exact due to rounding.

Table 3.1f: Average Energy Prices for TOU-GS-3-D

ID	Period	Avg. Pilot Price ($/kWh)	Tariff Rate ($/kWh)	Pilot – OAT* ($/kWh)
B-005	Summer On-Peak	$0.684	$0.556	$0.128
	Summer Mid-Peak	$0.604	$0.158	$0.447
	Summer Off-Peak	$0.335	$0.122	$0.213
	Winter Mid-Peak	$0.482	$0.242	$0.240
	Winter Off-Peak	$0.283	$0.134	$0.149
	Winter Super Off-Peak	$0.239	$0.092	$0.147

*Differences in the Pilot and Tariff rates may not be exact due to rounding.

In Tables 3.1g and 3.1h, the OAT rate employs the legacy TOU period definitions. This creates an odd alignment of TOU prices and tender prices during the summer months. That is, the TOU on-peak period is noon to 6 p.m., but the highest hourly tender prices from the Pilot price tend to occur from 5 to 8 p.m. Therefore, we see the "inversions" in the tables, in which the summer on-peak average tender price is lower than the summer Mid-Peak average tender price.

Table 3.1g: Average Energy Prices for TOU-GS-2-R[31]

ID	Period	Avg. Pilot Price ($/kWh)	Tariff Rate ($/kWh)	Pilot – OAT* ($/kWh)
A-001	Summer On-Peak	$0.336	$0.583	-$0.247
	Summer Mid-Peak	$0.421	$0.308	$0.113
	Summer Off-Peak	$0.306	$0.165	$0.142
	Winter Mid-Peak	$0.345	$0.172	$0.173
	Winter Off-Peak	$0.295	$0.108	$0.187
A-002	Summer On-Peak	$0.385	$0.583	-$0.197
	Summer Mid-Peak	$0.442	$0.308	$0.134
	Summer Off-Peak	$0.320	$0.165	$0.155
	Winter Mid-Peak	$0.344	$0.172	$0.172
	Winter Off-Peak	$0.295	$0.108	$0.187
A-006	Summer On-Peak	$0.326	$0.583	-$0.256
	Summer Mid-Peak	$0.409	$0.308	$0.101
	Summer Off-Peak	$0.294	$0.165	$0.129
	Winter Mid-Peak	$0.329	$0.172	$0.157
	Winter Off-Peak	$0.283	$0.108	$0.175
A-007	Summer On-Peak	$0.285	$0.583	-$0.298
	Summer Mid-Peak	$0.390	$0.308	$0.082
	Summer Off-Peak	$0.286	$0.165	$0.121
	Winter Mid-Peak	$0.314	$0.172	$0.142
	Winter Off-Peak	$0.280	$0.108	$0.172
A-008	Summer On-Peak	$0.302	$0.583	-$0.280
	Summer Mid-Peak	$0.397	$0.308	$0.089
	Summer Off-Peak	$0.292	$0.165	$0.128
	Winter Mid-Peak	$0.317	$0.172	$0.146
	Winter Off-Peak	$0.282	$0.108	$0.174
A-009	Summer On-Peak	N/A	N/A	N/A
	Summer Mid-Peak	N/A	N/A	N/A
	Summer Off-Peak	N/A	N/A	N/A
	Winter Mid-Peak	$0.298	$0.172	$0.126
	Winter Off-Peak	$0.281	$0.108	$0.173

*Differences in the Pilot and Tariff rates may not be exact due to rounding.

[31] This rate has legacy TOU periods (e.g., noon to 6 p.m. summer peak).

Table 3.1h: Average Energy Prices for TOU-GS-3-R[32]

ID	Period	Avg. Pilot Price ($/kWh)	Tariff Rate ($/kWh)	Pilot – OAT* ($/kWh)
A-005	Summer On-Peak	$0.288	$0.525	-$0.237
	Summer Mid-Peak	$0.396	$0.276	$0.121
	Summer Off-Peak	$0.286	$0.154	$0.133
	Winter Mid-Peak	$0.320	$0.167	$0.153
	Winter Off-Peak	$0.282	$0.104	$0.178

*Differences in the Pilot and Tariff rates may not be exact due to rounding.

3.4 Usage on High-Price and Surrounding Days

From September 4 through 6, 2024, Pilot prices hit the highest levels of the summer of 2024. It may be instructive to examine customer usage profiles on those dates compared to surrounding dates. The price spikes appear to be caused by unusually high temperatures, making it difficult to find days that have similar temperatures but more moderate prices. Rather than selecting a specific date to serve as a comparison day, we show how hourly usage, prices, and temperatures vary from the week before the price spikes through the following week, excluding weekends and Labor Day.

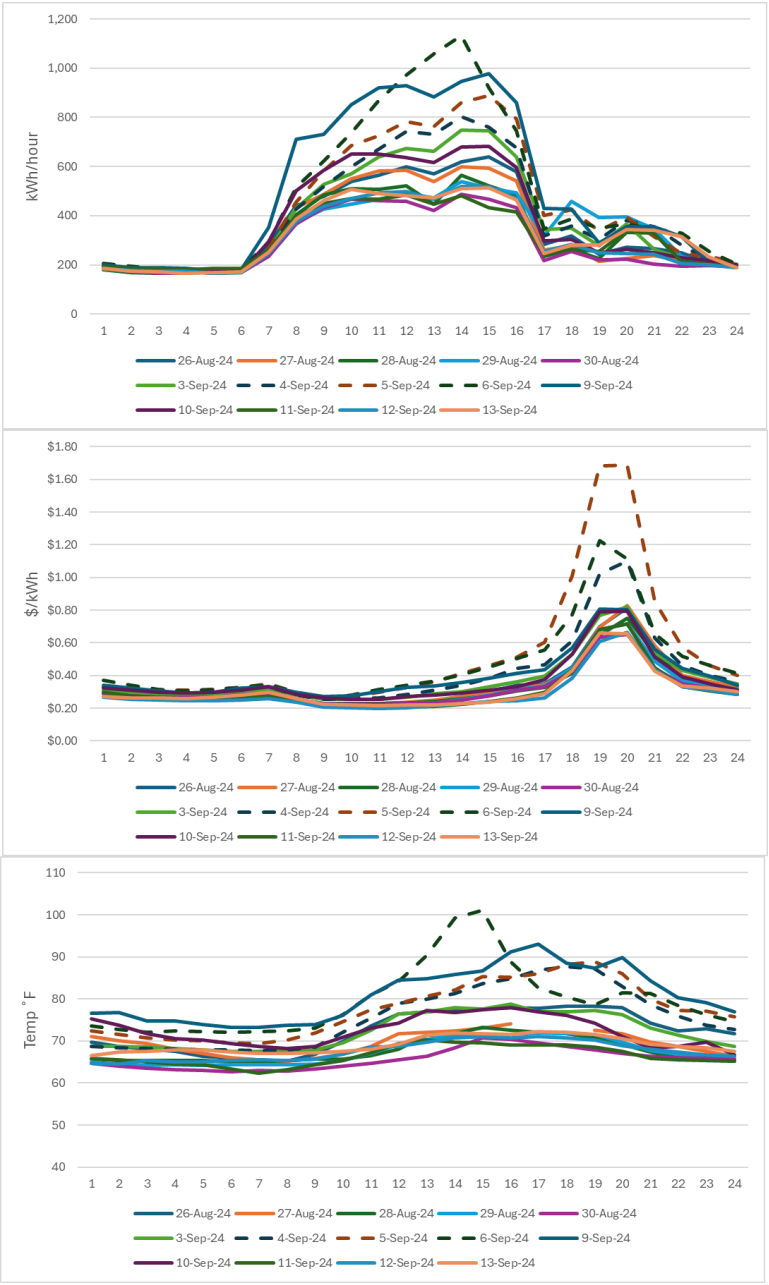
This should be viewed as a somewhat anecdotal exercise, focusing on days with the highest expected price response. Statistical analyses are more comprehensive (i.e., able to include all Pilot dates), but their complexity may render the results more difficult to understand/interpret than looking at metered usage data and Pilot prices.

We pooled ASP A's customers ([redacted]) and all the residential customers served by ASP C into one figure each. The two customers served by ASP B are shown separately. Figures 3.7 through 3.10 have three panels each: the top panel shows hourly usage by date (totaled across customers where applicable), the middle panel shows average hourly prices by date, and the bottom panel shows average hourly temperatures by date. In each case, the dashed lines represent the three highest-price days (September 4-6, 2024). The highest prices on each of those days are in hour ending (HE) 19 and 20. Prices earlier in the day (especially before HE 14 or so) do not exhibit much variation across the days, especially relative to the variation in prices during peak hours.

Figure 3.7 shows the usage profiles for ASP A's customers, [redacted]. Notice that their usage always drops off prior to the highest-price hours, regardless of the magnitude of the prices during HE 18-20. While there is significant variation in usage across days during the mid-day hours, it appears that this is due to differences in temperatures rather than a response to prices. For example, the usage differences in HE 11 are large relative to the price differences, though in line with the temperature differences across dates.

[32] This rate has legacy TOU periods (e.g., noon to 6 p.m. summer peak).

Figure 3.7: Daily Usage Profiles from Aug. 26-Sep. 9, All ASP A



Figures 3.8 and 3.9 show the usage profiles for ASP B's customers. There doesn't appear to be any evidence of pre-cooling during lower-price hours followed by lower usage during the high-price hours that follow. Figure 3.9 shows a consistent drop in usage during HE 19, but this occurs on all days (not just the ones with the highest prices) and we confirmed that it was also a feature of their load profile prior to joining the Pilot. Therefore, it appears that it is either a response to OAT prices or a natural feature of their demand for electricity.

Figure 3.8: Daily Usage Profiles from Aug. 26-Sep. 9, ASP B-004

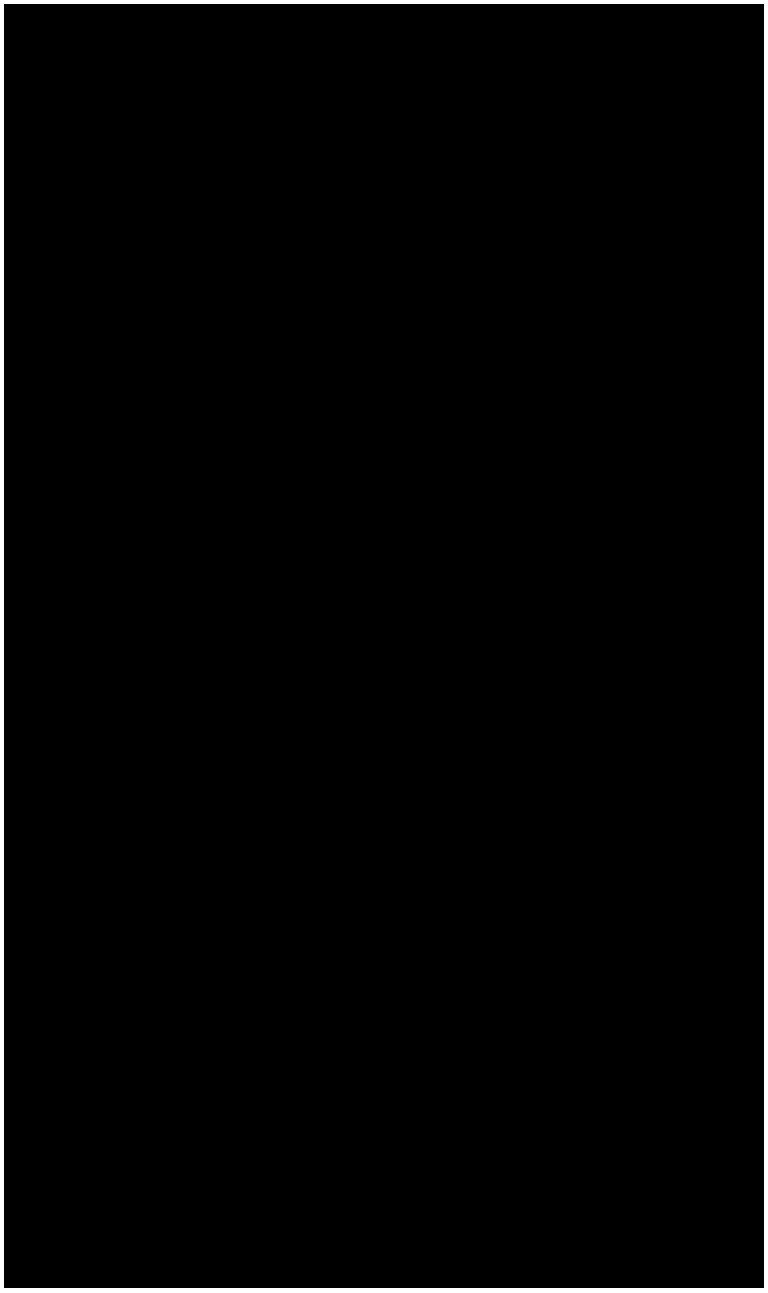


Figure 3.9: Daily Usage Profiles from Aug. 26-Sep. 9, ASP B-005

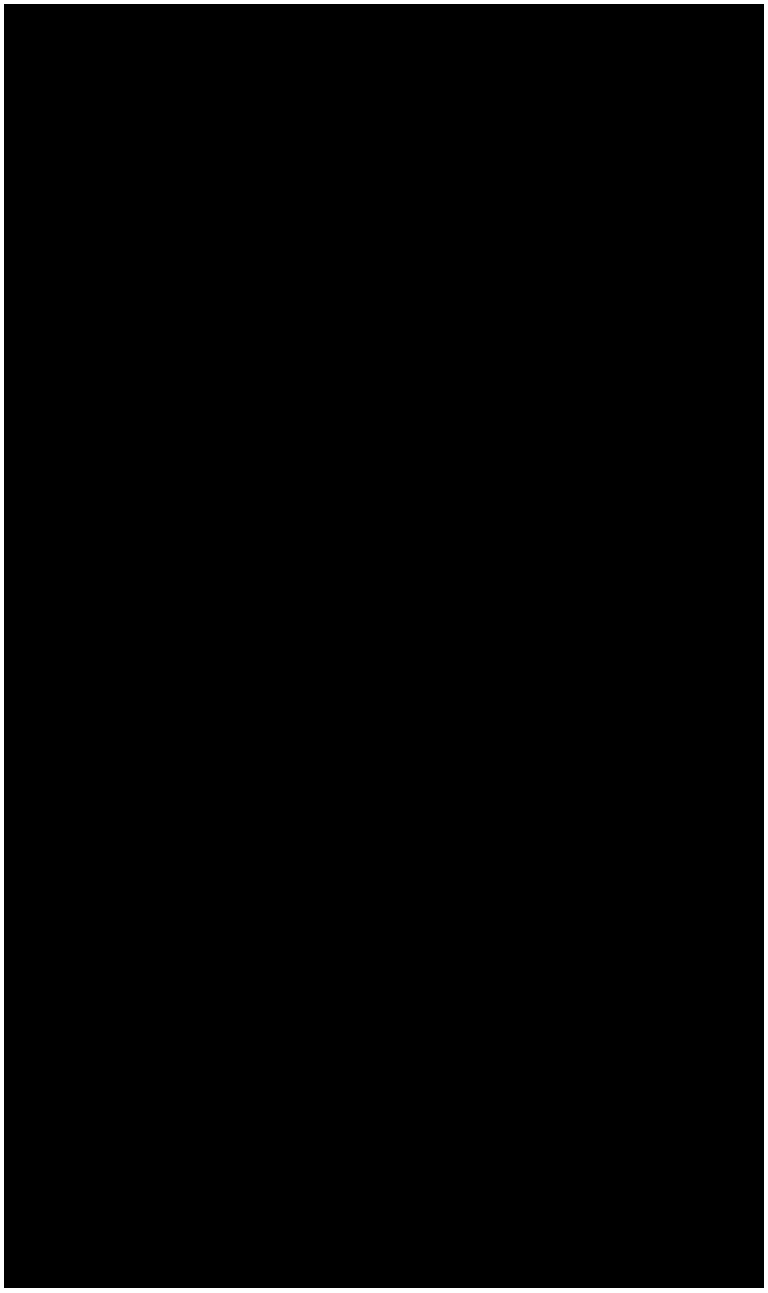
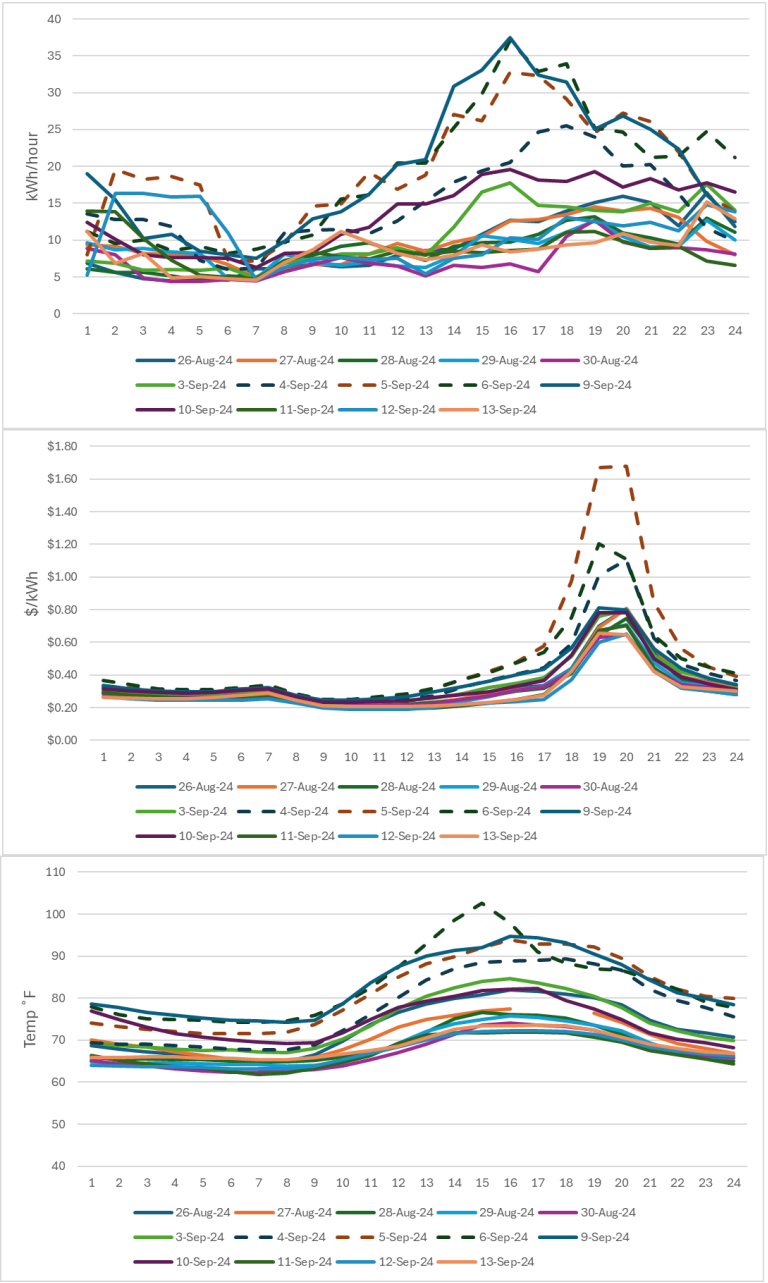


Figure 3.10 combines the loads for the residential customers served by ASP C. Residential loads can be somewhat unpredictable when the number of customers and/or days is low, so it is more difficult to discern a regular pattern for these loads versus the customers shown in Figures 3.7, 3.8, and 3.9. Nevertheless, it is difficult to infer price response from the loads shown in figures. For example, September 9 has somewhat high temperatures and loads but lower prices than September 4-6, but the load shape is not clearly different from those of the high-price days.

Figure 3.10: Daily Usage Profiles from Aug. 26-Sep. 9, All ASP C



Taken together, the figures above show little evidence that customers changed their usage in response to the highest prices during September 4-6, 2024. We do not have data indicating why this occurred, but possibilities include customers prioritizing comfort over savings, or the automated response optimizing to OAT rates rather than dynamic prices. For example, ASP A's customers are served on legacy TOU rates that provide an incentive to manage billed demand, and the peaks for these customers are likely to occur earlier than the hours with the highest Pilot prices.

3.5 Estimates of Changes in Peak Usage

The Decision approving the Pilot required SCE to "evaluate the efficacy of the pilot tariff in shifting loads enrolled in the program from peak to off-peak periods".[33] One measure of whether this occurred is to compare each customer's pre-Pilot usage to their in-Pilot usage, controlling for differences in weather conditions. Specifically, we estimated customer-specific statistical models of the following form:

$$PeakShare_t = a + b^{Pilot} \times Pilot_t + b^{CDD} \times CDD_t + b^{HDD} \times HDD_t + \sum(b^m \times month_t^m) + e_t$$

Table 3.2 explains the variables and terms in the model. The estimated coefficient of interest is b^{Pilot}, which reflects the change in the share of peak-period usage during the Pilot period, controlling for temperatures.

Table 3.2: Explanation of Terms in the Peak Share Statistical Models

Variable/Term	Description
$PeakShare_t$	The share of total usage that occurred during peak hours in month *t*
a and the various *b*s	Estimated parameters
$Pilot_t$	Indicator variable for month *t* being in the Pilot period
CDD_t	Daily average cooling degree days (base 60 degrees) during month *t*
HDD_t	Daily average heating degree days (base 60 degrees) during month *t*
$month^m_t$	Indicator variable that observation at time *t* is in month *m*
e_t	Error term

Peak hours are defined in two ways, with separate models estimated for each definition: 4 to 9 p.m. (HE 17 to 21) and 5 to 8 p.m. (HE 18 to 20). This corresponds to the alternate on-peak definitions employed in SCE's TOU rates and provides a robustness check of the hours during which customers are more likely to respond. That is, even customers on a TOU rate with a 4 to 9 p.m. peak period may observe that dynamic tender prices tend to be highest from 5 to 8 p.m. and thus concentrate load reductions on those hours.

Note that the peak usage share can lose meaning in the presence of negative usage (or near-zero total usage) for NEM customers. To ensure that we examine only days with valid peak usage shares, we remove any days with negative total peak, off-peak, or daily usage. In addition, we removed weekends for the non-residential customers, as we wanted to focus the analysis on the days with the most activity (particularly for ASP A's customers). Appendix A.1 presents a different version of the analysis, in which we use

[33] Phase 2 Decision, p. 99. Note that this excerpt concludes with the text "… and should be compared to non-participant loads." We did not compare participant and non-participant loads due to small sample sizes. For example, it would be difficult to make a meaningful comparison of peak usage shares of Pilot participants and non-participants when the number of participants is very low. Instead, we focus on pre-Pilot versus Pilot peak usage shares for participating customers, as described in this section.

the total peak-period usage as the dependent variable. This allows us to retain the observations with negative usage. A potential disadvantage of this alternate model is that the estimates may be more likely to reflect exogenous changes in a customer's overall usage level rather than a price-induced substitution from high- to low-price hours.

Table 3.3 shows the estimated peak share coefficients for every customer and for the two peak-period definitions examined. The p-value corresponding to the estimate is in parentheses. An asterisk indicates a p-value less than 0.05. Highlighting is used to designate customers on track to receive a Pilot credit.

Table 3.3: Estimates of Changes in Ratio of Peak-Period Usage

ID	Dates	NEM?	Pilot Coefficient Estimate	
			Peak = HE 17-21	Peak = HE 18-20
A-001	8/23 to 9/24	1.0	0.001 (0.760)	0.001 (0.565)
A-002	8/23 to 4/24	1.0	-0.018* (0.000)	-0.009* (0.008)
A-005	10/23 to 9/24	1.0	-0.007* (0.001)	-0.006* (0.000)
A-006	12/23 to 9/24	1.0	0.005 (0.267)	0.000 (0.938)
A-007	10/23 to 9/24	1.0	-0.011* (0.015)	-0.011* (0.002)
A-008	10/23 to 9/24	1.0	-0.008* (0.030)	-0.009* (0.000)
A-009	10/23 to 5/24	1.0	-0.016 (0.370)	-0.004 (0.709)
B-004	8/23 to 9/24	2.0	0.005* (0.023)	0.000 (0.741)
B-005	7/23 to 9/24		-0.011* (0.000)	-0.009* (0.000)
C-002	10/23 to 9/24		0.003 (0.521)	0.003 (0.330)
C-004	8/23 to 9/24		0.009 (0.085)	0.012* (0.002)
C-024	10/23 to 9/24		0.002 (0.625)	0.003 (0.317)
C-030	10/23 to 9/24		-0.007* (0.043)	-0.005* (0.036)
C-043	10/23 to 9/24		-0.004 (0.471)	-0.002 (0.611)
C-044	3/24 to 9/24		0.022* (0.003)	0.021* (0.001)
C-045	10/23 to 9/24	1.0	-0.044 (0.107)	-0.073* (0.001)
C-051	12/23 to 4/24		0.005 (0.560)	0.004 (0.559)
C-052	12/23 to 4/24	2.0	0.017 (0.660)	0.079* (0.040)
C-053	12/23 to 9/24		0.001 (0.905)	0.002 (0.700)
C-054	12/23 to 9/24		-0.010* (0.033)	-0.007 (0.096)
C-055	1/24 to 9/24		-0.009* (0.035)	-0.006* (0.040)
C-056	1/24 to 4/24		0.003 (0.816)	0.000 (0.985)

The estimates show mixed evidence of consistent reductions in peak usage shares during the Pilot period.

- Using either peak-period definition, 8 of the 22 customers had a statistically significant reduction in the peak usage share during the Pilot. [redacted].
- In contrast, three customers (two when defining peak as HE 17 to 21 and three using the HE 18 to 20 definition) reflect statistically significant *increases* in the peak usage share during the Pilot.

The analysis provides evidence that some enrolled customers changed their load profile during the Pilot, reducing the share of peak-period usage. However, the majority of the customers (14 out of 22) did not show evidence of a lower peak usage share, and the evidence provided in the next sub-section (which looks at the relationship between in-Pilot price and usage changes) casts doubt on whether the peak-share reductions estimated in this sub-section are due to Pilot participation. It is possible that the estimates reflect exogenous (non-temperature) effects on customer usage profiles.

This section focused on a before vs. during Pilot comparison of customer usage. In the following section, we will examine whether customer response to prices differed with Pilot tender price levels.

3.6 Statistical Estimates of Load Impacts

3.6.1 ASP A Estimates using Randomized Treatment Days

ASP A has been collaborating with University of California Berkeley Center for the Built Environment (CBE) to apply a testing protocol by which they can estimate the response to the Pilot pricing and enabling technology relative to the actions customers would have taken in the absence of the Pilot. This entailed randomly selecting days on which customer facilities were controlled by ASP A's algorithms versus the customer's typical decision-making processes. With a large enough sample of dates and sites, the randomization allows for a simple comparison of hourly loads on treated vs. untreated dates to estimate Pilot load response.

The randomization was applied to three ASP A sites, summarized in Table 3.4. Two of them were active in the Pilot at the time, while a third was served on TOU rates during the experimental period. The TOU customer (A-006) subsequently enrolled in the Pilot. Only one of the sites (A-001) is expected to have significant load response capabilities during the heating season, which is why that is the only customer with the later (winter) experimental period.[34]

[34] While A-001 is the only customer with a "core" winter experimental period, all three customers have experimental data during October, which is a winter pricing month.

Table 3.4: ASP A Customers with Randomized Treatment Days

ID	Experimental Period(s)	Description
A-001	8/16/2023 to 10/30/2023; 12/11/2023 to 3/8/2024	Enrolled in the Pilot during experimental period; has space heat.
A-002	8/16/2023 to 10/30/2023	Enrolled in the Pilot during experimental period; no space heat.
A-006	8/14/2023 to 10/24/2023	On TOU during controlled period; no space heat.

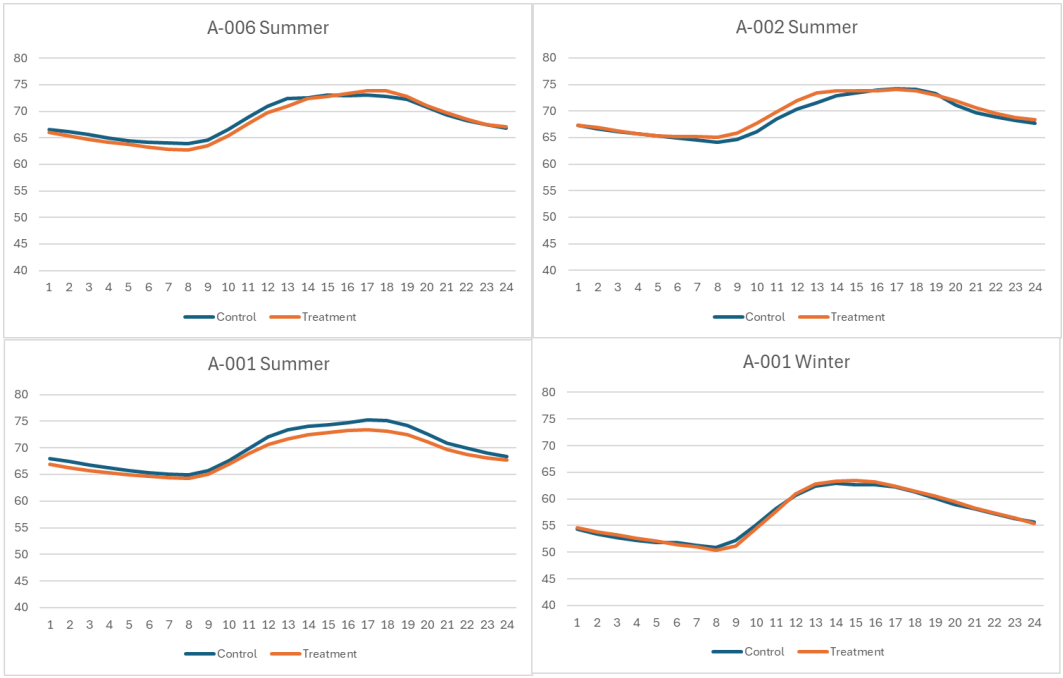
Figure 3.11 contains four panels, each of which shows the average hourly usage on treated days (i.e., when algorithms are applied to respond to Pilot or TOU prices) versus untreated days (i.e., when the customer does what it would do in the absence of ASP A's algorithms). For purposes of the figure, October is pooled with the summer months so that we have one panel for each experimental period listed in Table 3.4. The load profiles show the following:

- A-006 (the TOU customer) uses less during midday hours of summer treatment days.
- A-001 and A-002 usage profiles are similar on treatment and control days.

Figure 3.11: Average Hourly Load Profiles for ASP A Customers on Treated vs. Control Dates

Figure 3.12 shows the average temperatures associated with the load profiles shown in Figure 3.11. For customer A-006, the usage difference is directionally consistent with the temperature difference across the day types, though the usage difference may be larger than the temperature difference can explain.

Figure 3.12: Average Hourly Temperatures for ASP A Customers on Treated vs. Control Dates



We estimated statistical models to determine whether the usage differences shown in Figure 3.11 are statistically significant. The model specification is shown below, with the terms described in Table 3.5. For customers A-001 and A-002, we also included the Pilot price and the price interacted with the treatment variable, which provides an estimate of the extent to which usage is related to price on treatment days.

$$kWh_t = a + b^{Treat} \times Treatment_t + b^{Temp} \times Temperature_t + b^{Mon} \times Monday_t + b^{Fri} \times Friday_t + e_t$$

Table 3.5: Explanation of Terms in the ASP A Hourly Models

Variable/Term	Description
kWh_t	The customer's usage in hour *t*
a and the various *b*s	Estimated parameters
$Treatment_t$	Indicator variable for hour *t* being a treated hour
$Temperature_t$	Temperature in hour *t* in degrees Fahrenheit
$Monday_t$	Indicator variable for hour *t* being on a Monday
$Friday_t$	Indicator variable for hour *t* being on a Friday
e_t	Error term

Separate models are estimated for each customer, season (where applicable), and hour of day, resulting in 96 estimated treatment effects (24 per day for four different

customer/season combinations).[35] Of these estimates, only 5 of the 96 are statistically significantly different from zero. Our conclusion from this is that while some of the treatment vs. control hourly usage differences appear to be notable in the figures, the differences are not large enough to be statistically significant once one accounts for the low number of treated days, the day-to-day variability of usage, and the temperature differences across the day types (which is controlled for in the regressions but not in the usage figures). That is, we do not find evidence that customer usage behavior differed on treatment and control days. Over time, additional data from cooling seasons will provide a better opportunity to demonstrate the load response capabilities of ASP A's algorithms and technologies.

3.6.2 Estimates of Price Response using a Non-Experimental Design

Unlike the customers described above, most Pilot customers (i.e., all ASP B and ASP C customers as well as the ASP A customers not on the testing protocol) did not have an experimental testing design in place for use in estimating Pilot load response. For these customers, we analyzed whether the daily share of usage in peak hours is related to the daily peak to off-peak price ratio, controlling for temperatures and day type. Specifically, the estimated model is:

$$Peak\_Share_t = a + b^P \times Price\_Ratio_t + b^{CDD} \times CDD_t + b^{HDD} \times HDD_t + \Sigma_d(b^d \times DOW^d_t) + \Sigma(b^m \times month^m_t) + e_t$$

Table 3.6: Explanation of Terms in the Price Ratio Models

Variable/Term	Description
$Peak\_Share_t$	The share of the customer's usage on day *t* that occurs in peak hours
a and the various *b*s	Estimated parameters
$Price\_Ratio_t$	The peak price divided by the off-peak price on day *t*
CDD_t	Cooling degree days (60-degree threshold) on day *t*
HDD_t	Heating degree days (60-degree threshold) on day *t*
DOW^d_t	Day-of-week indicator variables for day *t* being day of week *d*
$month^m_t$	Month indicator variables for day *t* being in month *m*
e_t	Error term

The estimate of interest is b^P, which reflects the estimated change in the share of peak usage as the price ratio changes. We would expect the estimate to be negative and statistically significant, indicating that a higher peak price relative to the off-peak price would be associated with a lower share of usage in the peak hours. As in the pre-Pilot vs. in-Pilot peak share models, we remove any days with negative total peak, off-peak, or daily usage, as well as weekends for the non-residential customers. We also continued to define "on-peak" in two ways: hours-ending 17 to 21 and hours-ending 18 to 20. Table 3.7 shows the estimates of b^P, with an asterisk indicating a p-value below 0.05.

35 [redacted]

Table 3.7: Estimates of Changes in the Peak Usage Share in Response to the Price Ratio

ID	Dates	NEM?	Peak = HE 17-21	Peak = HE 18-20
A-005	11/23 to 9/24	1.0	0.030* (0.000)	0.018* (0.000)
A-007	11/23 to 9/24	1.0	0.009 (0.456)	0.006 (0.410)
A-008	11/23 to 9/24	1.0	0.027* (0.019)	0.019* (0.003)
A-009	10/23 to 5/24	1.0	0.001 (0.930)	0.005 (0.470)
B-004	9/23 to 9/24	2.0	0.010 (0.091)	-0.001 (0.816)
B-005	7/23 to 9/24		-0.001 (0.820)	0.000 (0.957)
C-002	10/23 to 9/24		0.005 (0.774)	-0.010 (0.357)
C-004	8/23 to 9/24		0.030* (0.019)	0.025* (0.004)
C-024	10/23 to 9/24		-0.012 (0.316)	-0.012 (0.136)
C-030	10/23 to 9/24		-0.012 (0.260)	-0.013* (0.049)
C-043	10/23 to 9/24		0.008 (0.649)	0.002 (0.833)
C-044	3/24 to 9/24		-0.015 (0.373)	-0.006 (0.606)
C-045	11/23 to 9/24	1.0	0.008 (0.929)	0.030 (0.645)
C-051	12/23 to 4/24		-0.023 (0.351)	-0.007 (0.661)
C-052	12/23 to 4/24	2.0	0.704* (0.000)	0.778* (0.000)
C-053	12/23 to 9/24		0.007 (0.691)	0.001 (0.909)
C-054	12/23 to 9/24		0.011 (0.452)	0.009 (0.409)
C-055	1/24 to 9/24		-0.007 (0.367)	-0.005 (0.372)
C-056	1/24 to 4/24		-0.010 (0.608)	-0.027 (0.060)

To interpret the coefficients, consider the -0.013 estimate for C-030 using the HE 18 to 20 peak definition. This estimate means that as the peak to off-peak price ratio increases by 1 (e.g., the peak price went from $0.50 per kWh to $0.75 per kWh as the off-peak price remained unchanged at $0.25 per kWh), the share of peak usage declines by 1.3 percentage points.

Only one of the estimates (C-030 using the HE 18-20 peak-period definition) showed the expected price response effect, which is a negative and statistically significant coefficient (which indicates that the share of peak-period usage goes down as the peak price increases relative to the off-peak price).

The sole responder, C-030, also had negative and significant estimates in the before vs. during Pilot estimates presented in Section 3.5. That is, that customer displayed both an overall reduction in the peak share of usage during the Pilot period and greater relative reductions in peak usage when intra-day price differentials were higher. However, we did not find evidence of peak-shifting behavior for the majority of the customers included in this study.

4. BILL IMPACTS

As described in the Introduction, Pilot participants will continue to be on their OAT during the Pilot and be billed under that SCE rate. Each calendar month, a shadow bill is calculated representing what they "*would have*" paid under the subscription + dynamic pricing model. At the end of the relevant 12-month period, the customer is credited for savings they would have realized under dynamic pricing rate, but they will not be billed for more if the OAT bills are lower than the Pilot bills. The equation below shows the calculation of the dynamic bill credit for customer *c* during months *m*.

$$\text{Dynamic Pilot Credit}_c = \text{MAX}\{\Sigma_m(\text{OAT Bill}_{c,m} - \text{Shadow Bill}_{c,m}), 0\}$$

In the equation, MAX is the maximum function, Σ_m is the summation function, "OAT $\text{Bill}_{c,m}$" is customer *c*'s bill on their OAT using metered usage during month *m*, and "Shadow $\text{Bill}_{c,m}$" is customer *c*'s shadow bill during month *m*. The shadow bill incorporates a subscription component and a settlement component, as described in Section 2.1.

Table 4.1 summarizes the OAT and shadow bills available at the time of this report.[36] Shading is used to indicate customers on track to receive a credit (i.e., the cumulative shadow bill is less than the cumulative OAT bill). As the table shows, 9 of the 22 customers were on track to receive a bill credit given the Pilot experience available for us to examine. The largest credit ([redacted]) is attributable to customer B-005. The only higher percentage credit is associated with customer C-056, though their credit is small in absolute terms ([redacted]).

[36] Note that the Pilot credit summaries presented here in the evaluation are based on all available months for each customer. For the actual shadow billing, the shadow bill credit calculation for customers was conducted at the end of their relevant period for NEM customers and at the end of the 12 months of participation for non-NEM customers, with the months in the following period being included in a subsequent shadow bill credit calculation. This change in the timing of the calculation may affect whether a customer received a credit, as the calculation is cumulative over the shadow bill period. For example, customer C-045 was due a credit at the end of their relevant period, while the table reflects the fact that their total shadow bill was higher than their total OAT bill across all 12 Pilot months.

Table 4.1: Overall Bill Impacts

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
ID	Dates	Total kWh	OAT Bill	Shadow Bill	OAT $/kWh (D/C)	Shadow $/kWh (E/C)	% Bill Diff (E/D)-1
A-001	8/23 to 9/24	[redacted]					
A-002	8/23 to 4/24						
A-005	10/23 to 9/24						
A-006	12/23 to 9/24						
A-007	10/23 to 9/24						
A-008	10/23 to 9/24						
A-009	10/23 to 5/24						
B-004	8/23 to 9/24						
B-005	7/23 to 9/24						
C-002	10/23 to 9/24	6,111	$2,068	$2,093	$0.338	$0.343	1.2%
C-004	8/23 to 9/24	2,799	$797	$780	$0.285	$0.279	-2.2%
C-024	10/23 to 9/24	2,478	$664	$655	$0.268	$0.264	-1.4%
C-030	10/23 to 9/24	9,436	$3,473	$3,565	$0.368	$0.378	2.7%
C-043	10/23 to 9/24	10,212	$3,743	$3,875	$0.366	$0.379	3.5%
C-044	3/24 to 9/24	7,960	$2,700	$3,019	$0.339	$0.379	11.8%
C-045	10/23 to 9/24	4,429	$1,201	$1,307	$0.271	$0.295	8.9%
C-051	12/23 to 4/24	4,306	$1,568	$1,542	$0.364	$0.358	-1.7%
C-052	12/23 to 4/24	-885	-$691	-$422	$0.782	$0.478	N/A
C-053	12/23 to 9/24	11,521	$4,450	$4,623	$0.386	$0.401	3.9%
C-054	12/23 to 9/24	6,621	$2,119	$2,187	$0.320	$0.330	3.2%
C-055	1/24 to 9/24	11,380	$3,347	$3,527	$0.294	$0.310	5.4%
C-056	1/24 to 4/24	987	$297	$277	$0.300	$0.281	-6.6%
Total Res.	8/23 to 9/24	77,356	$25,736	$27,027	$0.333	$0.349	5.0%
Total Non-Res.	7/23 to 9/24	5,303,588	$1,388,061	$1,412,089	$0.262	$0.266	1.7%

Table 4.2 shows how the total usage was divided between subscription purchases and the net ex-post kWh for the month.[37] It also adds the subscription average price paid to the

[37] The net ex-post quantity for a month is the total kWh purchased above the subscription quantities minus the total kWh sold below the subscription quantities (i.e., the "unused" subscription quantity).

table, thereby allowing comparisons to the average prices under OAT and shadow bill. This information provides additional context for the credits (or lack thereof) shown in Table 4.1.

For example, A-006 and A-008 are both on track to receive credits of [redacted]. In each case, the Table 4.2 shows the customer saved on its subscription relative to the OAT ([redacted]). The customer with the largest credit, B-005, saved [redacted] on its subscription relative to the OAT average price. The next table will help explain the rest of their credit.

Figure 4.1 shows the extent to which the shadow bill credit calculation is affected by the relationship between the customer's average OAT price and their subscription price.[38] The correlation between the two data series is 0.936, indicating a very strong relationship between the shadow bill credit and the relationship between the OAT and subscription prices. The figure shows that shadow bill outcomes are largely due to how the subscription is priced relative to the customer's average OAT price. Because the subscription is priced at current OAT rates, differences in the two values are likely to be attributable to changes in their load profile from the pre-Pilot to in-Pilot periods. For example, a customer who reduced their share of peak-period usage during the Pilot would experience an average OAT price that is less than their subscription price (which is priced using the load profile with the higher share of peak-period usage).[39]

There are a few potential reasons for the differences between OAT and subscription prices, including:

- If automation was not present in the pre-Pilot period, the load changes could represent the customer's enhanced ability to respond to OAT prices, or perhaps a response to typical dynamic price patterns.

- Exogenous (i.e., unrelated to Pilot pricing or automation technology) changes in the Pilot period relative to the pre-Pilot period. Weather and structural changes to buildings are two potential sources of exogenous effects on a customer's load profile.

The statistical analyses of dynamic price response do not find strong evidence of customer response to day-to-day and hour-to-hour dynamic price variation, which is another potential source of the difference between OAT and subscription average prices.

[38] Customer C-052 is omitted from the figure because their negative subscription price produces an outlier in the "OAT – Subscription in $/kWh" that obscures the variation across other customers.

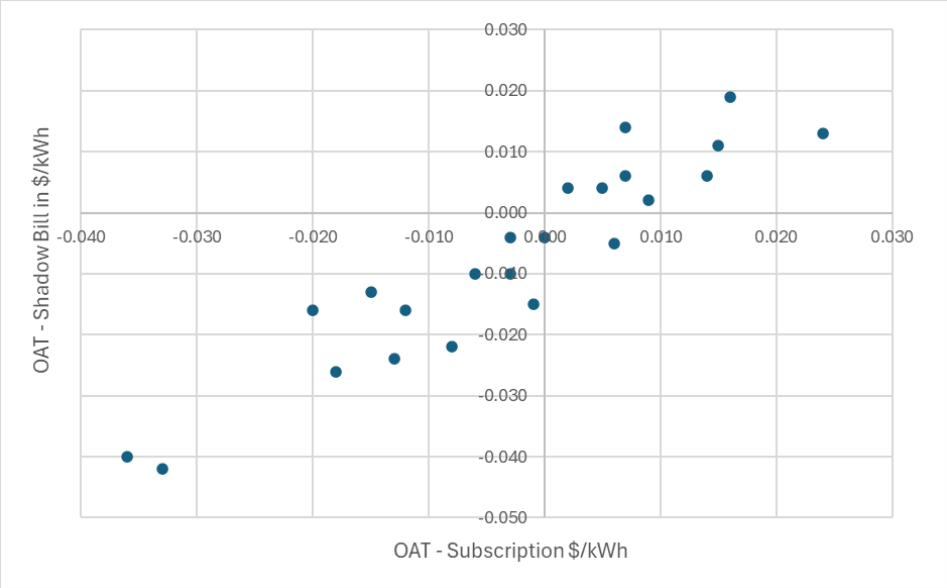
[39] The reduction in the OAT bill may affect the customer's ability to earn a Pilot credit (which requires that the cumulative Pilot bill is lower than the OAT bill), but that doesn't imply that the customer was worse off for having had the change in its usage profile. The absence of a credit just indicates that the OAT provided a larger benefit for the usage change than the Pilot did.

Table 4.2: Comparison of OAT and Subscription Average Price Paid[40]

ID	Dates	Total kWh	Total Subscription kWh	Total Ex-Post kWh	OAT $/kWh	Subscription $/kWh	Shadow $/kWh
A-001	8/23-9/24						
A-002	8/23-4/24						
A-005	10/23-9/24						
A-006	12/23-9/24						
A-007	10/23-9/24						
A-008	10/23-9/24						
A-009	10/23-5/24						
B-004	8/23-9/24						
B-005	7/23-9/24						
C-002	10/23-9/24	6,111	5,929	182	$0.338	$0.332	$0.343
C-004	8/23-9/24	2,799	2,905	-106	$0.285	$0.271	$0.279
C-024	10/23-9/24	2,478	2,537	-59	$0.268	$0.263	$0.264
C-030	10/23-9/24	9,436	9,382	55	$0.368	$0.371	$0.378
C-043	10/23-9/24	10,212	11,964	-1,752	$0.366	$0.381	$0.379
C-044	3/24-9/24	7,960	7,564	396	$0.339	$0.375	$0.379
C-045	10/23-9/24	4,429	2,624	1,323	$0.271	$0.284	$0.295
C-051	12/23-4/24	4,306	4,428	-122	$0.364	$0.357	$0.358
C-052	12/23-4/24	-885	349	-1,234	$0.782	-$0.324	$0.478
C-053	12/23-9/24	11,521	11,807	-286	$0.386	$0.387	$0.401
C-054	12/23-9/24	6,621	6,869	-248	$0.320	$0.326	$0.330
C-055	1/24-9/24	11,380	11,607	-227	$0.294	$0.314	$0.310
C-056	1/24-4/24	987	1,038	-51	$0.300	$0.284	$0.281
Total Res.	8/23-9/24	77,356	79,003	-2,128	$0.333	$0.345	$0.349
Total Non-Res.	7/23-9/24	5,303,588	5,074,333	225,972	$0.262	$0.265	$0.266

[40] The average prices show in the total row represent the load-weighted average of the customer-specific prices, where the load weight is "Total kWh" for the "OAT $/kWh" and "Shadow $/kWh" values, while the load weight is "Subscription kWh" for the "Subscription $/kWh" value.

Figure 4.1: OAT – Shadow Bill vs. OAT – Subscription Price ($/kWh)



While the previous table showed the total ex-post kWh, Tables 4.3a (for non-residential customers) and 4.3b (for residential customers) separately show the ex-post purchases above the subscription quantity and the ex-post sales of excess subscription load. Returning to customer B-005, the table shows that the customer was a net seller of subscription load and that those sales tended to be profitable, with an average selling price of [redacted] per kWh after having purchased the usage at a subscription price of [redacted] per kWh.

Table 4.3a: Transaction Summaries by Customer, ASPs A and B

ID	Buy or Sell	% Sell Hours (kWh<Sub)	Total Subscription kWh	Total Ex-Post kWh	Subscription Price	Ex-Post Price
A-001	Sell					
	Buy					
A-002	Sell					
	Buy					
A-005	Sell					
	Buy					
A-006	Sell					
	Buy					
A-007	Sell					
	Buy					
A-008	Sell					
	Buy					
A-009	Sell					
	Buy					
B-004	Sell					
	Buy					
B-005	Sell					
	Buy					

Table 4.3b: Transaction Summaries by Customer, ASP C

ID	Buy or Sell	% Sell Hours (kWh<Sub)	Total Subscription kWh	Total Ex-Post kWh	Subscription Price	Ex-Post Price
C-002	Sell	57%	3,575	-901	$0.359	$0.368
	Buy		2,354	1,083		$0.421
C-004	Sell	60%	1,849	-707	$0.325	$0.311
	Buy		1,056	601		$0.353
C-024	Sell	61%	1,695	-512	$0.325	$0.317
	Buy		843	453		$0.332
C-030	Sell	60%	5,546	-1,541	$0.388	$0.310
	Buy		3,836	1,596		$0.352
C-043	Sell	53%	7,554	-3,807	$0.394	$0.368
	Buy		4,410	2,055		$0.350
C-044	Sell	50%	4,133	-733	$0.387	$0.346
	Buy		3,431	1,129		$0.385
C-045	Sell	53%	1,883	-2,725	$0.344	$0.312
	Buy		742	4,047		$0.349
C-051	Sell	53%	2,622	-726	$0.377	$0.339
	Buy		1,806	605		$0.341
C-052	Sell	67%	204	-1,995	-$0.076	$0.248
	Buy		146	761		$0.243
C-053	Sell	65%	7,738	-3,315	$0.394	$0.271
	Buy		4,072	3,032		$0.316
C-054	Sell	68%	4,740	-1,079	$0.339	$0.317
	Buy		2,130	830		$0.348
C-055	Sell	58%	7,187	-1,910	$0.321	$0.332
	Buy		4,421	1,683		$0.310
C-056	Sell	70%	759	-317	$0.367	$0.302
	Buy		279	266		$0.292

Table 4.4 provides a summary of Pilot credits with the customers organized by their OAT rate, using gray shading to separate rates. Small samples on each rate prevent us from making general conclusions within and across OAT rates. For example, none of the TOU-D 4-9 PM customers earned a credit, while all TOU-D 5-8 PM customers did. Note that only eight customers are on one of those rates, so it would be unwise to make a general conclusion about what would happen to other customers on those rates if they were to face Pilot pricing.

Table 4.4: Credits by Customer, Organized by OAT Rate

ID	Dates	Total kWh	Pilot Bill	OAT Bill	Credit	OAT Rate
A-001	8/23 to 9/24	[redacted]				TOU-GS-2-R
A-002	8/23 to 4/24					TOU-GS-2-R
A-006	12/23 to 9/24					TOU-GS-2-R
A-007	10/23 to 9/24					TOU-GS-2-R
A-008	10/23 to 9/24					TOU-GS-2-R
A-009	10/23 to 5/24					TOU-GS-2-R
A-005	10/23 to 9/24					TOU-GS-3-R
B-004	8/23 to 9/24					TOU-GS-2-D
B-005	7/23 to 9/24					TOU-GS-3-D
C-045	10/23 to 9/24	4,429	$1,307	$1,201	$0	DOMESTIC
C-054	12/23 to 9/24	6,621	$2,187	$2,119	$0	DOMESTIC
C-052	12/23 to 4/24	-885	-$422	-$691	$0	TOU-D-A
C-002	10/23 to 9/24	6,111	$2,093	$2,068	$0	TOUD-4-9PM
C-030	10/23 to 9/24	9,436	$3,565	$3,473	$0	TOUD-4-9PM
C-043	10/23 to 9/24	10,212	$3,875	$3,743	$0	TOUD-4-9PM
C-044	3/24 to 9/24	7,960	$3,019	$2,700	$0	TOUD-4-9PM
C-053	12/23 to 9/24	11,521	$4,623	$4,450	$0	TOUD-4-9PM
C-004	8/23 to 9/24	2,799	$780	$797	$17	TOUD-5-8PM
C-024	10/23 to 9/24	2,478	$655	$664	$9	TOUD-5-8PM
C-051	12/23 to 4/24	4,306	$1,542	$1,568	$26	TOUD-5-8PM
C-055	1/24 to 9/24	11,380	$3,527	$3,347	$0	TOU-D-PRIME
C-056	1/24 to 4/24	987	$277	$297	$19	TOU-D-PRIME
Total Res.	8/23 to 9/24	77,356	$27,027	$25,736	$71	N/A
Total Non-Res.	7/23 to 9/24	5,303,588	$1,412,089	$1,388,061	$33,155	N/A

Table 4.5 shows (in the rightmost column) customer bills if all customer usage was billed at day-ahead hourly tender prices (i.e., there was no subscription). The table includes shadow and OAT bills for comparison.

Fourteen of the 22 customers would have had a lower Pilot bill had they been priced solely at the hourly tender prices, while 13 of the 22 customers would have paid less than the OAT bill if priced at hourly tender prices. However, some of the differences are large. For example, customer B-005 would have paid [redacted] more on its shadow bill if they had been priced entirely at settlement prices. This is another illustration of the benefit that customer received from its subscription pricing. In addition, note that removing the subscription would expose the customers to more price risk. That is, with subscriptions, a sustained period of high prices can provide an opportunity to benefit by selling subscription load at high prices and limit the need to purchase expensive energy to the quantity above the subscription quantity.

Table 4.5: Bills When Priced Entirely at Day-Ahead Tenders

ID	Dates	NEM?	Total kWh	Shadow Bill	OAT Bill	Bill @ Hourly Tenders
A-001	8/23 to 9/24					
A-002	8/23 to 4/24					
A-005	10/23 to 9/24					
A-006	12/23 to 9/24					
A-007	10/23 to 9/24					
A-008	10/23 to 9/24					
A-009	10/23 to 5/24					
B-004	8/23 to 9/24					
B-005	7/23 to 9/24					
C-002	10/23 to 9/24		6,111	$2,093	$2,068	$2,161
C-004	8/23 to 9/24		2,799	$780	$797	$944
C-024	10/23 to 9/24		2,478	$655	$664	$819
C-030	10/23 to 9/24		9,436	$3,565	$3,473	$3,057
C-043	10/23 to 9/24		10,212	$3,875	$3,743	$3,413
C-044	3/24 to 9/24		7,960	$3,019	$2,700	$2,626
C-045	10/23 to 9/24	1.0	4,429	$1,307	$1,201	$1,763
C-051	12/23 to 4/24		4,306	$1,542	$1,568	$1,372
C-052	12/23 to 4/24	2.0	-885	-$422	-$691	$220
C-053	12/23 to 9/24		11,521	$4,623	$4,450	$3,372
C-054	12/23 to 9/24		6,621	$2,187	$2,119	$1,946
C-055	1/24 to 9/24		11,380	$3,527	$3,347	$3,320
C-056	1/24 to 4/24		987	$277	$297	$261
Total Res.	8/23 to 9/24		77,356	$27,027	$25,736	$25,276
Total Non-Res.	7/23 to 9/24		5,303,588	$1,412,089	$1,388,061	$1,727,985

5. COST RECOVERY

As noted in the introduction, the Decision calls for "[a]n evaluation of the cost recovery which assess[es] the impact of any under-collection of revenues associated with the Pilot similar to the evaluation required of the VCE dynamic rate pilot."[41]

In consultation with the ED, the interpretation of this text is that there is no under-collection to examine if the customer pays the amount of their OAT bill (i.e., they do not receive a Pilot credit). Therefore, the cost recovery analysis focuses on customers who are on track to receive a credit on the Pilot.

The design of the Pilot "two-part" rate design suggests that the Pilot may adequately recover the costs to serve the participants, thus limiting the potential of cost shifts to

[41] Decision 21-12-015, p. 99.

non-participating customers.[42] That is, the subscription pricing method ensures that OAT-level revenues are recovered for the customer's historical load profile. The dynamic pricing method has CAISO energy prices as its basis, adding components that allocate fixed capacity-related costs to hours in proportion to their system net loads. Any assessment that determines that this method does not produce prices that recover avoided costs is likely driven by different assumptions about how to allocate fixed costs across hours, as these costs are not directly observable in a market in the same manner as LMPs.

In general, there two primary potential sources of Pilot credits:

1. *The difference between their average price per kWh on the OAT rate and on the subscription.* A customer that changes its usage level and shape relative to the pre-Pilot period may experience a change in its OAT average price paid. For example, if they increase their share of usage during on-peak hours, or reduce their load factor during the Pilot, one expects their current OAT average price to be higher than their subscription average price (which reflects their historical usage priced at OAT rates).

2. *Whether the customer benefited from ex-post transactions.* For example, one customer increased usage relative to pre-Pilot levels and the ex-post average price was significantly lower than the OAT and subscription average price, thus allowing them to expand usage at a lower average price per kWh. Another way for the customer to save via ex-post transactions is if they tend to sell subscription usage when the settlement price is high and purchase kWh above the subscription amount when the settlement price is low.

Table 5.1 summarizes these factors for the customers currently on track to receive a Pilot credit. The two rightmost columns calculate the components of the shadow bill credit, including:

- The credit due to OAT vs. Pilot pricing of the subscription quantities. This is calculated as the subscription quantity multiplied by the difference between the OAT and subscription average prices per kWh. A positive value indicates that the customer paid more on the OAT rate, thus contributing to a shadow bill credit for the customer.[43]

- The credit associated with settlements around the subscription quantities. This amount has two components: the average OAT price multiplied by the difference between actual and subscription usage; and the net ex-post settlement transaction dollars (i.e., the net amount of the shadow bill represented by settlements around the subscription quantities). The difference between the

[42] This is only considering revenue and cost changes at the margin due to load response. Cost shifting could still occur if the benefits of the program are outweighed by the costs to launch and implement the Pilot.

[43] The values required for this calculation can be found in Table 4.2.

components represents how much more (or less) the customer paid for its settlement quantities on the OAT rate versus the Pilot rates.[44]

An example may assist readers in interpreting the table. Customer B-005 was on track to receive a [redacted] credit. This customer paid [redacted] less for its subscription usage on the Pilot versus the OAT, and benefited by [redacted] on the ex-post settlements, thus producing the credit of [redacted].

All nine customers in the table had savings on their subscription quantity, while three of the nine had additional savings on their ex-post transactions.

Table 5.1: Factors Contributing to Customer Shadow Bill Credits

ID	OAT Bill	Pilot Credit	Subscription Savings	Ex Post Savings
A-002	[redacted]			
A-006				
A-007				
A-008				
B-005				
C-004	$797	$17 (2.2%)	$40	-$23
C-024	$664	$9 (1.4%)	$13	-$4
C-051	$1,568	$26 (1.7%)	$31	-$5
C-056	$297	$19 (6.6%)	$17	$3
Total Non-Res.	$700,476	$33,155 (4.7%)	$20,855	$12,300
Total Res.	$3,326	$71 (2.1%)	$101	-$29

As noted at the beginning of this section, we believe that the design of the Pilot pricing method is likely to prevent cross-subsidies due to price response (of which we have little evidence). While some pricing parameters can be debated and/or adjusted (e.g., the allocation of capacity-related costs to hours in a peaky or less peaky fashion), there is a range of pricing parameters over which it is reasonable to expect that the prices are a good reflection of the avoided costs.

An analysis of the customers currently on pace to receive a credit leads us to conclude that the subscription pricing method is an important source of credits, or a reduced ability to earn a credit via price response. This raises questions about what constitutes a cross

[44] Tables 4.2 and 4.3 provide the information required for these calculations.

subsidy or is a "fair" outcome. For example, even if one assumes that a customer's pre-Pilot vs. in-Pilot load profile difference is entirely due to exogenous factors (i.e., not due to the Pilot itself), the customer paid OAT rates for its subscription load. The credit is due to deviations from the subscription load being priced at dynamic prices rather than OAT prices. This produces a *different* outcome than would have occurred in the absence of the Pilot, but it may be a more cost reflective outcome if dynamic prices are more closely aligned with system costs than OAT prices.

The optimal method of subscription pricing (e.g., whether/how to update quantities over time, how to deal with customer changes such as NEM adoption) is a topic worthy of in-depth research that is beyond the scope of this study.

6. STAKEHOLDER COMMENTS

The Pilot has been a complex undertaking involving coordination across multiple parties: the ASPs, TeMix, and SCE. We conducted interviews and sought written feedback from these parties to ensure that we reflected their experience on the Pilot and were given an opportunity to provide their lessons learned. The sub-sections below contain the direct feedback we received, and views expressed in all but the SCE subsection reflect those of each of the ASPs and of TeMix. In some cases, we provide written comments provided by the party. In other cases, we summarize conversations that we had with the party.

6.1 ASP A

The following is summarized from written feedback provided by ASP A for inclusion in the evaluation.

ASP A enrolled customers into the Pilot who had advanced HVAC controls that can respond to price fluctuations and maintain building comfort while reducing/shifting peak demand. ASP A noted multiple critical aspects that were unique and different from the state of the art in many ways:

1. **An innovative rate and tariff structure:** While ASP A service originally was built to accept a dynamic price, incorporating a forward transactive element (i.e., forecasting demand and then buying or selling excess) added a layer of complexity. Building out this functionality was not as simple as accepting a pricing feed through an Application Programming Interface (API), since ASP A wanted to make sure to account for customer comfort as well as price impacts. Its engineering team worked with TeMix to better understand the concept, with Lawrence Berkeley National Laboratory (LBNL) to think through the potential impacts on comfort optimization, and then developed and tested the programming logic. This took most of 2022 to test on its (at the time) two enrolled sites. The early sites showed promise and ASP A asked to enroll six additional sites in the pilot to participate by summer of 2023.[45]

[45] This study included six ASP A customers based on the shadow bills made available to the evaluation team.

2. **Integration of advanced technology and real-time response mechanisms is going to have hiccups:** Whereas the state of the art in HVAC controls typically uses schedules, indoor temperature setbacks, or turns off HVAC during peak periods (causing high opt-out and override rates), ASP A technology was reportedly built to optimize energy use within comfort bounds. [redacted] This new program introduced a lot of moving parts from pricing integration and communication logistics to communicating with business officials and occupants. It was therefore not realistic to make all of those things work together without a hitch and go from two test sites and multiple new prices, technology deployments, and customer messages to immediately and without hiccups produce plug and play demand shift. ASP A selected a handful of sites for the 2023 testing season and addressed technical and non-technical questions as they came up:

    - how resilient were the technologies to large gaps in price (when, for example, the price server had outages);
    - how resilient were the technologies to networking reliability (when the same events driving lack of reliability on the grid caused communication failures); and
    - how much did customer and end user education and qualification impact the ability to operate the system reliably and produce results.

    ASP A noted these critical interim questions to ask and problems to solve to avoid the same hurdles it faced.

3. **Comprehensive measurement and verification (M&V):** Many of the [redacted] ASP A sought to enroll are large and complex with morning startup peaks of ~2MW (note, as much of 80% of this load can be from HVAC use). Typical M&V for energy counterfactuals is already difficult to prove on such [redacted]; however, at the time ASP A provided written comments to SCE's evaluator in September 2024, it had not received shadow bills yet and it therefore had to try to infer impact comparisons after the summer testing season was over to try to ascertain lessons learned and ask ourselves how rollout could have gone more smoothly. There were many issues with getting this kind of quantifiable feedback. According to ASP A, shadow bills were not available when it tried to piece together the impacts from TeMix[46], which meant they had to do a lot of back and forth to try and interpret what had actually happened from a cost and savings perspective. ASP A therefore had to wait to receive feedback about the 2023 summer heating season to make improvements to their HVAC optimization strategies for the following summer. ASP A noted the following: "At the end of the day it felt like what the M&V was measuring was…missing a more strategic question about what got in the way of actually being able to evaluate impact or remove barriers to it on the road to creating a scalable program or tariff."

In the intervening years, ASP A received a CEC CaltestBed voucher for independent testing, measurement, and verification work performed by the University of California

[46] SCE sent shadow bills to ASP A from mid-September through mid-November.

Berkeley CBE. The CBE team supported the efforts of ASP A to identify a subset of up to six representative [redacted] for field testing and defined and scoped an M&V plan and protocols to measure energy, power, and occupant comfort. For testing, they designed a 'randomized block' testing scheme during pre-defined testing periods to alternate between ASP A MPC+ML[47] controller and the customer's own baseline control policy (typically this is basic thermostat default schedules or an Energy Management System). The 15-week randomization process minimized sample bias and ensured that the same number of days are assigned to control and intervention strategies for each testing period. It allowed direct comparison of the MPC+ML (intervention) and control samples compared to a typical M&V approach. Implementing the testing protocol and then thinking about also layering on the complexity of how to compare various pricing approaches at similar sites were all details on which the ASP A and CBE teams worked. ASP A noted that the insights gained for this effort could have provided evaluation feedback that all ASPs could use.

6.2 ASP B

The following comments were provided by ASP B during conversations and via email.

- The prompt payment of promised incentives is the most important aspect for ASP B. Because the shadow bills were delivered late, ASP B believes incentives are overdue to some customers. This puts the ASPs in a difficult position.

- It would have been useful to understand when these customers were "officially enrolled" in the Pilot to help manage their expectations about when incentive settlements would occur. ASP B felt that SCE did not clearly communicate this information to them.

- ASP B primarily responds to dynamic prices by looking at four-hour windows, comparing the average price during the first two hours (when they'd pre-cool) to the average price during the second two hours. Twenty-five cents/kWh differences or more is what they're targeting. They don't want to shift for small returns. Sometimes the intra-day price differentials are not high enough to motivate significant shifting of load. Other times, they are. They'd get a higher return from responding to TOU-GS-2 incentives. ASP B staff noted the importance of ensuring that price differentials are higher in total than existing tariffs so that load shifting is properly incentivized.

- Their customers prioritize comfort and convenience. They are not as energy intensive as some customers, so they are not going to focus solely on reducing electricity costs. Being able to rapidly address problems is important for the facilities managers, who have many demands on their time.

- Customers have not grasped the transactive model, as it is unnecessarily complicated for a customer-facing pilot. The message ASP B customers can comprehend is that the ASP will help them to use less electricity when it is expensive and more when it is cheap.

[47] MPC = model predictive control; ML = machine learning.

- ASP B reports continuing to respond to OAT incentives by managing billed demand and wanting to avoid setting a new peak demand when pre-cooling.

- Timely receipt of shadow bills was also an issue. "It would be very helpful to both customers and to ASPs to have monthly access to ongoing calculations of 'how we're doing.' Waiting for an annual true-up without knowing what our performance and that of our customers has been, is not the best situation."

6.3 ASP C

The following comments were provided by ASP C during conversations.

- ASP C description of the Pilot reported that they "were driving the car as we were building it." ASP C recognized the many challenges of implementing this pricing method and therefore did not want to be overly critical of anyone.
- ASP C found the enrollment process, which insisted on using the intimidating UtilityAPI, difficult initially, which led to some customers losing interest. The insistence that the permission sharing request come from TeMix and not ASP C was another barrier to increasing enrollment.

- ASP C customers have no awareness of prices, so the only source of demand response would be controlled loads (e.g., thermostats or electric vehicles such as Teslas).

- TeMix was very responsive to some technical problems (e.g., working with thermostats that had their own algorithms, or interfacing with Tesla), but ASP C encountered resistance from the TeMix project manager when implementing simpler and less intrusive customer requests or customer interface tools such as an App-Energy Expert (i.e., resistant to their input).

- When installers were sent to customers, they would focus on explaining the dynamic prices (why they vary across hours and days), because subscription pricing as a component of two-part pricing is more complex for customers to grasp.

- ASP C was frustrated that they had not received any shadow bill/credit information in a timely manner to pass on to customers.

- The most important issues for ASP C going forward are:

    - It has to be easy for the customer get feedback on how they're doing and have an easier interface to obtain and provide information (2-way).

    - Ideally, customers would have an app that provides real-time feedback and allows them to enter their own preferences (e.g., temperature ranges for comfort).

6.4 TeMix

The following text reflects written feedback we received directly from TeMix for inclusion in the evaluation. Text has been edited for brevity; note these comments reflect TeMix's position on the pilot.

TeMix believes this pilot, its sister PG&E/VCE[48] pilot, and the preceding RATES[49] pilot have shown that the CALFUSE vision is technically sound and feasible. According to TeMix this should reassure everyone about CALFUSE's direction and its potential for future success. The CALFUSE vision is for a two-part subscription and dynamic transactive price tariff. The subscription portion ensures stable bills and cost recovery while enabling equity policies. Customer-facing dynamic prices reflect locational scarcity and abundance in wholesale conventional and renewable generation, storage, and transmission. Additionally, these customer-facing prices reflect retail customer price responsive usage, distributed generation and storage, and locational distribution two-way scarcity and losses. Though TeMix, SCE, ASPs, and participants encountered pain points over the course of the pilot, the DRP pilot, its sister PG&E/VCE[50] pilot, and the preceding RATES[51] pilot were able to execute the CALFUSE strategy.

California's clean energy policies, combined with increasing wholesale and distributed renewable, variable generation, and storage, are stressing the existing systems in new ways. Suppliers' and customers' operations and investments need to adapt. The market, formed by customers' and suppliers' crucial investment and operational decisions, is responding. The CALFUSE vision provides the correct signals for these investment and operational decisions, valuing the role of each participant in the system. The TeMix Platform provides the computing infrastructure and methodology to implement the CALFUSE vision fully.

The California energy system is increasingly fixed-cost, comprising renewable generation, storage, wires, and energy-consuming devices that consume no fuel. The challenge is that there is no easy way to calculate the customer-facing marginal cost of energy. Instead, the energy price is determined by customer willingness to shift and shape energy usage and the shifting and shaping of fixed-cost distributed generation and storage especially in extreme weather and grid events. Price-responsive investment decisions also determine the energy price. The pricing formulas used in the two current CALFUSE pilots rely too heavily on outdated marginal cost concepts that mute the strength of the price signal, highlighting the need for improved dynamic scarcity pricing models.

TeMix understands that California's electricity institutions' full implementation of the CALFUSE vision will take time because tariff pricing, distribution services, and wholesale operations are typically siloed. Dynamic pricing scares some, but in the context of the CALFUSE two-part subscription transactive tariff, it should not. The transactive elements of the CALFUSE vision are essential to support forward operational planning and savings

[48] CPUC Decision (D.) 21-12-015
[49] Complete and Low-Cost Retail Automated Transactive Energy System (RATES) (dret-ca.com)
[50] CPUC Decision (D.) 21-12-015
[51] Complete and Low-Cost Retail Automated Transactive Energy System (RATES) (dret-ca.com)

by customers and suppliers. The transactive elements enable intra-day and intra-hour price response for grid reliability and savings, especially during extreme grid conditions.

The current command and control, dispatchable, overly centralized system is being significantly displaced by customer-owned and operated storage, solar generation, and flexible end-user devices such as electric vehicles, heat pumps, and intelligent controls. CALFUSE and its pilots show the way forward.

In an interview, TeMix had additional comments:

TeMix's comments on the pricing and billing role were as follows:

- SCE could have communicated the subscription values (monthly kWh and cost) to TeMix in simple tables, which would have allowed both TeMix and SCE to verify that TeMix was using the correct values. Instead, SCE transmitted subscription prices for multiple rates per customer with other data in large spreadsheets, which, early on, resulted in some errors that had to be corrected, and shadow bills recreated.

- TeMix was able to distill SCE's pricing models to about 10 parameters that are imported to their models, which worked well. There were some issues with flat adders (i.e., a constant $/kWh value applied to all hours) that were resolved over time.

- TeMix advocates moving to a more automated enrollment process.

  - SCE sets the pricing parameters that determine how "peaky" the dynamic prices are. That is, capacity costs are allocated across hours and some methods will spread those costs across more hours than others. The fewer hours that are assigned capacity costs, the peakier the affected hours will be (though there will be fewer higher-priced hours). TeMix would prefer a pricing method that results in higher but less frequent peaks so that the reliability of the grid to meet peaks is higher.

  - There were significant problems obtaining accurate meter load data in a timely manner. Initially, a third-party provider was used to process SCE's published data and billing data for use by TeMix, which led to problems that took significant resources to resolve. Issues included both missing data and data that changed over time. SCE has since implemented a process in which they provide the meter bill data directly to TeMix. This eliminated most meter and bill data issues as of early 2024, though data gaps and significant delays in receiving meter data still need to be resolved in some cases. Although the initial challenge of accurate meter data was mitigated by leveraging SCE data directly in early 2024, there have still been a few ongoing challenges, including delays in confirming that the meter data is the actual meter data used for customer billing.

- The meter data issues described above have often delayed providing shadow bills. TeMix's process of generating shadow bills is entirely automated once TeMix receives validated meter and OAT billing data. However, when such data problems occur, it is time-consuming to resolve them, which significantly

increases TeMix's costs and delays the publication of shadow bills. However, due to considerable work by SCE and TeMix, the direct communication of meter and bill data has improved significantly.

TeMix's comments on their role managing ASP C's residential customers were as follows:

- The residential customer enrollments only included thermostat-controlled loads. Electric vehicles and battery storage were not able to be included (SCE budget did not have the funds to pay the ASP). This limited the potential for price response.

- TeMix's algorithm used for ASP C learns a model of the house (thermodynamic machine learning) and finds the least-cost way to operate the air conditioner or heat pump while maintaining comfort. TeMix's technology can incorporate customer input via Alexa (i.e., helping refine comfort levels). Still, ASP C did not have funding to implement that feature in this pilot, which led to all customers being operated using a standard set of parameters.

- TeMix would like more manufacturer involvement. Tesla and ecobee could be excellent partners, but they have yet to develop algorithms that respond to the Pilot's dynamic prices. Instead, their algorithms focus on managing usage in response to standard TOU rates. It can be difficult for TeMix to manage devices that have their own algorithms – a more direct approach is for the manufacturers' algorithms to respond directly to the dynamic prices. TeMix believes the CPUC could provide incentives to manufacturers to adapt their algorithms to the Pilot's pricing.

Overall, TeMix reported that they have enjoyed working with SCE and the ASPs and that the Pilot has provided valuable experience.

6.5 SCE

Implementation

The original concept of the SCE Pilot arose from a dynamic pricing research study funded by the California Energy Commission (CEC) called the Retail Automated Transactive Energy System (RATES). RATES was implemented by TeMix in 2016 with SCE's participation. Its research objective was to demonstrate a "transactive energy" trading pricing and settlement platform that allows customers to respond to dynamic prices while managing their energy usage in real time. The RATES project enrolled over 100 residential customers and concluded in 2019.[52]

During Phase 2 of the CPUC's Summer Reliability rulemaking in 2021, TeMix proposed revisiting RATES as a means to provide load management for customers and ensure reliable electric service during the summer of 2022. In D.21-12-015, the CPUC mandated SCE and PG&E to each implement a pilot based on the TeMix proposal, which would operate from 2022 through 2024. SCE filed its Pilot plan approach in AL-4684-E on

[52] https://www.energy.ca.gov/sites/default/files/2021-05/CEC-500-2020-038.pdf

January 5, 2022 in compliance with D.21-12-015. This, along with supplemental AL 4684-E-A, outlined the overall scope, Pilot partners, shadow bill implementation, schedule, and tariff design for the proposed Pilot.

Over the development and implementation of the dynamic rate Pilot plan, SCE faced many design and operational challenges which required innovative approaches to Pilot initiation and ASP engagement, with constant process adjustments during the term of the Pilot. These included the need to meet a short implementation window for the summer of 2022 coupled with delays in developing the dynamic pricing models and subscriptions, delays in developing the circuit load forecasts, and further delays associated with the process of validating and revising customer shadow bills. Each of these issues are addressed in the following sections.

Design Challenges

- The Pilot's tariff design was unprecedented for SCE, hence this dynamic rate pricing endeavor should be viewed as an experimental pilot. Over its course, SCE staff needed to account for changes in transmission and distribution costs and non-bypassable charges in the hourly prices at a couple of points during the Pilot's operation. These changes in costs were reflected in updated flat adders that needed to be incorporated in customer shadow bills, not all of which were correctly included in the initial adjustments made by SCE.

- Because of the experimental nature of the Pilot's design, SCE updated dynamic price models as the Pilot continued; due to the manual nature of the changes and the short timeframe to implement, some of the activities were not fully documented at first, and as a result, the initial records of these price changes were incomplete.

- For some, forward transactions (originally included as a feature in the transactive pricing model) were difficult to execute and were ultimately not used by the ASPs and their customers; SCE therefore requested a discontinuation of forward transactions during the Pilot.

- SCE faced challenges with staff availability across multiple departments as data and validation tasks developed over the course of pilot. Few individuals had the Pilot as a dedicated day-to-day responsibility. This led to delays in Pilot implementation, billing, and data validation. Most Pilot activities required shared resources from other departments. For instance, the design and development of the hourly dynamic price models involved ongoing detailed discussions with the CPUC and the SCE rate design department, which delayed their delivery to TeMix.

- Community Choice Aggregation (CCA) customers were not eligible for the Pilot, which posed a significant challenge for verifying participant eligibility. The automatic enrollment campaign for CCAs coincided with the launch of the Pilot enrollment campaign, necessitating eligibility checks before and after Pilot customer enrollments. This process required coordination across multiple SCE teams to confirm bundled account status, ultimately eliminating over 75 unbundled CCA accounts that were previously eligible.

- The challenges mentioned above were some of the hurdles that various SCE resource teams resolved manually and through data systems to retrieve and quality check the required data. The Pilot consisted of 38 customer accounts across 33 SCE circuits. As an experimental Pilot, scaling up to a larger participant group was desired but not attainable with the existing resources and manual processes.

Shadow Bills - Data Issues and Validation

Pilot participants continued to pay their electric bills (based on their OATs) while the customers' monthly shadow bills were calculated by TeMix separate from SCE's billing system. At the end of one year of Pilot participation (or the customer's NEM relevant period), participants were eligible to receive incentives based on the differences in their shadow bills and OAT bills. As noted in SCE's brochure describing the Pilot, "At the end of 12 months of participation, the monthly regular bills you paid will be compared against the bills based on the SCE flexible pricing rate under the pilot. If you saved money on the SCE flexible pricing rate, your ASP will provide you with an incentive payment for the difference. If you did not save money on the SCE flexible pricing rate, you will incur no cost."

Below are some of the challenges encountered with shadow bill validations:

- TeMix contracted with a third-party to obtain interval meter data for customers participating in the pilot, as it had a system in place to accept data files from the third-party source. SCE conducted a validation of this third-party data, discovered issues with missing data, and advised TeMix of this finding. These interval data issues from the third-party provider caused problems in creating accurate weekday/weekend profiles, delaying the generation of shadow bills. To address these data issues, SCE developed an internal process to retrieve and send all customer billing interval data directly to TeMix starting in December 2023. This improved TeMix's shadow billing process.

- The Pilot team faced challenges in completing data validation and shadow bill calculations promptly, as these tasks were manually intensive and often required the involvement of multiple SCE staff from different departments to resolve issues. Upon review, the validation team found some errors in factors and other details that necessitated the regeneration of shadow bills. SCE manually adjusted a subset of TeMix shadow bills to account for CPP charges and incentives, NEM tracked charges, rate factor changes, and other elements. Identifying these elements caused several stops and starts, impacting the finalization of shadow bill deliverables. SCE decided to make these adjustments to reduce the additional back-and-forth of shadow bill calculation adjustments with TeMix.

- SCE also had additional learnings related to select account scenarios that required adjustments to the way accounts were calculated to provide customers with a "level playing field". Examples include subscription adjustments for customers moving from non-NEM to NEM, adjustments to exclude tracked charges from OAT bills for months when the customer was not on the pilot, handling situations where the customer changed their OAT rate or rate class, etc. Implementing forecasts from multiple circuits and the inclusion of hourly dynamic rate factors,

changing every 24 hours, introduced significant billing complexities and potential inaccuracies.

- The information exchange between SCE, its vendors, and customers was manual and inefficient due to the experimental nature of the Pilot design, which lacked traditional processes. For instance, the SCE Rate Design team generated spreadsheets to transmit subscription pricing to TeMix, while TeMix provided Excel-based shadow bill summaries to SCE.[53] Additionally, the evaluation team requested circuit-level tender prices for specific periods but had to repeatedly coordinate with TeMix to obtain all relevant files. This was mainly because some circuit load forecasts from GridX were not initiated until after the original customer start date. The challenge lay in the inability to transmit real-time meter data daily across SCE's service-wide territory for daily circuit forecasts, as this capability was currently unavailable.

- Due to the delays in generating and validating shadow bills, ASPs and customers did not know whether customers were earning credit during a majority of the Pilot's operation. The information was not shared with them at the end of one year of participation due to the validation challenges.

- The Pilot experiences with manual processes (typical for experimental pilots with limited customers) provided both the starting point for a dynamic tariff design but also many learnings with regards to system limitations. These learnings demonstrated the need for a centralized customer information database and automated data exchange for future dynamic pricing rates to be effectively scaled.

Dynamic Prices

One of the goals of this Pilot was to derive hourly dynamic prices that would vary day-to-day and provide the basis for the ASP's customer end-use load response. The Pilot team was interested in understanding the ASP response to the dynamic prices compared to the customers' OAT.

- The within-day price variation from the prices in the Pilot was not as high a differential as the ASPs expected for managing customer costs. So some of the ASPs managed to the OAT tariff so that it would be more rewarding for customer incentives from load shifts.

- SCE can consider whether the price model parameter values can be adjusted to produce higher intra-day incentives to shift load. SCE is also examining different price functions (sigmoidal versus quadratic) for use in future dynamic price design.

[53] TeMix noted that it had a centralized database for the Pilot, but other than CAISO inputs and GridX forecasts, most of the data inputs from SCE to TeMix were based on manual processes. The creation of shadow bills by TeMix for SCE was automated and, according to TeMix, the provided spreadsheets were intended to be read-only reports and not the basis for reprocessing shadow bills.

Manufacturer Interest

SCE reached out to multiple third-party entities when the Pilot was in its design stage to identify supporting resources, determine market participant interest and customer availability in working with SCE in the Pilot. These companies were investigated as potential ASPs, and they ranged from traditional demand response aggregators, automation technology startups, energy management service providers, as well as appliance and systems manufacturers, distributors, and consumer trade organizations.

SCE found in their discussions with these parties that the business models for many of these entities did not align with the limited value proposition that participating as an ASP in the Pilot provided. As would be expected, many of the manufacturers of electrical equipment were mostly concerned with maximizing equipment sales, enhancing market shares, and often did not provide the technology or connectivity services as required by the Pilot. Manufacturer interest was therefore limited but not totally absent or rejected outright. Many manufacturers of consumer goods such as smart appliances, electric vehicles, battery storage and air conditioning systems indicated some interest and requested engagement at a later time as the Pilot outcomes and business use cases became more developed.

Customer Reactions

Between November 12, 2024 and February 4, 2025, SCE conducted a survey with a subset of participants after they received their flexible comparison reports.[54] SCE invited 21 participants to take the survey over two waves. A total of six respondents completed the survey, and provided the following anecdotal results:

- Satisfaction from these six respondents varied. As noted by one respondent, "Paying attention to the hours we could 'save' electricity is stressing my family members and we have stopped doing things because of the higher prices." Other comments included the inability to modify thermostat changes from the ASP (a residential account), as well as the desire for more communication regarding the pilot. More surveys are being conducted to gather more meaningful results.

- Education: One customer commented that they did not even know they were on a dynamic rate. Conversely, half of the customers who responded (three) were aware of the SCE Pilot fact sheet and found it somewhat or a little useful. Customer responses from this group are anecdotal, however it aligns with the potential benefit that education has provided for SCE rate offerings.

- Device Upgrades: Half of the customers who responded (three) had to upgrade their existing devices to smart devices in order to participate in the Pilot. This was expected as the ASPs provided technology in almost all instances for their customers as part of the Pilot design. The need for smart devices is considered a

[54] SCE delivered Flexible Comparison Reports to participants that shows how flexible rates impact customer bills compared to their bills on their OATs. At the end of 12 months of participation, the monthly regular bills participants paid are compared to bills based on the flexible pricing rate under the pilot to determine whether participants receive incentives.

future requirement for effective price response, either through an ASP or with direct customer participation.

7. SUMMARY AND CONCLUSIONS

The Decision approving the Pilot included evaluation requirements that are quantitative in nature and implied that the Pilot duration was sufficiently long that the customer Pilot experience would be informative about the expected benefits and costs associated with the Pilot pricing mechanism.[55]

As it happened, the complexity of the pricing mechanism and technologies surrounding it (e.g., to create and transmit prices and bills; and to enable customer-side price response) have meant that the Pilot has been most instructive in the lessons learned that can be carried forward for future dynamic tariff design.

The key takeaways we have from the Pilot are described below.

- The evaluation of load responsiveness found the following:
  - The ASPs in the Pilot reported the ability to successfully respond to the hourly dynamic price signals from TeMix. ASPs were able to integrate technologies (primarily smart thermostats) in the Pilot that responded to the ASP Agent schedules based on the day-ahead price signals without customer intervention.
  - The analysis did not find evidence of consistent and/or large changes in hourly energy usage due to ASP/customer price response. Possible explanations for this finding include:
    - Extended time required to set up and implement Pilot activities, including time for the ASPs to refine their response algorithms, time to acclimate customers to the Pilot (e.g., ensure they understand the kinds of changes they can expect to experience as their AC units respond to prices), and time to produce information that provides ASPs and customers with feedback to understand the value of their participation and evaluate how they can improve performance.
    - The shadow bill credit methodology gives customers an incentive to simultaneously pay attention to OAT rates and dynamic prices. It is possible that ASPs prioritized reducing costs from the OAT during the Pilot period as those were more visible monthly to customers (shadow bills were not). Because of the "dual incentives" issue, the Pilot was not designed to obtain statistically valid estimates of customer response to dynamic prices.

[55] Specifically, there are requirements to evaluate load responsiveness, bill impacts, and cost recovery.

        - Hourly price differences from the dynamic rates may not have been high enough to induce significant price responses. At a given time, ASPs and customers may have prioritized maintaining comfort over the possible shadow bill savings available from shifting air conditioning loads.

- The monthly bill impacts of the Pilot dynamic rate (shadow bill) in comparison to a customer's OAT showed 41% (9 of the 22) of the customers evaluated in this report saved money on the Pilot. At the time of this evaluation:[56]

    - 4 of 13 residential customers were on track to receive a credit averaging 2.1% of their OAT bill.

    - 9 of 13 residential customers had shadow bills that were, in aggregate, 6.1% higher than their OAT bills.

    - 5 of 9 commercial customers were on track to receive a credit averaging 4.7% of their OAT bill.

    - 4 of 9 commercial customers had shadow bills that were, in aggregate, 8.3% higher than their OAT bills.

- The evaluation of cost recovery concluded that subscription savings were the most important factor in determining whether a customer was due a shadow bill credit. The optimal method of subscription pricing (e.g., whether/how to update quantities over time, how to deal with NEM or electric vehicle adoption) is a topic worthy of in-depth research that is beyond the scope of this study.

- The ASPs reported that they did not receive timely information on shadow bills and credits as expected for customer communications. The Pilot experienced significant delays in providing information to ASPs due to implementation issues and a largely manual infrastructure (e.g., customer-specific shadow bill spreadsheets).

- ASPs suggested that customer engagement could be improved by providing closer to real-time feedback and the ability to set preferences (e.g., desired temperature ranges) in a smartphone application (or something similar).

[56] Note that the Pilot credit summaries presented here in the evaluation are based on all available months for each customer. For the actual shadow billing, the shadow bill credit calculation for customers was conducted at the end of their relevant period for NEM customers and at the end of the 12 months of participation for non-NEM customers, with the months in the following period being included in a subsequent shadow bill credit calculation. This change in the timing of the calculation may affect whether a customer received a credit, as the calculation is cumulative over the shadow bill period.

- ASPs report that intra-day price variation needs to be higher to provide sufficient incentives to shift loads. It appears that the existing TOU rates in the customer OATs often provided higher incentives to shift.[57]

- Consider implementing a formal testing algorithm (i.e., the randomized treatment days used by one of the ASPs) on a more widespread basis to assist in evaluating the efficacy of the Pilot tariff in shifting loads enrolled in the program from peak to off-peak periods, compared to non-participant loads.

[57] Even if one assumes that the Pilot provides the "correct" incentive to shift loads and the TOU rates overpay customers, a customer will be likely to choose the TOU rate if it provides a higher reward for their usage changes.

GLOSSARY OF KEY PILOT TERMS

Automation Service Provider (ASP): companies that install and manage enabling technologies at retail customer sites.

Dynamic price tender (or just "tender"): a binding price for electricity during a specified period of time. These can be offered from an hour to days ahead of the time the electricity is consumed.

Ex-post price: the dynamic price at the time the electricity is consumed. Ex-post pricing occurred in 5-minute intervals until May 2024, when the Pilot changed to hourly settlements at the day-ahead dynamic price tender.

Otherwise Applicable Tariff (OAT): The SCE rate schedule a Pilot customer is served on prior to and during the Pilot, (e.g., TOU-GS-2-R).

Shadow bill: the total dollars associated with Pilot participant's electricity usage when billed at Pilot prices. This combines the subscription cost and the dynamic pricing components.

Shadow bill credit: the credit a Pilot customer receives at the end of 12 participating months on the Pilot if the total of their shadow bills is less than the total of their OAT bills. The customer does not pay if the total of their shadow bills is higher than the total of their OAT bills.

Subscription quantity: a fixed hourly quantity of electricity the customer purchases at OAT prices. The quantities are based on the customer's historical usage.

Subscription price: the customer's subscription load priced at the customer's OAT divided by their total subscription load.

APPENDIX

- Table A.1, below
- SCE Advice Letter 4684-E
- SCE Advice Letter 4684-E-A

Appendix Table A.1: Estimates of Changes in Peak-Period Usage

ID	Dates	NEM?	Pilot Coefficient Estimate	
			Peak = HE 17-21	Peak = HE 18-20
A-001	8/23 to 9/24	1.0	1.628 (0.302)	1.622 (0.136)
A-002	8/23 to 4/24	1.0	-10.675* (0.000)	-5.359* (0.000)
A-005	10/23 to 9/24	1.0	71.043* (0.000)	36.752* (0.000)
A-006	12/23 to 9/24	1.0	9.712* (0.000)	6.326* (0.000)
A-007	10/23 to 9/24	1.0	3.851* (0.027)	1.968 (0.070)
A-008	10/23 to 9/24	1.0	9.330* (0.000)	3.490* (0.000)
A-009	10/23 to 5/24	1.0	-1.612 (0.773)	-1.899 (0.566)
B-004	8/23 to 9/24	2.0	142.076* (0.000)	82.907* (0.000)
B-005	7/23 to 9/24		-156.574* (0.000)	-101.592* (0.000)
C-002	10/23 to 9/24		0.105 (0.447)	0.089 (0.359)
C-004	8/23 to 9/24		-0.039 (0.515)	0.020 (0.647)
C-024	10/23 to 9/24		0.011 (0.846)	0.023 (0.577)
C-030	10/23 to 9/24		-0.095 (0.500)	-0.088 (0.337)
C-043	10/23 to 9/24		-0.646* (0.042)	-0.381 (0.064)
C-044	3/24 to 9/24		0.988* (0.005)	0.897* (0.000)
C-045	10/23 to 9/24	1.0	0.489* (0.010)	0.198 (0.106)
C-051	12/23 to 4/24		-0.179 (0.811)	-0.130 (0.794)
C-052	12/23 to 4/24	2.0	-1.183* (0.020)	-0.756* (0.015)
C-053	12/23 to 9/24		-0.258 (0.239)	-0.090 (0.554)
C-054	12/23 to 9/24		-0.416* (0.045)	-0.268 (0.083)
C-055	1/24 to 9/24		-0.902* (0.000)	-0.606* (0.000)
C-056	1/24 to 4/24		0.033 (0.838)	0.018 (0.865)

PUBLIC UTILITIES COMMISSION
505 VAN NESS AVENUE
SAN FRANCISCO, CA 94102-3298

April 26, 2022

Shinjini C. Menon
Managing Director, State Regulatory Operations
Southern California Edison Company
8631 Rush Street
Rosemead, CA

***Subject*: Southern California Edison Company Advice Letter 4684-E**

Dear Ms. Menon:

Southern California Edison Company (SCE) Advice Letter (AL) 4684-E and SCE AL 4684-E-A, which provide information regarding SCE's forthcoming Dynamic Rate Pilot (Pilot) pursuant to Decision (D.) 21-12-015, are approved as filed, effective March 7, 2022.

The appendix of this letter contains a discussion of the AL, protests by the Small Business Utility Association (SBUA) and Enel X North America (Enel X), SCE's reply to these protests, SCE's Supplemental AL 4684-E-A, and Energy Division staff's disposition on the protested issues.

If you have any questions, please contact Achintya Madduri at (415) 696-7350 or achintya.madduri@cpuc.ca.gov.

Sincerely,

FOR.

Pete Skala
Interim Deputy Executive Director for Energy and Climate Policy/
Interim Director, Energy Division

cc: ED Tariff Unit
Achintya Madduri (ED)
Paul Phillips (ED)
Dan Buch (ED)
Jennifer L. Weberski (SBUA)
Sara Steck Myers (Enel X)

Appendix: Energy Division Technical Review and Analysis

Background

On November 19, 2020, the California Public Utilities Commission (CPUC) initiated Rulemaking (R.)20-11-003 to establish policies, processes, and rules to ensure reliable electric service in California in the event of an extreme weather event in 2021.

Ordering Paragraph (OP) 59 of Decision (D.) 21-12-015 (also referred to herein as the "Decision"), issued December 2, 2021, authorized SCE to use TeMix's Retail Automated Transactive Energy System (RATES) platform for a three year (2022-2024) dynamic pricing pilot (Pilot) in SCE's territory and granted SCE's request for a budget of $2.5 million. The Pilot is intended to assist in assessing the costs and benefits of real-time rates, including required infrastructure, manufacturer interest, and customer impacts. The Pilot will be administered by SCE under its Demand Response (DR) Emerging Markets and Technology program, authorized in D.17-12-003.

The TeMix proposal is consistent with ED staff's Unified, Universal, Dynamic Economic (UNIDE) pricing roadmap, which was originally proposed by Energy Division (and presented in a May 25 workshop).[1] The Pilot will use the RATES™ platform developed by TeMix,[2] a software platform piloted by the California Energy Commission (CEC) Electric Program Investment Charge (EPIC) grant EPC-15-054 in SCE's territory. TeMix proposed using the same platform for implementing a three-year dynamic rate pilot.

In OP 63 of the Decision, CPUC required SCE to submit a Tier 2 AL to address the following Pilot elements: (1) scope, (2) partners, (3) shadow bill implementation, (4) dates, and (5) tariff design.

SCE included the following details of the Pilot elements in AL 4684-E, which was filed on January 5, 2022:

1. **Pilot Scope**: The Pilot will combine real time pricing design and transactional subscription elements from both the RATES and UNIDE tariff concepts. The Pilot will also investigate how customer-based distributed energy resources can act as both flexible assets and grid interactive resources when these new pricing signals are transmitted to end use customers. So that these hypotheses are fully examined, the Pilot metrics will be structured to develop a series of empirical analyses to assess the costs and benefits of real-time dynamic rate communications, with the ultimate objectives of transferring the research investments from the 2016 CEC EPIC RATES pilot into flexible customer demand side opportunities that can accelerate solutions for system reliability for the summers of 2022 and 2023.

   The Pilot will include eligible SCE retail customers as participants in the first phase. SCE will examine and pursue opportunities to identify and enroll residential, commercial, and industrial customers as appropriate with smart enabling price-responsive end-uses including

[1] D.21-12-015, Attachment 1, p. 10.
[2] *See* TeMix Opening Testimony at 1-2 and SCE Reply Testimony at 8-10.

electric vehicle charging, behind-the-meter batteries, and controllable loads that may have the enabling software to interface with TeMix. Due to the accelerated Pilot schedule, and the urgency to meet summer 2022 reliability needs, SCE intends to work with automated service providers (ASPs) that may have existing SCE customers available with installed communicating enabling technologies that are compatible with the TeMix RATES software messaging platform. This aggregated approach for customer enrollment through ASP engagement is expected to reduce the cost for individual customer outreach and enrollment processes, thereby expediting the fulfillment of the schedule milestones as indicated in the project schedule. SCE expects that customer enrollment may be a continuous process, and will be phased to ensure that there are minimal gaps in the data analysis and to capture any changes in customer participation over the term of the study.[3]

2. **Pilot Partners:** SCE will execute a service contract with TeMix to use the TeMix platform software service. The Pilot will use the TeMix RATES™ platform architecture, as piloted through a CEC EPIC grant in SCE's service territory starting in 2018 with over 100 participating residential customers.[4]

   SCE will also work with other stakeholders such as current ASPs, major electric vehicle (EV) manufacturers and/or smart charger service providers, solar/battery aggregators or service providers, and others with the capability to directly receive price tenders (binding offers to buy/sell future energy quantities at a specified price) from the TeMix RATES platform to optimize load flexibility (such as EV and storage charging and discharging schedules).

   SCE will coordinate with Electric Power Research Institute (EPRI) to examine opportunities to engage various customer groups to receive the TeMix signals similar to what EPRI has done through existing CEC-EPIC research projects.

   SCE also intends to collaborate with Lawrence Berkeley National Laboratory (LBNL) to leverage LBNL's research with the California Load Flexibility Research and Development Hub (CalFlexHub).[5] CalFlexHub was established by the CEC to conduct applied research and development and technology demonstration and deployment projects that develop and increase the use and market adoption of advanced flexible demand technologies and strategies as electric grid resources and facilitate integration of distributed energy resources. This collaboration is intended to allow SCE to coordinate price messaging protocols and develop an expeditious pathway for alternative messaging transport services that may result in additional customer eligibility for the Pilot (e.g., underserved rural areas and disadvantaged communities lacking Wi-Fi access).

   In addition, there are other technology and software providers who already manage groups of SCE customers for demand management services and other value streams. These providers and other ASPs will be engaged to collaborate with SCE and TeMix and will be included in the project team as providers and advisors. Additionally, SCE will work to engage other innovative partners who have expressed interest in collaborating in the Pilot. SCE expects that these partners can provide consulting and technical services in the areas of market and grid operations, licenses for automated service platforms, economic reviews and system

[3] *See* pp. 2-7 of SCE AL 4684-E.
[4] *See* CEC EPIC grant EPC-15-054.
[5] *See* CEC EPIC grant GFO-19-309.

impact analyses (e.g., avoided cost calculations), and the estimation of load shift impacts and energy reduction savings. To that end, SCE will form two technical advisory committees (TACs): (1) an internal TAC to expedite coordination for execution of the Pilot and share real time learnings with the SCE project team; and (2) an external TAC to oversee the Pilot's design, deployment, and execution as well as assess evaluations and make recommendations to ensure that the Pilot is on track to meet its goals.[6]

3. **Shadow Bill Implementation**: While on the Pilot, customers will continue to be billed in accordance with their Otherwise Applicable Tariff (OAT). Concurrently, TeMix will configure the platform to calculate and provide monthly bill amounts based on the hourly price signals provided to customers participating in the Pilot. Any customer savings recognized from the hourly price signals compared to the customer's OAT will be provided to the customer on at least an annual basis.[7]

4. **Pilot Dates**: The Pilot's three-year timeline is defined in OP 63 of the Decision. SCE provided an illustrative timeline and said that the Pilot timeline is under development and may be subject to change.[8]

5. **Pilot Tariff Design**: SCE proposes to implement this Pilot without establishing a pilot tariff schedule because the Pilot will assess "the monthly bill impacts of the Pilot dynamic rate in comparison to a customer's otherwise applicable tariff." The subscription transactive price, which includes a customer-specific baseline energy quantity billed at an OAT to reduce bill/revenue volatility, will be further analyzed and developed in the Pilot. This dynamic price can be calibrated to reduce cost shifts while stabilizing utility revenues and customer bills. By using the appropriate mix of generation and delivery price signals for both day-ahead and/or real-time prices, the dynamic price tariff should align demand side management with capacity planning and other operational constraints that span the wholesale and retail delivery systems. TeMix will provide the technology platform, assist SCE in calibrating the price parameters, and assist in developing the subscription portion of the price for each customer. No tariff schedule is needed for this Pilot because customers will be billed based on their current SCE rate schedule. SCE will not implement billing system enhancements and participating customers will receive a shadow bill on the dynamic price rate.

SBUA Protest

On January 25, 2022, Small Business Utility Advocates (SBUA) submitted a protest of AL 4684-E and requested Commission staff to direct SCE to file a supplemental to the AL to address the following concerns:

1. **AL 4684-E does not explain how SCE will study the enhancement of system reliability**. In its protest, SBUA stated that SCE does not explain how it will develop definitions and metrics to measure system utilization, or how SCE will demonstrate that those measurements will reasonably assess system reliability impacts. SBUA also stated that the prior RATES pilot allocated 60 percent of generation capacity costs to bulk generation and

[6] *See* pp. 7-9 of SCE AL 4684-E.
[7] Id. at 9.
[8] *See* Figure 5 on pp. 9 of SCE AL 4684-E.

remaining 40 percent to three-hour ramp generation, and that SCE's AL did not have a discussion of the allocation of generation capacity costs.

SBUA stated that it is participating in an MGCC Study that is expected to propose a method to measure the scarcity of generation capacity on a day-ahead hourly basis in order to allocate MGCCs accordingly. This MGCC Study is being performed in partnership with PG&E, the Public Advocates Office, and other parties in compliance with D.21-11-017 (in A.20-10-011). A recent settlement in PG&E's Phase 2 General Rate Case (A.19-11-019) also proposes to use of those same methods for piloting certain residential and commercial rates. SBUA suggested that this study may result in the development of "evidence-based generation scarcity pricing curves."[9]

SBUA further stated that "there is little evidence that the proposed pilot will actually study the use of dynamic rates to enhance system reliability, as directed by CPUC."[10]

2. **The AL does not explain how non-marginal costs will be recovered**. In its protest, SBUA stated that dynamic pricing should be based on marginal cost rates. However, a substantial portion of SCE's rates are not marginal costs, but are allocated using the Equal Percent of Marginal Cost (EPMC) "scalar" method. If hourly rates are also increased to collect EPMC costs, then customers will receive incorrect pricing signals. For example, if the "correct" hourly cost during a period of resource scarcity is $2 per MWh and the EPMC factor is 2.0, then a customer would be scaled up to $4 per MWh. In addition to over-incentivizing load reduction, this methodology would also send an effective price signal for battery storage of $4 per MWh, which would far exceed the price available to battery storage operators dispatched through the CAISO. SBUA pointed to the use of a revenue neutral adder adopted by PG&E in D.21-11-017 and the settlement in PG&E's Phase 2 GRC (A.12-11-019), noting that "SCE's relative silence on how it views this issue suggests that the outcome of this pilot would not lead to a potential design for a widely-available dynamic rate."[11]

3. **AL 4684-E does not clearly describe eligibility requirements, which should be open to broad participation.** In its protest, SBUA stated that SCE does not clearly state what eligibility requirements will be included in the pilot scope. SBUA also stated that it is also unclear whether the pilot will be limited to SCE's bundled customers. Costs for SCE's demand response programs are recovered in distribution rates. As a consequence, SBUA asserts that SCE's pilot should include provisions for making dynamic rates available to customers of all LSEs on SCE's system. However, this will be challenging, as the LSE sets the generation charge component of the customer's bill.[12]

4. **The $2.5 million budget is not justified.** In its protest, SBUA stated that the SCE AL does not provide any details regarding how the authorized budget of $2.5 million is to be spent. SBUA also objected to the SCE AL's description of customer incentives, which SBUA states were neither estimated by SCE in its Reply Testimony, nor approved by CPUC.[13]

[9] See pp. 2 of SBUA Protest.
[10] Id. at 3.
[11] *Id*.
[12] *Id*.
[13] *Id*. at 4.

5. **The AL does not discuss the evaluations.** SBUA stated that while SCE is not required to discuss the mid-term and final evaluations required by the Decision, "it is surprising that the AL provides no substantive discussion of the evaluation," and that, "SCE will find it challenging to demonstrate the costs and benefits of real-time rates if the rates are not well-aligned with system costs and without clarity on how the shadow pricing relates to each component of the customer's otherwise applicable tariff"[14]

ENEL X Protest

On January 25, 2022, Enel X North America, Inc. (Enel X) submitted a protest of AL 4684-E on the grounds that the Pilot described by SCE is not sufficiently detailed to comply and achieve the goals set for the Pilot by the Decision. Enel X requested that the CPUC direct SCE to file a supplemental advice letter prior to the launch of the Pilot to provide further additional details:[15]

1. **For Pilot Scope**:
    a. Specify the rate classes or schedules that would be eligible for the Phase 2 RATES Pilot;
    b. Specify whether the total number of Pilot participants would be capped, either across the Pilot or for specific rate classes;
    c. Specify whether Pilot eligibility is limited by interconnection permit, export-compensation permit, Demand Response (DR) program participation, or other factors;
    d. Clarify whether the Pilot is intended to be limited to SCE bundled customers, or whether unbundled CCA or Direct Access customers could also participate;
    e. Clarify whether SCE intends to extend the Pilot RATES offering beyond the 2022-2024 term authorized in D.21-12-015, alluded to as "Phase 1;" and
    f. Specify how many distribution circuits will be included in the Pilot.
2. **For Pilot partners**: Describe how SCE intends to conduct Marketing and Outreach activities to enroll Pilot participants.
3. **For Shadow Bill implementation**: Specify whether Pilot participants will need to make a payment to SCE if their total RATES bills are higher than the Otherwise Applicable Tariff, or whether the Pilot will include a form of bill protection.
4. **For Pilot tariff design**:
    a. Specify the six-step "UNIDE" rate design and methodology that will be used as the basis for Pilot participation;
    b. Specify how the Pilot subscription profile would be created, level of temporal granularity in the subscription, whether customers or Automation Service Providers (ASPs) would have control over the subscription amount, whether the subscription profile would be updated over time, and how associated subscription rate(s) would be set; and

[14] See pp. 4 of SBUA Protest
[15] See pp. 2 of Enel X Protest

c. Specify whether SCE intends to adjust elements of the RATES tariff for different customer classes, to achieve revenue neutrality for a class-average customer from each class

SCE Reply to SBUA and ENEL X Protests

In its reply to the SBUA and ENEL X protests, SCE argued that the SBUA and ENEL protests do not provide a basis under General Order 96-B, Rule 7.4.2 for rejecting the Advice Letter. SCE stated that neither party argued that SCE failed to discuss each of the elements that the Decision directed SCE to address, and the Decision does not direct SCE to address the additional matters that these parties assert should be discussed in a supplemental advice letter. As such, there are no "material errors or omissions" in the Advice Letter that would warrant its rejection, and none of the other protest grounds identified by Rule 7.4.2 is applicable.[16]

SCE replied to the concerns raised in SBUA's protest as follows:

1. **AL 4684-E does not explain how SCE will study the enhancement of system reliability.** SCE stated that it will be conducting comprehensive studies that assess the costs and benefits of real-time rates, including required infrastructure, and impacts to system reliability. SCE stated that these studies will evaluate flexible load management that is enabled by automation that allows customers to more actively participate in programs governed by dynamic electricity tariffs and thereby contribute to system reliability.[17]

2. **The AL does not explain how non-marginal costs will be recovered**. SCE noted that various theories recommend different approaches to the recovery of non-marginal costs, and because there is no one-size-fits-all approach to the recovery of non-marginal costs, SCE may explore, through the Pilot, options for the recovery of such costs that range from a fixed charge approach to blended approaches that tailor the recovery of non-marginal costs in the dynamic price rate.[18]

3. **AL 4684-E does not clearly describe eligibility requirements, which should be open to broad participation.** SCE noted that a number of Pilot eligibility factors need to be considered when enrolling participants. SCE expects to include a broad selection of bundled customers in the Pilot, and that the actual number of customers may be limited by the budgetary constraints of shadow bill payments for customer participation costs. These and other factors are currently under review, and SCE is in discussions with ASPs and TeMix to focus on key eligible customer groups that can participate in the Pilot by May 1, 2022.[19]

4. **The $2.5 million budget is not justified.** SCE noted that SBUA's contention that the Advice Letter does not justify the proposed $2.5 million budget lacks merit because the

[16] See pp. 2 of SCE Reply
[17] See pp. 3 of SCE Reply
[18] See pp. 3 of SCE Reply
[19] See pp. 3 of SCE Reply

Decision already approved this budget.[20] SCE provided clarification that expenditures of this budget are currently in the process of being defined through negotiations with various parties, including TeMix, providing services in support of the Pilot. Other costs such as shadow bill preparation and payments, UNIDE facilities platform integration with ASPs, meter data and SCADA interface with SCE, project management, M&V, and other related activities are still being developed. SCE noted that the budget authorized for the Pilot is reasonable and will mitigate potential impact to participating ratepayers.[21]

5. **The AL does not discuss the evaluations.** SCE noted that the Decision does not require SCE to address evaluation in the Advice Letter and that SBUA's criticism provides no basis for CPUC to reject the Advice Letter. SCE provided clarification that the Pilot works on the broadly accepted principle that positive and contributory load response to an adequately designed price signal presents a low-cost alternative to deploying additional capacity on the system, be it for peak load or excess supply. The Pilot will thus focus on conducting evaluation studies to assess the load responsiveness to real-time rates, including required infrastructure, manufacturer interest, and customer impacts.[22]

SCE replied to the concerns raised in Enel X's protest as follows:

1. **Pilot scope**. SCE argued that ENEL's contention that the Advice Letter fails to provide sufficient detail about the Pilot's scope is incorrect, as the Advice Letter addresses scope at length in compliance with the Decision. SCE also provided additional clarification regarding participant eligibility and noted that although there is no specific cap on the number of participants, the totals will be limited based on a customer's technological compatibility and estimated costs of shadow billing payments based on the participant mix. SCE also noted that participant eligibility is limited to SCE bundled service customers so that those energy costs can be tracked via a shadow bill. SCE expects that the scope of customers enrolled in this phase of the Pilot may include an aggregation of multiple circuits.

2. **Pilot partners**. SCE argued that the Advice Letter addresses Pilot partners at length, in compliance with the Decision. SCE clarified that it intends to enroll participants through ASPs rather than through direct marketing and outreach to minimize enrollment delays and marketing costs to meet the Pilot's start date of May 1, 2022.

3. **Shadow bill**. SCE clarified that the Pilot and shadow bill implementation will not increase any rate or change, cause the withdrawal of service, or conflict with any other schedule or rule. The shadow bill process is designed to provide compensation for any incremental electricity costs that may be incurred as a result of customers participating in this Pilot while being billed on their OAT. There will be no additional charges to customers that may incur higher bills compared to their OAT.

[20] See D.21-12-015, p. 96 "(We grant SCE authorization to use TeMix's RATES platform for a three-year (2022-2024) dynamic pricing pilot in SCE's territory, and grant SCE its requested $2.5 million for the pilot."); see also id., OP 60.
[21] See pp. 4 of SCE Reply
[22] See pp. 4 of SCE Reply

4. **Pilot tariff design**. SCE noted that it will be implementing the Pilot without establishing a unique or separate tariff schedule for participants, as those customers will remain on their OAT. The dynamic price signals provided to the ASPs and subsequent customers will be developed by TeMix, through the technology platform under contract to SCE. TeMix will develop the UNIDE/RATES Subscription Transactive Rate (STR) for the Pilot, which will use the day-ahead Hourly CAISO Locational Prices (LMPs) as well as the day-of 15-minute and 5-minute LMPs. Leading up to the Pilot's projected May 1, 2022 start date, SCE and TeMix will be developing the initial specification of the STR for the Pilot.

SCE Supplemental AL 4684-E-A

To provide further information regarding Pilot elements and to address Energy Division questions regarding: (1) Formula of Price Curves and Rationale for Shape Chosen, (2) Inflection Points for Curves and Rationale for those Inflection Points, (3) Revenue Targets for Each of the Component Curves, (4) Illustrative Prices, (5) Addressing "Revenue Neutrality", SCE filed Supplemental AL 4684-E-A on April 25, 2022, and included the following details:

1. **Formula for Price Curves and Rational for Shape Chosen**. SCE's chosen quadratic price curve was used as a means to recover fixed costs along the entire duration of the load curve as opposed to the typical applications of concentrated fixed cost recovery used in standardized TOU rate design. Concentrated recovery of fixed costs using a flat-adder threshold basis can cause steep cross-hour price differentials that are almost surely bypassed by resources that are acutely flexible and can create compounding effects on cross-hour load impacts on the grid. SCE believes that the formulas can be iterated upon but stressed that the continuity of recovery along the entire duration of the load curve.

2. **Inflection Points for Curves and Rationale for those Inflection Points**. SCE's inflection points were selected to enable fixed cost price signals for both Peak Load and Minimum Load conditions. The inflection points also provide a capacity signal that helps mitigate renewable curtailment by providing price-sensitive sink-resources a negative capacity price to soak-up excess renewable supply while maintaining some correlation to how the system experiences load through the course of the year.

3. **Revenue Targets for Each of the Component Price Curves.** Revenue targets will be assessed based on the revenue components authorized by the Commission for each revenue component included in the customer's OAT.

4. **Illustrative Prices.** SCE provided its confidential Illustrative Pricing Model to Energy Division on April 8, 2022, as a data request response.

5. **Addressing "Revenue Neutrality"**. The customer's bill under the Dynamic Price Plus Subscription offering would approximate the customer's bill under the OAT, assuming the customer does not change from a pre-determined baseline of electricity usage. Revenue neutrality for the subscription portion of the customer's bill is achieved through the revenue neutral design of the OAT. Revenue neutrality for the dynamic price portion of the customer's bill is achieved by scaling the raw marginal cost curves by the Equal Percent Marginal Cost (EPMC) scalar for each revenue component from SCE's GRC. Non-bypassable costs and other costs associated with State and Commission programs and

policies will be included as a flat rate adder that equals the corresponding rate components currently contained in the customer's OAT and will be applied to each hour of the dynamic price curve. Grid related distribution costs as determined in SCE's GRC will be included as a flat rate (cents/kWh) in the total dynamic rate. Transmission-related costs will continue to be assessed based on the billing determinants as described in the customer's OAT and will be excluded from the Dynamic Price curve.

Discussion

After reviewing SCE AL 4684-E and Supplementary AL 4684-E-A, Energy Division finds SBUA's requests to require SCE to clarify details outside of the Pilot elements is not required pursuant to OP 63 of the Decision. The issues raised by SBUA, namely (1) enhancement of system reliability, (2) recovery of non-marginal costs, (3) eligibility requirements, (4) pilot budget, and (5) pilot evaluations, were not issues that CPUC required SCE to address in its advice letter, and are not proper grounds for protest under General Order (GO) 96-B, General Rule (Rule) 7.4.2. GO 96-B, Rule 7.4.2 provides that a protest to an advice letter may rest on grounds that: (1) the utility did not properly serve or give notice of the advice letter; (2) the relief requested would violate, or is not authorized by, statute or Commission order; (3) the analysis, calculations, or data in the advice letter contain material errors or omissions; (4) the relief requested is pending before the Commission in a formal proceeding; (5) the relief requested is inappropriate for the advice letter process; and/or (6) the relief requested is unjust, unreasonable, or discriminatory. SBUA has not identified any "material errors or omissions" in the advice letter that would warrant its rejection, nor sustained any contention that the advice letter fails to comply with the Decision. As such, Energy Division rejects SBUA's protest pursuant to Rule 7.6.1 of Commission GO 96-B.

Energy Division also finds Enel X's protest does not provide a basis for rejecting the SCE AL 4684-E under Rule 7.4.2 as the advice letter and supplemental advice letter discusses each of the elements that the Decision directed SCE to address. Since Enel X identifies no "material errors or omissions" in the advice letter, there are no grounds that warrant its rejection.

Energy Division finds that SCE's discussion of the Pilot price design offered in the supplemental AL 4684-E-A provides additional details regarding the formulation and design principles of the dynamic prices and will enable eligible customers and service providers to evaluate the benefits of participating in the Pilot.

Disposition

Energy Division hereby approves Advice Letter 4684-E and Supplemental Advice Letter 4684-E-A, submitted by Southern California Edison Company.

SOUTHERN CALIFORNIA EDISON®
An EDISON INTERNATIONAL® Company

Shinjini C. Menon
Managing Director, State Regulatory Operations

January 5, 2022

ADVICE 4684-E
(U 338-E)

PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA
ENERGY DIVISION

SUBJECT: Southern California Edison Company's Dynamic Rate Pilot Pursuant to Decision 21-12-015

PURPOSE

In compliance with Ordering Paragraphs (OPs) 59, 60, and 63 of Decision (D.) 21-12-015 (the Decision), Southern California Edison Company (SCE) hereby submits this advice letter (AL) for its Dynamic Rate Pilot (the Pilot). The purpose of this AL is to describe the scope, partners, shadow bill implementation, dates, and tariff design for the Pilot. SCE is requesting approval, in compliance with the Decision, for Pilot activities to start no later than May 1, 2022.

BACKGROUND

On November 19, 2020, the California Public Utilities Commission (Commission) initiated Rulemaking (R.)20-11-003 to establish policies, processes, and rules to ensure reliable electric service in California in the event of an extreme weather event in 2021.

On July 30, 2021, Governor Newsom signed an emergency proclamation to "free up energy supply to meet demand during extreme heat events and wildfires that are becoming more intense and to expedite deployment of clean energy resources this year and next year."[1] The Governor's emergency proclamation directed all energy agencies, including the Commission, to take steps to achieve energy stability during this emergency. In response to the Governor's emergency proclamation, on August 2, 2021, the assigned Administrative Law Judge initiated Phase 2 of R.20-11-003. After receiving testimony, briefs, and comments on a proposed decision from the parties, the

[1] See Governor Newsom's Press Release at https://www.gov.ca.gov/2021/07/30/governor-newsom-signs-emergency-proclamation-to-expedite-clean-energy-projects-and-relieve-demand-on-the-electrical-grid-during-extreme-weather-events-this-summer-as-climate-crisis-threatens-western-s/ and the Proclamation of a State of Emergency at https://www.gov.ca.gov/wp-content/uploads/2021/07/Energy-Emergency-Proc-7-30-21.pdf.

Commission on December 6, 2021 issued the Decision, which directs the IOUs to take actions to prepare for potential extreme weather in the summers of 2022 and 2023.

In accordance with OPs 59 and 60 and Attachment 1 of the Decision, SCE is authorized to conduct the Pilot to study how price responsive pilot projects can enhance system reliability in 2022 and 2023. OP 63 directs SCE to submit a Tier 2 Advice Letter within 30 days of the issuance of the Decision that includes, but is not limited to, the following elements: (1) pilot scope, (2) pilot partners, (3) shadow bill implementation, (4) pilot dates, and (5) pilot tariff design.[2] This AL is submitted to meet the requirements of OP 63 and addresses each of these five elements.

Discussion

In OP 59 and Attachment 1 of the Decision, the Commission authorized SCE to use TeMix's Retail Automated Transactive Energy System (RATES) platform for a three-year (2022-2024) dynamic pricing pilot in SCE's territory and granted SCE its request for a budget of $2.5 million for the Pilot. The Pilot is intended to assist in assessing the costs and benefits of real-time rates, including required infrastructure, manufacturer interest, and customer impacts. The Pilot will be administered by SCE under its Demand Response (DR) Emerging Markets and Technology program, authorized in D.17-12-003.

1. Pilot Scope

The TeMix proposal as cited in the Decision offered to support the unified, universal, dynamic economic (UNIDE) staff roadmap vision, which was originally proposed by the Commission's Energy Division (and demonstrated in a May 25 workshop).[3] The Pilot will use the RATES™ platform developed by TeMix,[4] a software platform piloted by the California Energy Commission (CEC) Electric Program Investment Charge (EPIC) grant EPC-15-054 and demonstrated in SCE's territory. This same platform is available for implementing the UNIDE concept as a pilot. Figure 1 illustrates the system architecture of the original TeMix RATES pilot conducted from 2017 through 2020.

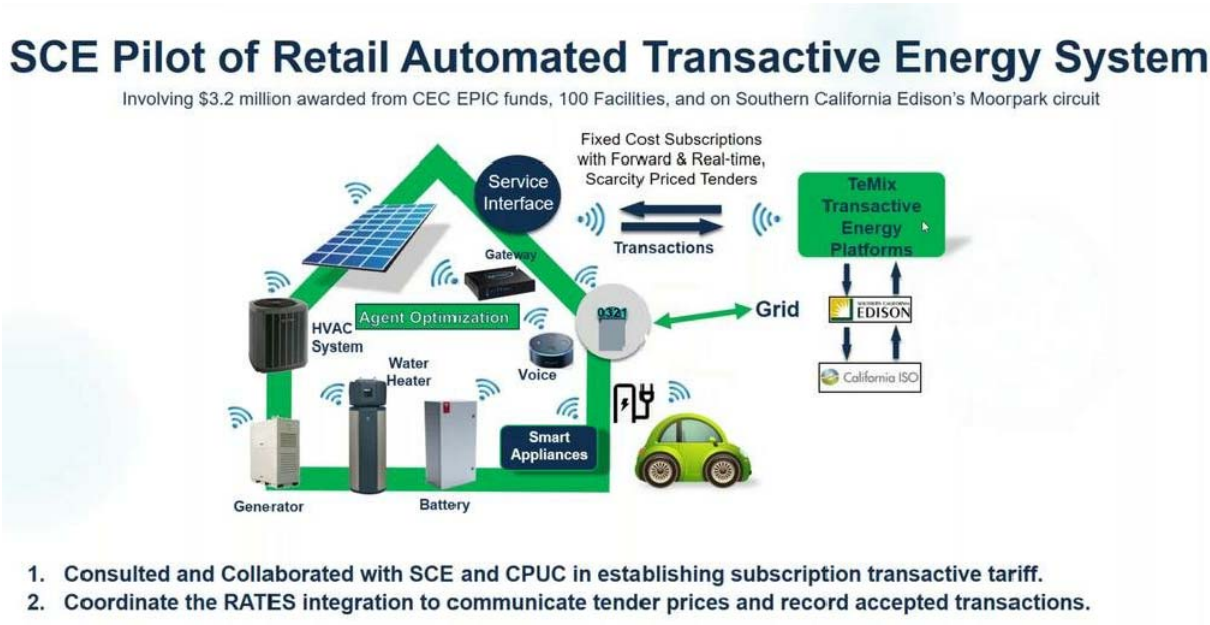
---

[2] D.21-12-015, OP 59; OP 63; Attachment 1, p. 12 ("SCE will submit a Tier 2 Advice Letter no later than 30 days after this decision that includes, but is not limited to, the following elements: (1) pilot scope, (2) pilot partners, (3) shadow bill implementation, (4) pilot dates, and (5) pilot tariff design.").

[3] D.21-12-015, Attachment 1, p. 10.

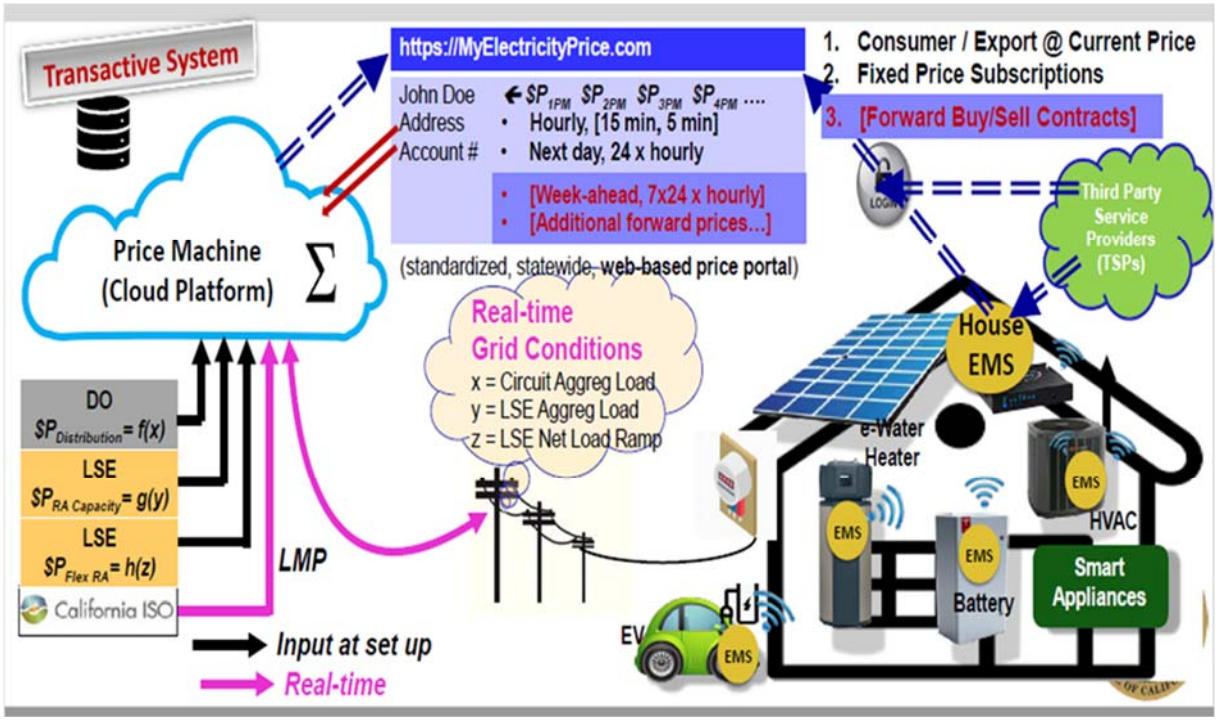
[4] TeMix Opening Testimony at 1-2; SCE Reply Testimony at 8-10.

Figure 1



The original TeMix RATES pilot sponsored by the CEC in 2016 can now be leveraged to develop economic options for both transactive price models and real time pricing with other parties and stakeholders, and to demonstrate how new forms of distributed energy resources can act as both customer assets and grid interactive resources. This "follow up" approach will allow SCE to develop transactive price models and real time pricing to meet the objectives of the Pilot. As such, SCE's Pilot will follow the TeMix platform and RATES tariff design, and will be a three-year (2022-2024) effort to examine the efficacy of the UNIDE roadmap using the RATES system architechture. An overview of the advanced UNIDE concept as proposed by the Energy Division is illustrated in Figure 2.

Figure 2



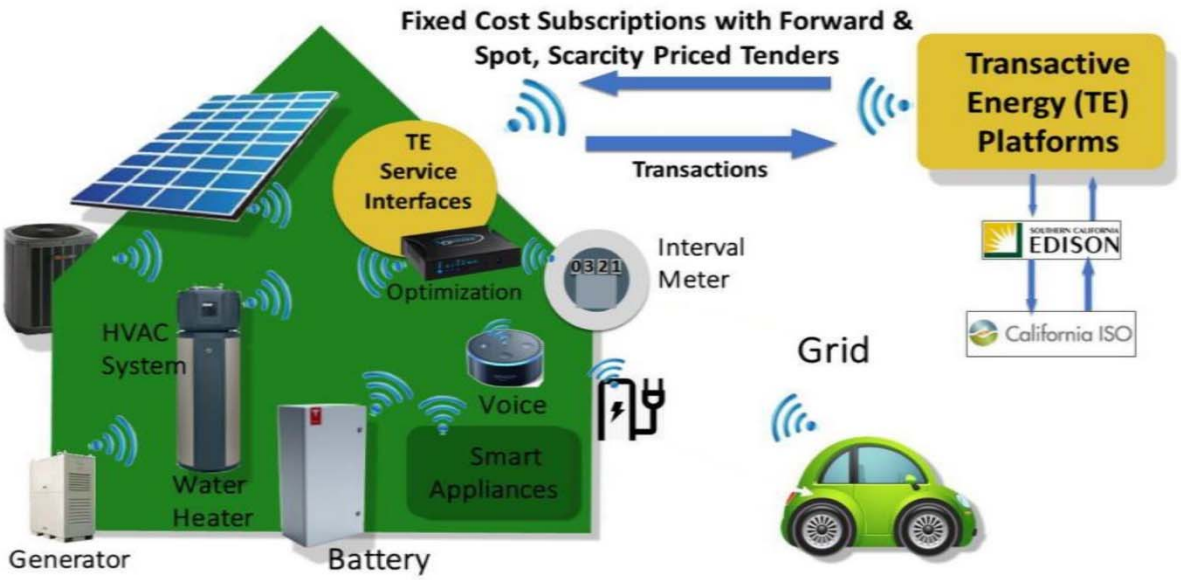
The Pilot will combine real time pricing design and transactional subscription elements from both the RATES and UNIDE tariff concepts. This is a prudent approach to enhancing and scaling up a system wide demand flexibility approach to improve system reliability and enhance customer benefits. The Pilot will also investigate how customer-based distributed energy resources can act as both flexible assets and grid interactive resources when these new pricing signals are transmitted to end use customers as proposed in the UNIDE model. So that these hypotheses are fully examined, the Pilot metrics will be structured to develop a series of empirical analyses to assess the costs and benefits of real-time dynamic rate communications, with the ultimate objectives of transferring the research investments from the 2016 CEC EPIC RATES pilot into flexible customer demand side opportunities that can accelerate solutions for system reliability for the summers of 2022 and 2023.

The key operational tasks of the Pilot will be to automate the creation of dynamic prices for the generation and delivery components of a transactive tariff, and present these composite dynamic hourly prices via an internet-based secure pathway to be accessed by retail customers, wholesale market particpants, and automated services platforms for distributed energy resources (DERs). Customers and their end use devices would be connected to the TeMix cloud platform to receive price tenders either directly, via local management, or from aggregated management signals from third-party automated services platform clouds via Internet/Wifi/LTE to the secure receivers at the customer site.

Figure 3 provides an illustration of the cloud based transport architecture is proposed for the Pilot based on the previous RATES transactive energy platform and demonstrates how it would interact with residential customers. In this illustration, appliances and devices such as electric HVAC heat pumps, electric vehicles, electric water heating devices, both heat pump and resistance, pool pumps, and smart speakers and residential energy management systems (EMS) have the potential to provide load flexibility. Other customer sectors besides single family residential could be enrolled in the Pilot, including multi-family, small business, institutional accounts, water agencies, process treatment facilities, large refrigeration, and commercial building energy management systems (including those with thermal storage systems).

To facilitate the objectives of the research hypotheses with "real world" assessments and impacts from a wide range of electrical end uses, the Pilot will include eligible SCE retail customers as participants in the first phase. SCE will examine and pursue opportunities to identify and enroll residential, commercial, and industrial customers as appropriate with smart enabling price-responsive end-uses. These end-uses include electric vehicle charging, behind-the-meter batteries, and controllable loads that may have the enabling software to interface with TeMix. Due to the accelerated Pilot schedule, as shown in Figure 5, and the urgency to meet summer 2022 reliaibity needs, SCE intends to work with automated service providers (ASPs) that may have existing SCE customers available with installed communicating enabling technologies that are compatible with the TeMix UNIDE software messaging platform.

Figure 3



SCE and TeMix have successfully collaborated on RATES and other research activities with a wide range of automated service interfaces (API) service providers that have demonstrated secure communications for energy management products and services. These include APIs from a number of service providers that are compatible with the TeMix messaging service. The ASPs in many cases have already equipped their

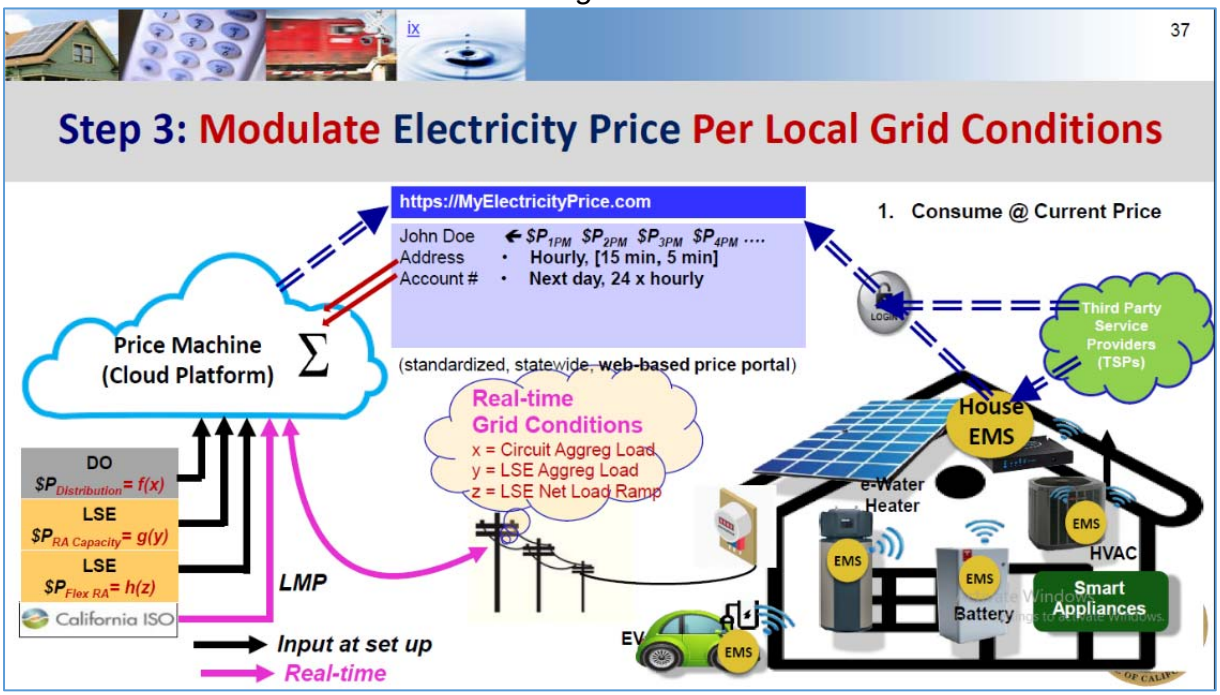
customers with the capability to automatically manage the electrical end use operations of customer facilities (single family homes, multi-family residences, large commercial offices, industrial facilities such as water services and refrigeration warehouses). Many of the managed services provided by ASPs include the optimization of end use loads such as air conditioning, process operations, behind the meter (BTM) solar paired with storage through smart inverter APIs, and electric vehicle managed charging and fleet services. These customer sectors and others will be approached for their availability to respond to the Pilot dynamic UNIDE price signals to achieve the flexible rate responsiveness desired to demonstate the efficacy of the Pilot and to ultimately enhance customer savings.

This aggregated approach for customer enrollment through ASP engagement would reduce the cost for individual customer outreach and enrollment processes thereby expediting the fulfillment of the schedule milestones as indicated in the project schedule in Figure 5. SCE expects that customer enrollment may be a continuous process, and will be phased to ensure that there are minimal gaps in the data analysis and to capture any changes in customer participation over the term of the study. TeMix will configure the Pilot UNIDE Platform and work with ASPs to accept enrollments of customers and their flexible devices through the applicable APIs. The platform will also be configured for the SCE distribution circuits needed for the Pilot and their specific (pNode) interface. The TeMix platform already demonstrated that it has interfaces to the CAISO that should be sufficient to start by May 1, 2022.

As noted earlier, the Decision requires that the design of SCE's Dynamic Rate Pilot be based on the 6-step UNIDE roadmap. Step 3 of the roadmap calls for implementing "scarcity price functions" designed to recover more fixed cost (of generation and distribution capacity) when system utilization is higher. As the illustration of the system architecture (included in the roadmap) shows in Figure 4, system utilization is represented by time-dependent independent variables ("x", "y", "z" in lower left of the diagram) that represent time-dependent load conditions on the grid.

During this pilot, SCE, through its Grid Operation and Strategy teams, will examine how the dependent real time grid and aggregated circuit load conditions derived from its distribution grid SCADA systems can provide the inputs to the scarcity pricing functions to generate the time-dependent hourly capacity charges (for both generation and distribution components).

Figure 4



TeMix and SCE have worked together during the RATES pilot. This experience will allow SCE and TeMix to collaborate closely to identify how the granularity, latency, and accuracy of these inputs can be provided to facilitate the summer 2022 timeline for the Pilot. The SCE internal teams will examine the SCADA real time data availability and develop an implementation plan that addresses the expectations in the Decision as discussed earlier. TeMix will work with SCE to provision the currently available data sources and methods to measure or estimate actual and forecasted loads on specific circuits involved in the Pilot. In addition, TeMix will also provide an API that will enable SCE to transfer the available circuit data to their platform in a cyber-secure manner.

2. Pilot Partners

To implement the Pilot, SCE will immediately execute a service contract with TeMix to use the TeMix platform software service. The Pilot will use the TeMix RATES™ platform architecture, as piloted through a CEC EPIC grant[5] in SCE's service territory starting in 2018 with over 100 participating residential customers. TeMix proposes for the Pilot to provide this software services platform for a period of three years or longer, with the option for extended services as needed. The platform will transmit dynamic tariff prices securely to participating SCE retail customers during the Pilot and will also record these UNIDE tender transactions for settlement purposes. The service is securely hosted by TeMix on the Microsoft Azure™ cloud, and operational "24/7," 365

[5] See CEC EPIC grant EPC-15-054.

days per year. According to TeMix, this platform will be operational for the Pilot implementation in Summer of 2022.

SCE will also work with other stakeholders such as current ASPs, major electric vehicle (EV) manufacturers and/or smart charger service providers, solar/battery aggregators or service providers, and others with the capability to directly receive the UNIDE tenders from TeMix and optimize (on behalf of the customer) end use flexibility strategies (such as EV and storage charging and discharging schedules). TeMix will provide optimization agents for use by the vendors to assess their applicability for eligibility, security, and compatability with current APIs (reducing the need for software development).

Currently the Electric Power Research Institute (EPRI) is conducting a number of CEC EPIC research projects that use a similar secure communications platform (OpenADR) and have previously worked with both the CEC and TeMix on research projects to faciliate flexibility and responsiveness to dynamic test signals. The customer sectors in prior research included industrial (refrigerated warehouses and water/wastewater facilities) and large commercial office parks and institutional customers (hospitals, state facilities, etc). SCE will coordinate with EPRI and examine opportunities to enage these and other customer groups to receive the TeMix signals similar to what EPRI has done through OpenADR.

SCE also intends to collaborate with Lawence Berkeley National Laboratory (LBNL) to leverage LBNL's research with the CalFlexHub. This collaboration will allow SCE to coordinate price messaging protocols and develop an expeditious pathway for alternative messaging transport services that may result in additional customer eligibility for the Pilot (e.g., underserved rural areas and disadvantaged communites lacking Wi-Fi access). The researchers at LBNL have previously worked under contract to EPRI and SCE on conducting market studies and technical assessments of real time secure demand response and dynamic pricing communications and new forms of enabling customer technologies. This research can inform the development and design of the Pilot.

In addition, there are other technology and software providers who already manage groups of SCE customers for demand management services and other value streams. These providers and other ASPs will be engaged to collaborate with SCE and TeMix and will be included in the project team as providers and advisors. Additonally, SCE will work to engage other innovative partners who have expressed interest in collaborating in the Pilot. SCE expects that these partners can provide consulting and technical services in the areas of market and grid operations, licenses for automated service platforms, economic reviews and system impact analyses (e.g., avoided cost calculations), and the estimation of load shift impacts and energy reduction savings.

To that end, SCE will form two technical advisory committees (TACs): (1) an internal TAC to expedite coordination for execution of the Pilot and share real time learnings with the SCE project team; and (2) an external TAC to oversee the Pilot's design,

deployment, and execution as well as assess evaluations and make recommendations to ensure that the Pilot is on track to meet its goals.

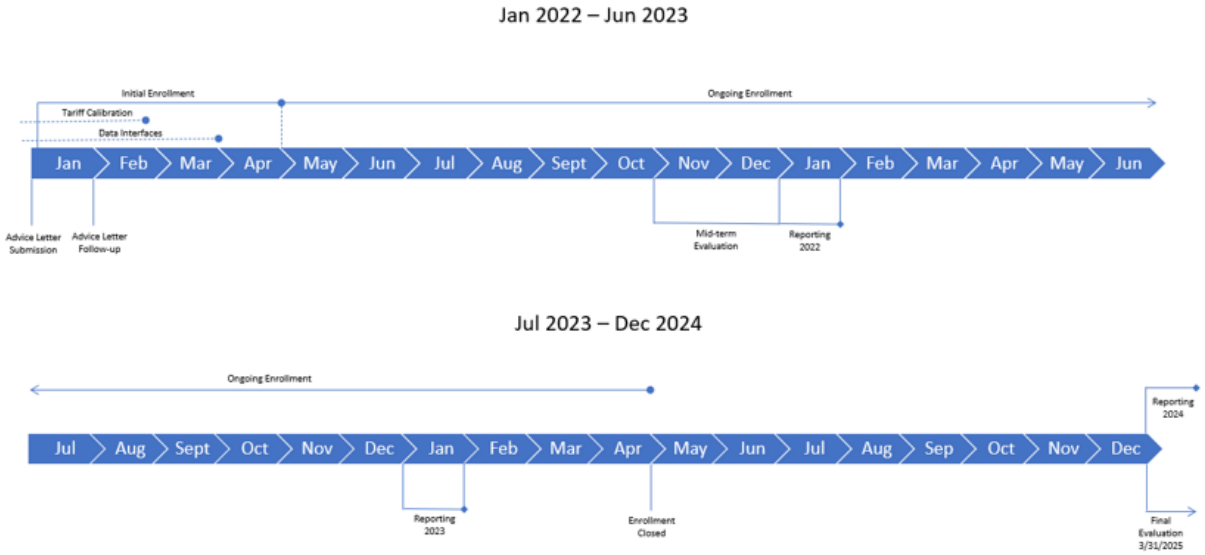
3. Shadow Bill Implementation

While on the Pilot, customers will remain on and continue to be billed in accordance with their Otherwise Applicable Tariff (OAT). Concurrently, TeMix will configure the platform to calculate and provide monthly bill amounts based on the hourly price signals provided to customers participating in the Pilot. Any customer savings recognized from the hourly price signals compared to the customer's OAT will be provided to the customer on at least an annual basis.

4. Pilot Dates

As shown in Figure 5, the three year Pilot timeline is defined in OP 63 of the Decision. This Pilot timeline is under development and may be subject to change.

Figure 5
Pilot Timeline



5. Pilot Tariff Design

SCE proposes to implement this Pilot without establishing a pilot tariff schedule because the Pilot will assess "the monthly bill impacts of the Pilot dynamic rate in comparison to a customer's otherwise applicable tariff."[6] Per the Decision, the subscription transactive price, a core element of the UNIDE roadmap, will be further analyzed and developed in the Pilot. This dynamic price can be calibrated to reduce cost shifts while stabilizing utility revenues and customer bills. By using the appropriate

[6] D.21-12-015, OP 62, p. 180.

mix of generation and delivery price signals for both day-ahead and/or real-time prices, the dynamic price tariff should align demand side management with capacity planning and other operational constraints that span the wholesale and retail delivery systems. TeMix will provide the technology platform, assist SCE in calibrating the price parameters, and assist in developing the subscription portion of the price for each customer. No tariff schedule is needed for this Pilot because customers will be billed based on their current SCE Rate Schedule. SCE will not implement billing system enhancements and participating customers will receive a shadow bill on the dynamic price rate.

This AL will not increase any rate or change, cause the withdrawal of service, or conflict with any other schedule or rule.

TIER DESIGNATION

Pursuant to OP 63 and Attachment 1, page 12 of the Decision, this advice letter is submitted with a Tier 2 designation.

EFFECTIVE DATE

This advice letter will become effective on February 4, 2022, the 30th calendar day after the date submitted.

NOTICE

Anyone wishing to protest this advice letter may do so by letter via U.S. Mail, facsimile, or electronically, any of which must be received no later than 20 days after the date of this advice letter. Protests should be submitted to:

CPUC, Energy Division
Attention: Tariff Unit
505 Van Ness Avenue
San Francisco, California 94102
E-mail: EDTariffUnit@cpuc.ca.gov

Copies should also be mailed to the attention of the Director, Energy Division, Room 4004 (same address above).

In addition, protests and all other correspondence regarding this advice letter should also be sent by letter and transmitted via facsimile or electronically to the attention of:

Shinjini C. Menon
Managing Director, State Regulatory Operations
Southern California Edison Company
8631 Rush Street
Rosemead, California 91770
Telephone (626) 302-3377
Facsimile: (626) 302-6396
E-mail: AdviceTariffManager@sce.com

Tara S. Kaushik
Managing Director, Regulatory Relations
c/o Karyn Gansecki
Southern California Edison Company
601 Van Ness Avenue, Suite 2030
San Francisco, California 94102
Facsimile: (415) 929-5544
E-mail: Karyn.Gansecki@sce.com

There are no restrictions on who may submit a protest, but the protest shall set forth specifically the grounds upon which it is based and must be received by the deadline shown above.

In accordance with General Rule 4 of GO 96-B, SCE is serving copies of this advice letter to the interested parties shown on the attached GO 96-B, R.20-11-003, A.17-01-012, et al., R.13-09-011 service lists. Address change requests to the GO 96-B service list should be directed by electronic mail to AdviceTariffManager@sce.com or at (626) 302-4039. For changes to all other service lists, please contact the Commission's Process Office at (415) 703 2021 or by electronic mail at Process_Office@cpuc.ca.gov.

Further, in accordance with Public Utilities Code Section 491, notice to the public is hereby given by submitting and keeping the advice letter at SCE's corporate headquarters. To view other SCE advice letters submitted with the Commission, log on to SCE's web site at https://www.sce.com/wps/portal/home/regulatory/advice-letters.

For questions, please contact Kellvin Anaya at (909) 274-3438 or by electronic mail at Kellvin.Anaya@sce.com.

Southern California Edison Company

/s/ Shinjini C. Menon
Shinjini C. Menon

SCM:ka:jm

California Public Utilities Commission

ADVICE LETTER SUMMARY

ENERGY UTILITY

MUST BE COMPLETED BY UTILITY (Attach additional pages as needed)

Company name/CPUC Utility No.: Southern California Edison Company (U 338-E)

Utility type:
☑ ELC ☐ GAS ☐ WATER
☐ PLC ☐ HEAT

Contact Person: Darrah Morgan
Phone #: (626) 302-2086
E-mail: AdviceTariffManager@sce.com
E-mail Disposition Notice to: AdviceTariffManager@sce.com

EXPLANATION OF UTILITY TYPE
ELC = Electric GAS = Gas WATER = Water
PLC = Pipeline HEAT = Heat

(Date Submitted / Received Stamp by CPUC)

Advice Letter (AL) #: 4684-E

Tier Designation: 2

Subject of AL:
Southern California Edison Company's Dynamic Rate Pilot Pursuant to Decision 21-12-015

Keywords (choose from CPUC listing): Compliance

AL Type: ☐ Monthly ☐ Quarterly ☐ Annual ☑ One-Time ☐ Other:

If AL submitted in compliance with a Commission order, indicate relevant Decision/Resolution #:
Decision 21-12-015

Does AL replace a withdrawn or rejected AL? If so, identify the prior AL:

Summarize differences between the AL and the prior withdrawn or rejected AL:

Confidential treatment requested? ☐ Yes ☑ No

If yes, specification of confidential information:
Confidential information will be made available to appropriate parties who execute a nondisclosure agreement. Name and contact information to request nondisclosure agreement/ access to confidential information:

Resolution required? ☐ Yes ☑ No

Requested effective date: 2/4/22

No. of tariff sheets: -0-

Estimated system annual revenue effect (%):

Estimated system average rate effect (%):

When rates are affected by AL, include attachment in AL showing average rate effects on customer classes (residential, small commercial, large C/I, agricultural, lighting).

Tariff schedules affected: N/A

Service affected and changes proposed[1]:

Pending advice letters that revise the same tariff sheets: None

[1]Discuss in AL if more space is needed.

Clear Form

Protests and all other correspondence regarding this AL are due no later than 20 days after the date of this submittal, unless otherwise authorized by the Commission, and shall be sent to:

CPUC, Energy Division
Attention: Tariff Unit
505 Van Ness Avenue
San Francisco, CA 94102
Email: EDTariffUnit@cpuc.ca.gov

Name: Shinjini C. Menon
Title: Managing Director, State Regulatory Operations
Utility Name: Southern California Edison Company
Address: 8631 Rush Street
City: Rosemead
State: California Zip: 91770
Telephone (xxx) xxx-xxxx: (626) 302-3377
Facsimile (xxx) xxx-xxxx: (626) 302-6396
Email: advicetariffmanager@sce.com

Name: Tara S. Kaushik c/o Karyn Gansecki
Title: Managing Director, Regulatory Relations
Utility Name: Southern California Edison Company
Address: 601 Van Ness Avenue, Suite 2030
City: San Francisco
State: California Zip: 94102
Telephone (xxx) xxx-xxxx:
Facsimile (xxx) xxx-xxxx: (415) 929-5544
Email: karyn.gansecki@sce.com

Clear Form

ENERGY Advice Letter Keywords

Affiliate	Direct Access	Preliminary Statement
Agreements	Disconnect Service	Procurement
Agriculture	ECAC / Energy Cost Adjustment	Qualifying Facility
Avoided Cost	EOR / Enhanced Oil Recovery	Rebates
Balancing Account	Energy Charge	Refunds
Baseline	Energy Efficiency	Reliability
Bilingual	Establish Service	Re-MAT/Bio-MAT
Billings	Expand Service Area	Revenue Allocation
Bioenergy	Forms	Rule 21
Brokerage Fees	Franchise Fee / User Tax	Rules
CARE	G.O. 131-D	Section 851
CPUC Reimbursement Fee	GRC / General Rate Case	Self Generation
Capacity	Hazardous Waste	Service Area Map
Cogeneration	Increase Rates	Service Outage
Compliance	Interruptible Service	Solar
Conditions of Service	Interutility Transportation	Standby Service
Connection	LIEE / Low-Income Energy Efficiency	Storage
Conservation	LIRA / Low-Income Ratepayer Assistance	Street Lights
Consolidate Tariffs	Late Payment Charge	Surcharges
Contracts	Line Extensions	Tariffs
Core	Memorandum Account	Taxes
Credit	Metered Energy Efficiency	Text Changes
Curtailable Service	Metering	Transformer
Customer Charge	Mobile Home Parks	Transition Cost
Customer Owned Generation	Name Change	Transmission Lines
Decrease Rates	Non-Core	Transportation Electrification
Demand Charge	Non-firm Service Contracts	Transportation Rates
Demand Side Fund	Nuclear	Undergrounding
Demand Side Management	Oil Pipelines	Voltage Discount
Demand Side Response	PBR / Performance Based Ratemaking	Wind Power
Deposits	Portfolio	Withdrawal of Service
Depreciation	Power Lines	

Clear Form

SOUTHERN CALIFORNIA EDISON®
An EDISON INTERNATIONAL® Company

Shinjini C. Menon
Managing Director, State Regulatory Operations

April 25, 2022

ADVICE 4684-E-A
(U 338-E)

PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA
ENERGY DIVISION

SUBJECT: Supplemental to Tier 2 Advice Letter for Southern California Edison Company's Dynamic Rate Pilot Pursuant to Decision 21-12-015

PURPOSE

Southern California Edison Company (SCE) submits this supplemental advice letter (AL) to provide additional information on its Dynamic Rate Pilot (the Pilot), initially described in Advice 4684-E filed January 5, 2022 in compliance with Decision (D.) 21-12-015 (the Decision).

The purpose of this supplemental AL is to provide additional information requested by California Public Utilities Commission (Commission) staff on (1) Formula of Price Curves and Rationale for Shape Chosen, (2) Inflection Points for Curves and Rationale for those Inflection Points, (3) Revenue Targets for Each of the Component Curves, (4) Illustrative Prices, (5) Addressing "Revenue Neutrality."

SCE requests approval, in compliance with the Decision, for Pilot activities to start no later than May 1, 2022. This advice letter supplements in part and does not change the substance of the original AL 4684-E.

BACKGROUND

The Commission issued the Decision on December 6, 2021. Ordering Paragraph (OP) 59, OP 60, and Attachment 1 of the Decision authorized SCE to conduct the Pilot to study how price responsive pilot projects can enhance system reliability in 2022 and 2023. In compliance with OP 63 of the Decision, SCE submitted Advice 4684-E to address the Pilot's scope, partners, shadow bill implementation, dates, and tariff design. At the request of the Commission's Energy Division, SCE is filing this supplemental AL to provide additional details on the Pilot's design.

Discussion

SCE began work to implement the Pilot shortly after the Decision was issued, including weekly discussions regarding the Pilot design elements and operational requirements with TeMix, Inc. (TeMix). In addition, SCE has approached and discussed the Pilot with a wide range of Automated Service Providers (ASPs) in order to enroll residential, commercial, and industrial customers with smart enabling price-responsive end-uses, such as electric vehicle charging, behind-the-meter batteries, and controllable loads. The transactive platform services contract with TeMix is in the final stages of procurement, as are the service contracts with several ASPs. Internal processes for the development of the transactive rate design elements, the shadow bill strategy, ASP software integration, daily local grid level forecasting, and meter data transfers are near finalization and will soon be ready for beta testing prior to full Pilot operation.

SCE provides the following additional information regarding the implementation of the Pilot.

1. **Formula of Price Curves and Rationale for Shape Chosen**

   SCE's chosen quadratic price curve is intended to recover fixed costs along the entire duration of the load curve, as opposed to the typical applications of concentrated fixed cost recovery used in standardized TOU rate design. Concentrated recovery of fixed costs using a flat-adder threshold basis can cause steep cross-hour price differentials that are likely to be bypassed by resources that are acutely flexible and can create compounding effects on cross-hour load impacts on the grid. SCE believes that the formulaic definition of these dynamic price curves can be refined through iterative cycles and regression analysis on the causal effects of price on load determinants and/or customer responsiveness. However, SCE believes that the continuity of recovery along the entire duration of the load curve is an important element that should be considered in the determination of a price function for long-run fixed cost recovery.

2. **Inflection Points for Curves and Rationale for those Inflection Points**

   SCE's Inflection points were selected to enable fixed cost price signals for both Peak Load and Min Load conditions. The inflection point is selected as load basis when heat rates sink to some measure of system P-Mins during times of renewable over-supply and when non-renewable resources may need to continue to perform in times of increasing supply of renewable resources. The inflection points also provide a capacity signal that helps mitigate renewable curtailment by providing price-sensitive sink-resources a negative capacity price to soak-up excess renewable supply while maintaining some correlation to how the system experiences load through the course of the year.

3. Revenue Targets for Each of the Component Curves

Revenue Targets will be assessed based on the revenue components authorized by the Commission for each revenue component included in the customer's otherwise applicable tariff (OAT).

4. Illustrative Prices

SCE provided its confidential Illustrative Pricing Model to Energy Division on April 8, 2022 as a data request response.

5. Addressing "Revenue Neutrality"

The customer's bill under the Dynamic price plus Subscription offering would approximate the customer's bill under the OAT, assuming the customer does not change from a pre-determined baseline of electricity usage. Revenue neutrality for the subscription portion of the customer's bill is achieved through the revenue-neutral design of the OAT. Revenue neutrality for the dynamic price portion of the customer's bill is achieved by scaling the raw marginal cost curves by the Equal Percent Marginal Cost (EPMC) scalar for each revenue component from SCE's GRC. Non-bypassable costs and other costs associated with the State and Commission's programs and policies will be included as a flat rate adder that equals the corresponding rate components currently contained in the customer's OAT, and will be applied to each hour of the dynamic price curve. Grid-related distribution costs as determined in SCE's GRC will be included as a flat rate (cents/KWh) in the total dynamic rate. Transmission-related costs will continue to be assessed based on the billing determinants as described in the customer's OAT and will be excluded from the Dynamic Price curve.

PROTESTS

SCE asks that the Commission, pursuant to GO 96-B, General Rule 7.5.1, maintain the original protest period designated in Advice 4684-E and not reopen the protest period.

TIER DESIGNATION

This supplemental advice letter is submitted with a Tier 2 designation, the same tier designation as AL 4684-E.

EFFECTIVE DATE

SCE respectfully requests this supplemental advice letter become effective concurrent with original Advice 4684-E, on February 4, 2022.

NOTICE

In accordance with General Rule 4 of GO 96-B, SCE is serving copies of this advice filing to the interested parties shown on the attached GO 96-B, R.20-11-003, A.17-01-012, et al., R.13-09-011 service lists. Address change requests to the GO 96-B service list should be directed by electronic mail to AdviceTariffManager@sce.com or at (626) 302 4039. For changes to all other service lists, please contact the Commission's Process Office at (415) 703 2021 or by electronic mail at Process_Office@cpuc.ca.gov.

Further, in accordance with Public Utilities Code Section 491, notice to the public is hereby given by filing and keeping the advice letter at SCE's corporate headquarters. To view other SCE advice letters submitted with the Commission, log on to SCE's web site at https://www.sce.com/wps/portal/home/regulatory/advice-letters.

For questions, please contact Patrick Nandy by electronic mail at Patrick.Nandy@sce.com.

Southern California Edison Company

/s/ Shinjini C. Menon
Shinjini C. Menon

SCM:pn:jm

California Public Utilities Commission

ADVICE LETTER SUMMARY

ENERGY UTILITY

MUST BE COMPLETED BY UTILITY (Attach additional pages as needed)

Company name/CPUC Utility No.: Southern California Edison Company (U 338-E)

Utility type:
☑ ELC ☐ GAS ☐ WATER
☐ PLC ☐ HEAT

Contact Person: Darrah Morgan
Phone #: (626) 302-2086
E-mail: AdviceTariffManager@sce.com
E-mail Disposition Notice to: AdviceTariffManager@sce.com

EXPLANATION OF UTILITY TYPE
ELC = Electric GAS = Gas WATER = Water
PLC = Pipeline HEAT = Heat

(Date Submitted / Received Stamp by CPUC)

Advice Letter (AL) #: 4684-E-A

Tier Designation: 2

Subject of AL:
Supplemental to Tier 2 Advice Letter for Southern California Edison Company's Dynamic Rate Pilot Pursuant to Decision 21-12-015

Keywords (choose from CPUC listing): Compliance

AL Type: ☐ Monthly ☐ Quarterly ☐ Annual ☑ One-Time ☐ Other:

If AL submitted in compliance with a Commission order, indicate relevant Decision/Resolution #:
Decision 21-12-015

Does AL replace a withdrawn or rejected AL? If so, identify the prior AL:

Summarize differences between the AL and the prior withdrawn or rejected AL:

Confidential treatment requested? ☐ Yes ☑ No

If yes, specification of confidential information:
Confidential information will be made available to appropriate parties who execute a nondisclosure agreement. Name and contact information to request nondisclosure agreement/ access to confidential information:

Resolution required? ☐ Yes ☑ No

Requested effective date: 2/4/22

No. of tariff sheets: -0-

Estimated system annual revenue effect (%):

Estimated system average rate effect (%):

When rates are affected by AL, include attachment in AL showing average rate effects on customer classes (residential, small commercial, large C/I, agricultural, lighting).

Tariff schedules affected: None

Service affected and changes proposed[1]:

Pending advice letters that revise the same tariff sheets: None

[1]Discuss in AL if more space is needed.

Clear Form

Protests and correspondence regarding this AL are to be sent via email and are due no later than 20 days after the date of this submittal, unless otherwise authorized by the Commission, and shall be sent to:

California Public Utilities Commission
Energy Division Tariff Unit Email:
EDTariffUnit@cpuc.ca.gov

Contact Name: Shiniini C. Menon
Title: Managing Director, State Regulatory Operations
Utility/Entity Name: Southern California Edison Company

Telephone (xxx) xxx-xxxx: (626) 302-3377
Facsimile (xxx) xxx-xxxx:
Email: AdviceTariffManager@sce.com

Contact Name: Tara S. Kaushik c/o Karyn Gansecki
Title: Managing Director, Regulatory Relations
Utility/Entity Name: Southern California Edison Company

Telephone (xxx) xxx-xxxx:
Facsimile (xxx) xxx-xxxx:
Email: karyn.gansecki@sce.com

CPUC
Energy Division Tariff Unit
505 Van Ness Avenue
San Francisco, CA 94102

Clear Form

ENERGY Advice Letter Keywords

Affiliate	Direct Access	Preliminary Statement
Agreements	Disconnect Service	Procurement
Agriculture	ECAC / Energy Cost Adjustment	Qualifying Facility
Avoided Cost	EOR / Enhanced Oil Recovery	Rebates
Balancing Account	Energy Charge	Refunds
Baseline	Energy Efficiency	Reliability
Bilingual	Establish Service	Re-MAT/Bio-MAT
Billings	Expand Service Area	Revenue Allocation
Bioenergy	Forms	Rule 21
Brokerage Fees	Franchise Fee / User Tax	Rules
CARE	G.O. 131-D	Section 851
CPUC Reimbursement Fee	GRC / General Rate Case	Self Generation
Capacity	Hazardous Waste	Service Area Map
Cogeneration	Increase Rates	Service Outage
Compliance	Interruptible Service	Solar
Conditions of Service	Interutility Transportation	Standby Service
Connection	LIEE / Low-Income Energy Efficiency	Storage
Conservation	LIRA / Low-Income Ratepayer Assistance	Street Lights
Consolidate Tariffs	Late Payment Charge	Surcharges
Contracts	Line Extensions	Tariffs
Core	Memorandum Account	Taxes
Credit	Metered Energy Efficiency	Text Changes
Curtailable Service	Metering	Transformer
Customer Charge	Mobile Home Parks	Transition Cost
Customer Owned Generation	Name Change	Transmission Lines
Decrease Rates	Non-Core	Transportation Electrification
Demand Charge	Non-firm Service Contracts	Transportation Rates
Demand Side Fund	Nuclear	Undergrounding
Demand Side Management	Oil Pipelines	Voltage Discount
Demand Side Response	PBR / Performance Based Ratemaking	Wind Power
Deposits	Portfolio	Withdrawal of Service
Depreciation	Power Lines	

Clear Form