



Date: April 21, 2025
To: Municipal Light Board: Warren Leon, John Dalton, Brian Foulds, Bianca Taylor and Chris Schaffner
From: Jason Bulger, CMLP Director
Subject: Agenda for virtual Light Board meeting on **Wed., April 29, 2025, at 1:00 P.M.** (link below)

1:00 PM 1. **Call to Order**

1:00 PM 2. **Meetings and Minutes**

- Meeting minutes will be approved at the May 2025 meeting.

Upcoming Meetings:

May 14, 2025; Jun 11, 2025; Jul 9, 2025; Aug 13, 2025; Sep 10, 2025; Oct 8, 2025

1:00 PM 3. **Time-of-Use Presentation** 1 Hour Asst. Director Information
Background: In 2019, the Sacramento Municipal Utility District (SMUD) moved to time-of-use rates for nearly all residential customers.

Purpose: One or more employees from SMUD will talk through their roll-out of time-of-use rates and take questions from Board members based on SMUD’s experiences.

2:00 PM 9. **Liaison & Public Comments** 5 Minutes Chair Information

2:05 AM 10. **Adjourn**

Distribution: Select Board (1 copy)

Kerry Lafleur	Carole Hilton	Joe Repoff	Nan Okarma
Jan Aceti	Laura Scott	Jeff Cosgrove	Eric Simms
Cameron McKennitt	Karlen Reed		

Join Zoom Meeting

<https://us02web.zoom.us/j/84054613484?pwd=WkS6QGd6cncrcc7F0Q2NMWKLALpHK58.1>

Meeting ID: 840 5461 3484

Passcode: 124688

Link to view recordings of previous Light Board Meetings:

<https://www.youtube.com/playlist?list=PL1TTzrWEKOOOn0RIJ2MdE2SnNZMWYeoeat>

Link to view the Director’s Updates (also in meeting packets):

<https://concordma.gov/1106/Municipal-Light-Board>



CONCORD MUNICIPAL
LIGHT PLANT
ELECTRIC | BROADBAND | ENERGY MANAGEMENT

Link to view the Broadband Monthly Updates:
<https://www.concordma.gov/3148/Monthly-Updates>

SMUD's Time-of-Day Rate

April 29, 2025

Alcides Hernandez, Karen McCord

Reduce
5 to 8

p.m.



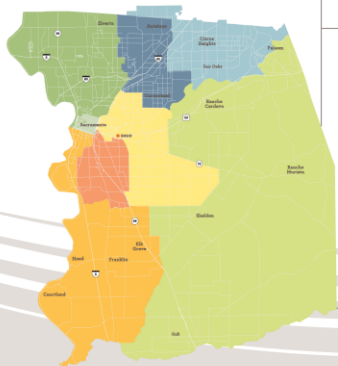
Powering forward. Together.



About SMUD

SMUD is your community-owned, not-for-profit electric service.

6th largest
community-owned
in the U.S.



75+
Years
Est. 1946

2023
Power mix
about
78%*
carbon-free



The most
ambitious goal
of any large
utility in the
United States

~**645,000** Customers

~**2,300** Employees



7 member
Elected
Board of Directors

SMUD's rates are among the lowest in California,
and on average more than **50% lower** than those of neighboring PG&E.

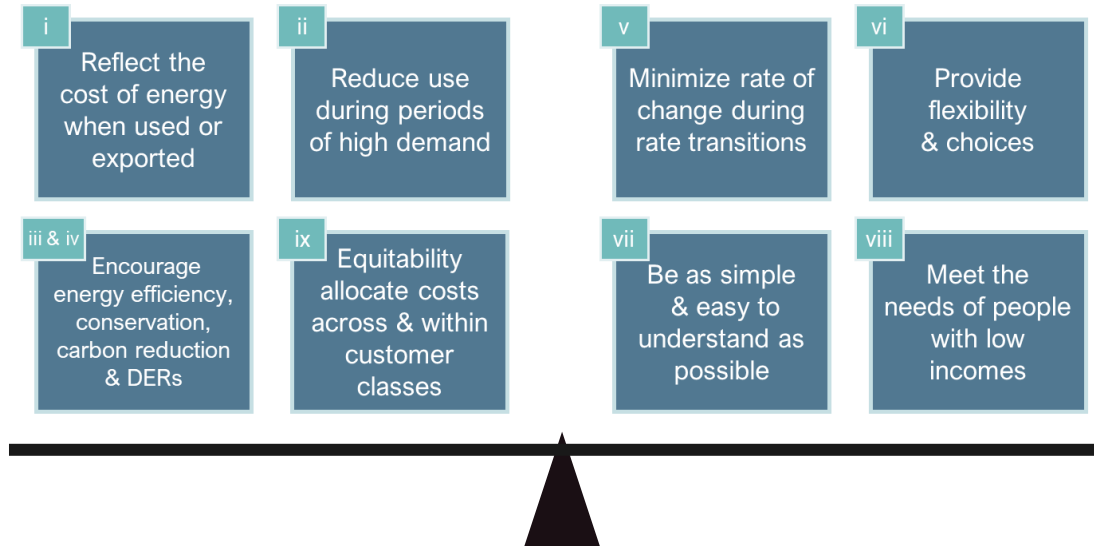
CleanPowerCity.org



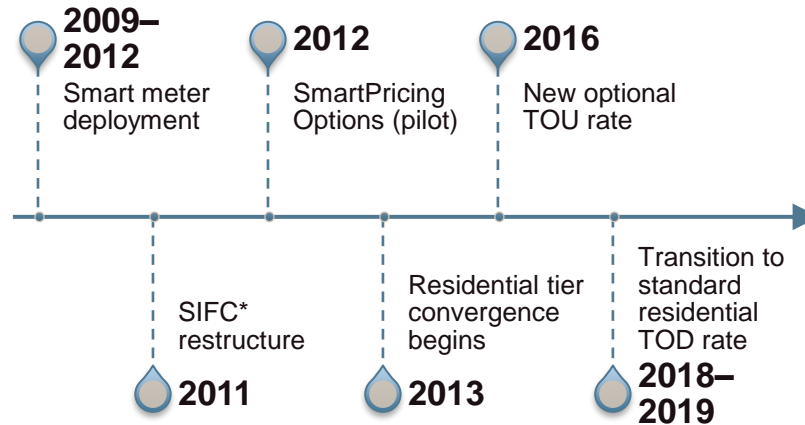
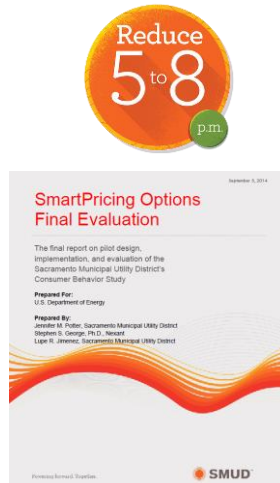
TOD Rate Design / Objectives

SMUD SD-2 Rates Principles

SMUD's rates shall be designed to balance and achieve the following goals:



10-year transition to TOD



SIFC: System Infrastructure Fixed Charge. This is the monthly customer charge on customer bills
The charge is \$26.20 per month effective 5-1-25

Some history

SMUD set to lead on electricity pricing

'TIME OF USE' COULD PROMPT CONSERVATION

BY THE EDITORIAL BOARD

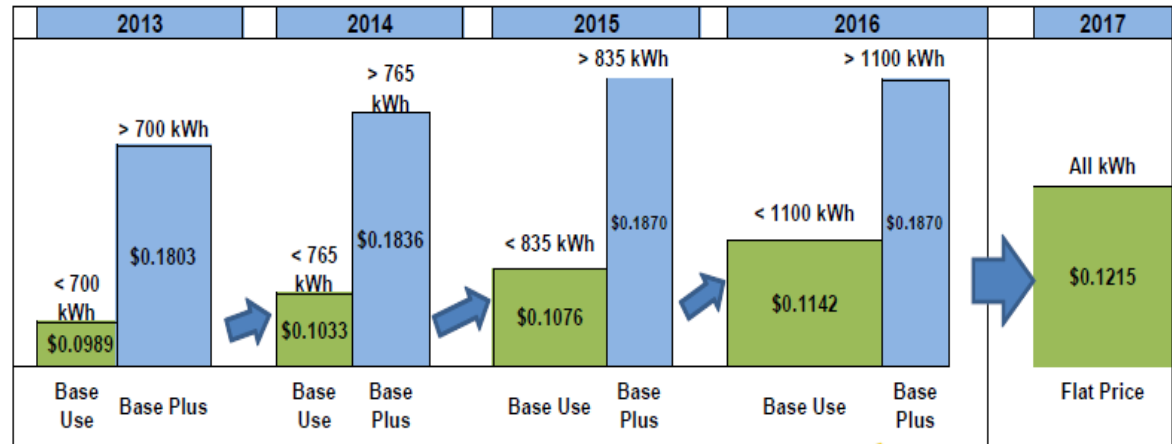
The Sacramento Municipal Utility District is weighing a rate increase that will cost the typical residential customer between \$2 and \$4 more a month by 2015. That may grab people's immediate attention. But what is far more significant is the farsighted change in the way SMUD is proposing to charge for electricity in future years.

The change being considered - time-of-use pricing - would require the SMUD board's approval and wouldn't be implemented until 2018 at the earliest. Still, by tying electricity pricing to the periods households are using electricity, SMUD would be sending the right message to its customers about when to power down to save money

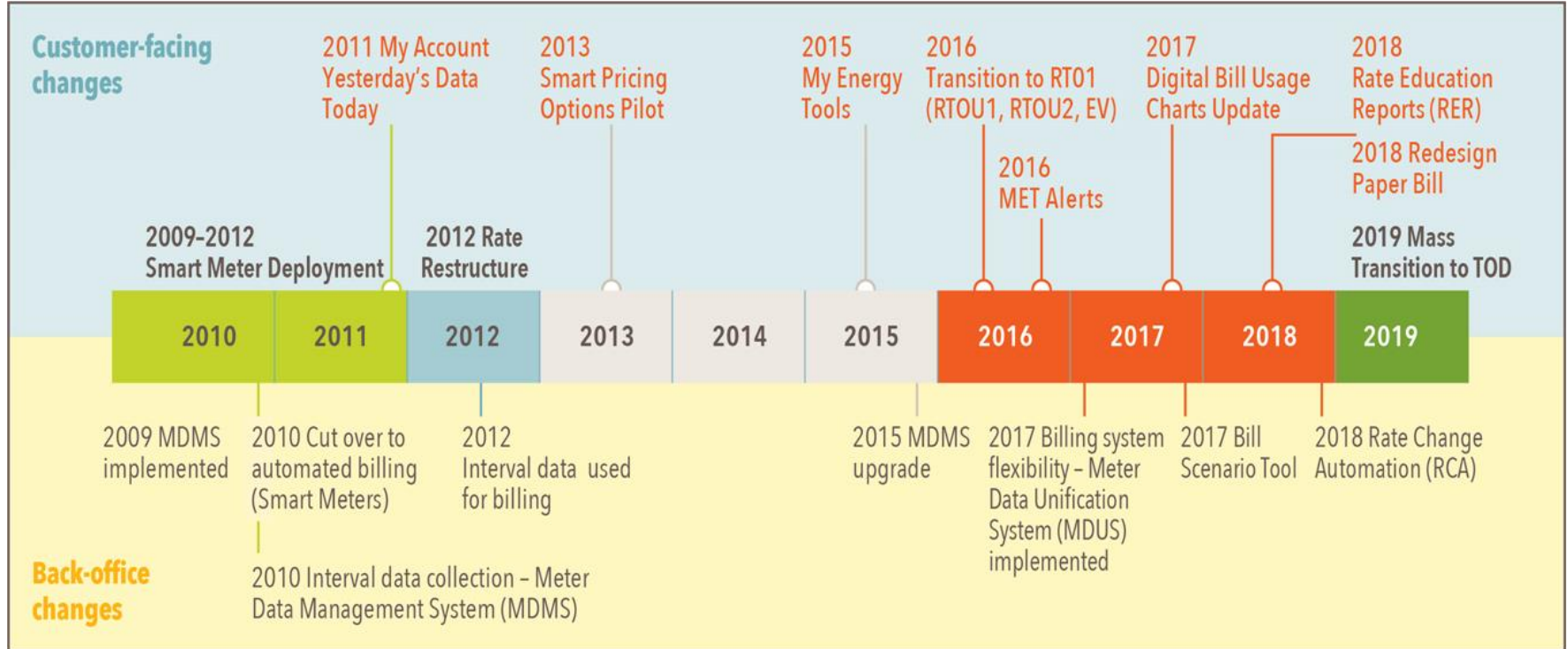
It's a big change from the way the utility charges residential customers now. Currently, households pay a lower base rate, 9.5 cents per kilowatt hour for the first 700 kilowatts they use in a month. They pay almost double that amount, 18 cents per kwh for any power they use above 700 kilowatts. But that pricing regimen does not accurately reflect SMUD's cost of generating power. The utility pays more during times of heavy demand and less when demand recedes.

The current system results in heavy users unfairly subsidizing low-use customers who use a disproportionate amount of electricity during times of peak demand. It sends the wrong price message to customers.

Residential tiers were eliminated between 2013 and 2017



Preparation journey



Time-of-Day (5-8 p.m.) Rate

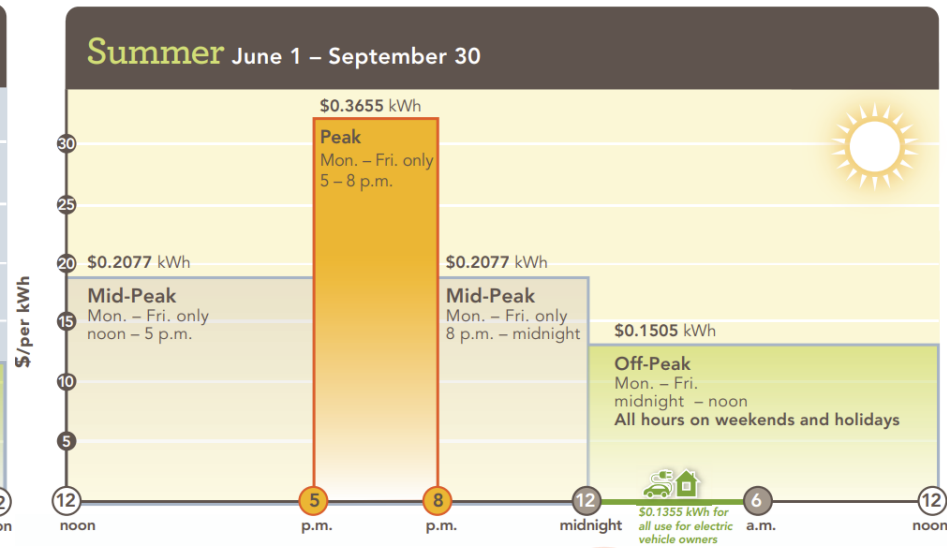
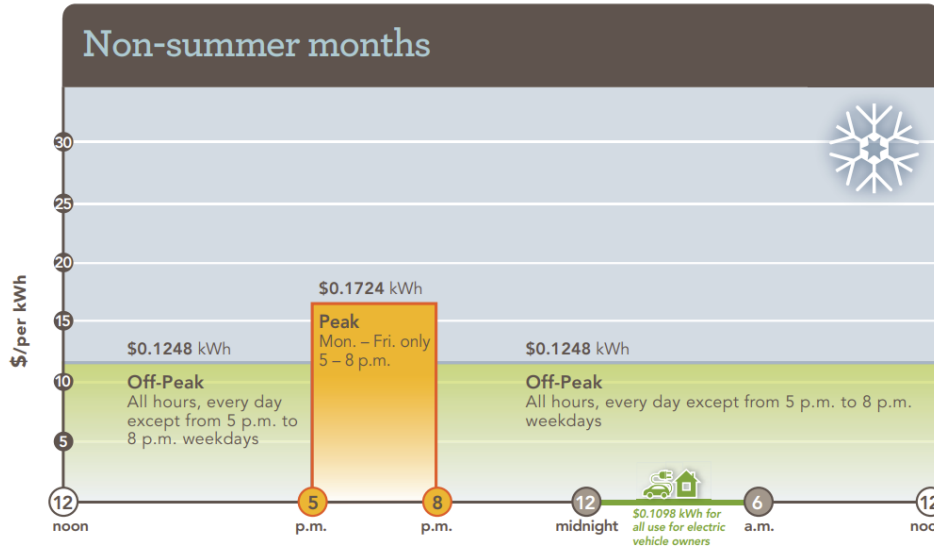
Simple rate design



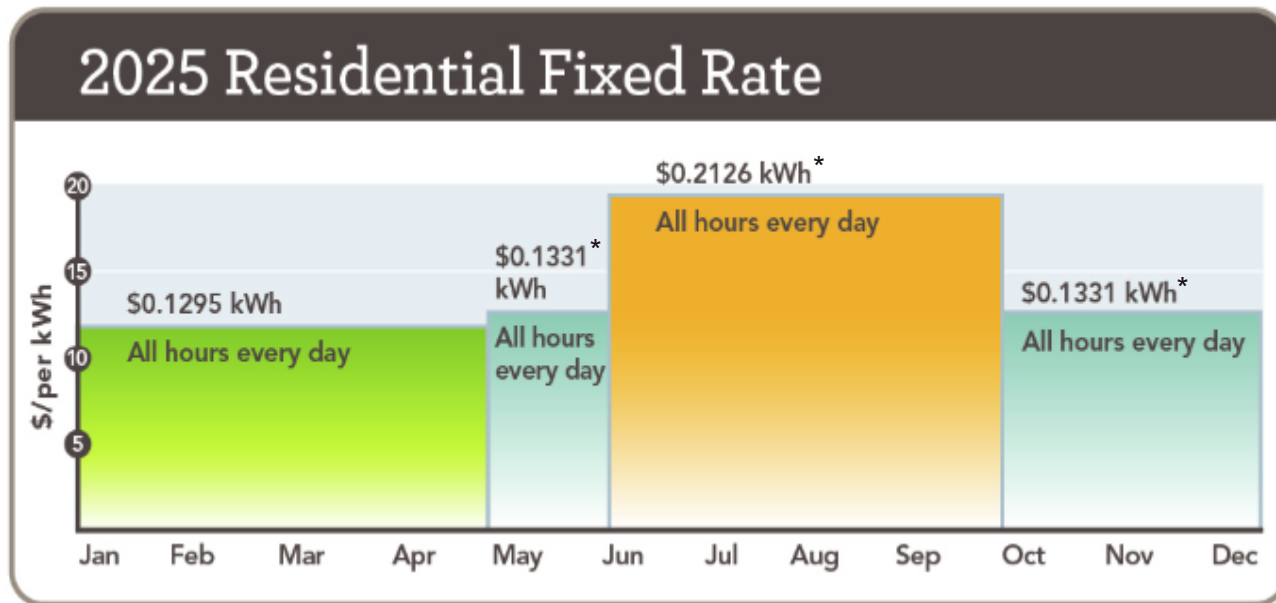
Weekends off-peak
Peak period 5-8 pm
Mid-peak in summer only



1.5¢ EV discount on all electric usage between midnight and 6 am



Alternative Fixed Rate



- Customer's choice
- Very simple rate
- Two prices
 - Summer (Jun-Sep)
 - Non-summer (Oct-May)
- Includes 4% premium

* It includes a rate increase of 2.75% effective 5-1-25

TOD results exceeded expectations

Benefits	Assumed based on pilot	2019 Normal Weather	2020 Normal Weather	2021 Normal Weather
Carbon Reduction	3k-5k tonnes	✓ 12.8k tonnes	✓ 12.8k tonnes	✓ 11.5k tonnes
Residential peak load reduction	75MW, or 5.8%	✓ ~130MW, or 8%	✓ ~110MW - 130MW, or 7-8%	✓ ~75MW - 115MW, or 4-7%
Financial benefit	\$4M annually	✓ \$5M estimated	✓ \$6M-8M estimated	✓ \$11M estimated
Selection of TOD	96%	✓ 98%	✓ 98%	✓ 97%

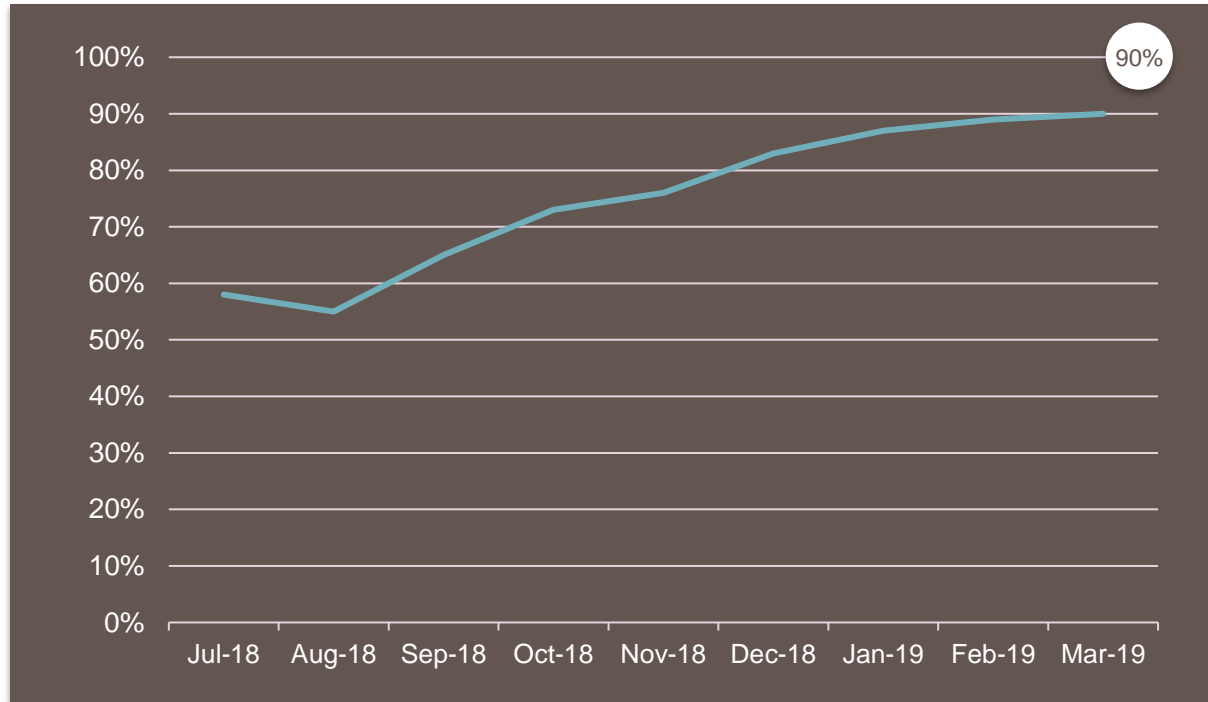
Customer transition



Transition schedule accelerated and successfully completed

TOD had a 99% overall adoption rate (currently 97%)

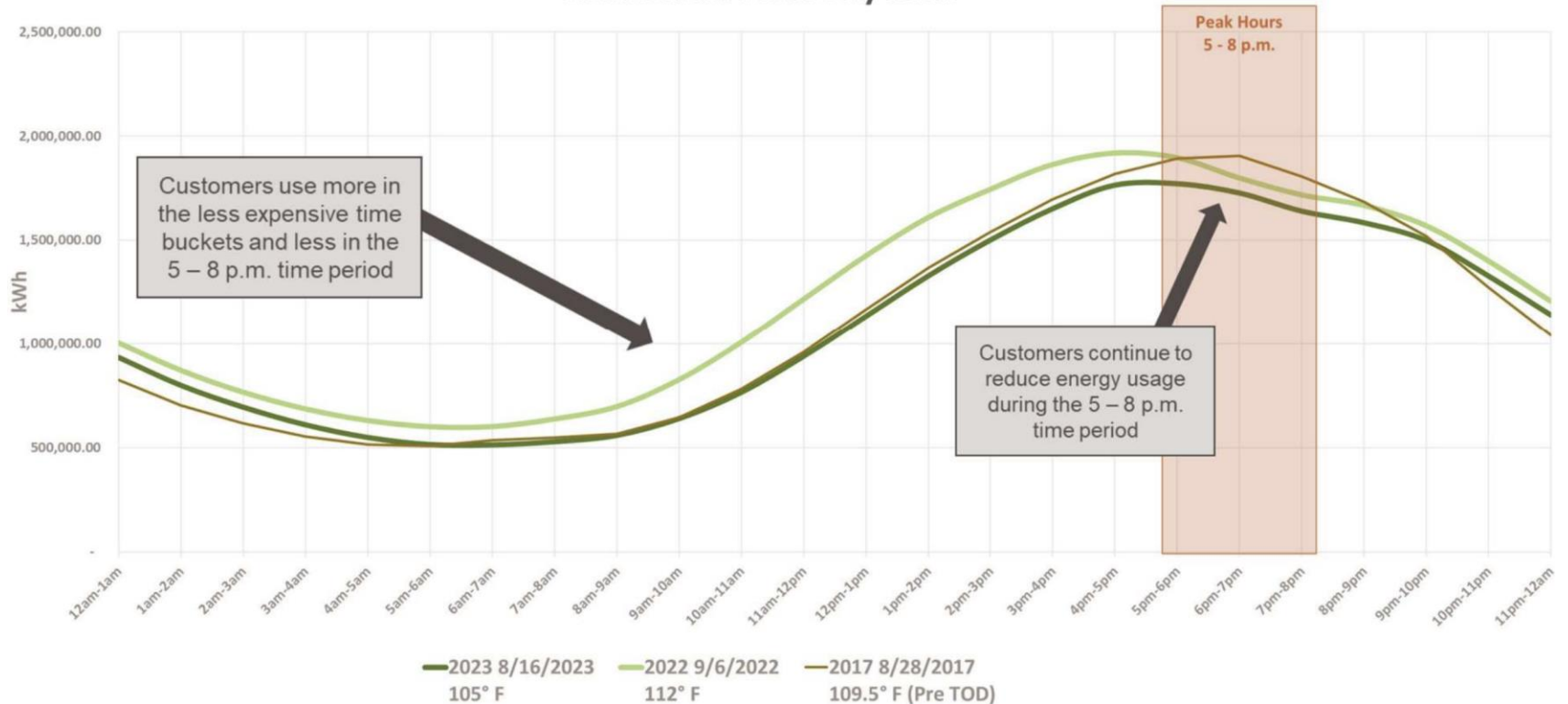
Customer awareness of TOD



Highest awareness of any SMUD program

TOD Rates continue to reduce residential peak

Residential Peak Day kWh

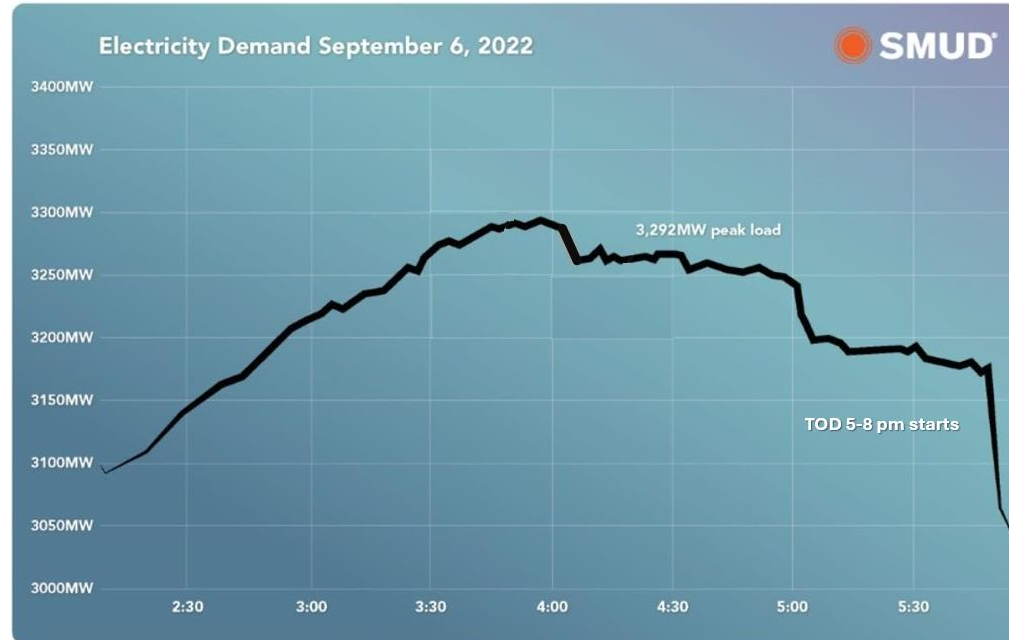


Summer 2022 was a record-breaking heat event

Demand response programs, TOD pricing, energy conservation and messaging was key

- The region saw 10 straight days of extreme heat
- Sacramento reached an all-time high temperature of 116°F on 9/6*
- SMUD almost broke its peak record of 3,299 MW from 2006, reaching a peak load of 3,292 MW
- Significant load reduction was observed on 9/6

* <https://www.sacbee.com/news/weather-news/article265412691.html>



Preparing for Time-of-Day

Transition to TOD Rate: Objectives

Provide customers with **tools and information** to help them make informed choices

Timely outreach: Mass and targeted **outreach and education**

Ensure best **customer experience** possible

Tools and information

Usage charts

Neighbor comparison & tips

How you're doing: Jun 12—Jul 13
You used 5% more than your neighbors

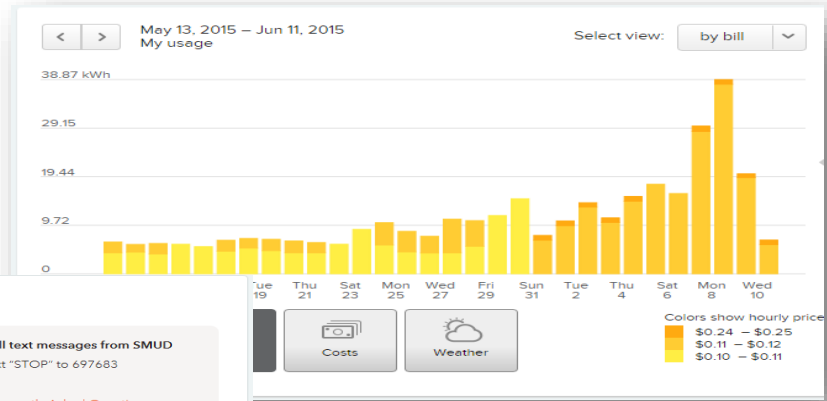
Category	kWh
Efficient neighbors	949 kWh
All neighbors	967 kWh
You	990 kWh

> More than average

Who are my neighbors? [View my usage](#)

Steps you can take right now

- Raise your thermostat a few degrees in the summer**
5 people do this
[Added to your completed tips](#) [Undo](#)
- Improve shading for windows**
[Added to your plan](#) [Undo](#)



High bill alerts

Alerts

Set alerts to be notified of things affecting your bill or service.

By enrolling in SMUD Alerts, you agree to receive SMS texts, voice and/or email messages from SMUD about your bill or service. SMUD rate and historical usage restrictions apply. An SMS enabled device is required to receive text messages. **Mobile carrier message and data rates may apply. Message frequency depends on the program selected and account settings.**

To stop all text messages from SMUD

- Text "STOP" to 697683

For Help

- Frequently Asked Questions
- Text "HELP" to 697683
- Call 888-742-7683
- Email customerservices@smud.org

Bill Threshold
Let me know when my bill reaches \$50.00. [Edit](#)

Email

Mid-Bill
Let me know my bill amount on day 16 of my billing period. [Edit](#)

Email

High Bill
Let me know if my current bill is running higher than the same time last year. [Edit](#)

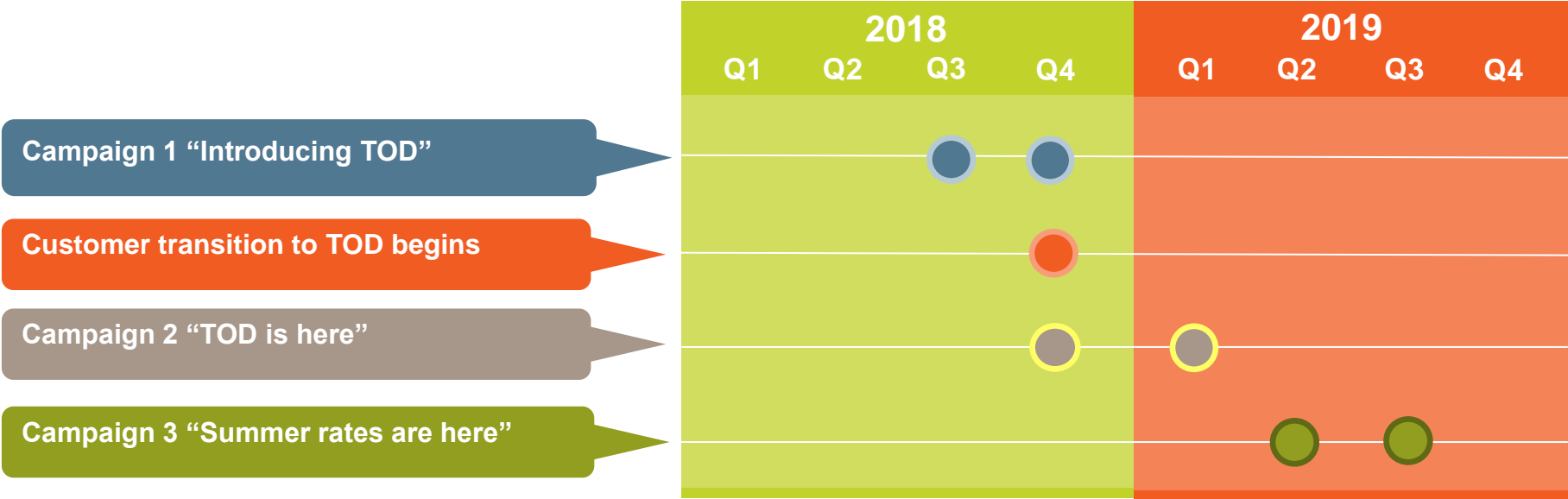
Outages
Let me know when an outage affects my service. [Edit](#)

Voice

Marketing, communications, education and outreach



Marketing campaign schedule



3 major campaigns & messaging

Introducing Time-of-Day Rates

- September 10 to November 30, 2018
- Reduce your use from 5 to 8 p.m. weekdays

01



02

Time-of-Day Rates are here

- December 1, 2018 to March 30, 2019
- Reduce your use from 5 to 8 p.m. weekdays and take advantage of our tips and tools



Summer rates are here

- June to August 2019
- Summer rates are here. Reduce your use from 5 to 8 p.m. weekdays and take advantage of tips and tools.

03



New educational and lifestyle videos

Animated educational videos explain the basics of electricity production, delivery, demand and pricing and why TOD pricing is needed.

Animated educational videos show customers how making simple changes can save energy and money.

“Lifestyle” customer testimonial video shares a family’s positive experience with TOD Rates, including their tips to involve kids in saving energy and money.



New tool: Interactive Time-of-Day cost estimator

Laundry room

Ⓢ Uses more energy. Shift usage to save.
(HE) High-efficiency item

- Clothes washer**
1 load (.75 kWh) ▼
- Clothes washer (HE)**
1 load (.42 kWh) ▼
- Clothes dryer**
1 load (3.75 kWh) Ⓢ ▲
- Morning (Midnight - noon)
 Afternoon (Noon - 5 PM)
 Evening (5 PM - 8 PM)
 Night (8 PM - midnight)
- Clothes dryer (HE)**
1 load (3 kWh) Ⓢ ▼

Choose another room

Clothes dryer

1 load (3.75 kWh) Ⓢ ▲

- Morning (Midnight - noon)
- Afternoon (Noon - 5 PM)
- Evening (5 PM - 8 PM)
- Night (8 PM - midnight)

Estimated total daily cost: **\$1.06**

\$0.00	\$0.00	\$1.06
Off-Peak	Mid-Peak	Peak
\$0.1166 per kWh	\$0.1611 per kWh	\$0.2835 per kWh
Monday - Friday Midnight - noon	Monday - Friday Noon - 5 PM and 8 PM - midnight	Monday - Friday 5 PM - 8 PM
Weekends and holidays All day		

Share this estimate

Clothes dryer

1 load (3.75 kWh) Ⓢ ▲

- Morning (Midnight - noon)
- Afternoon (Noon - 5 PM)
- Evening (5 PM - 8 PM)
- Night (8 PM - midnight)

Estimated total daily cost: **\$0.44**

\$0.44	\$0.00	\$0.00
Off-Peak	Mid-Peak	Peak
\$0.1166 per kWh	\$0.1611 per kWh	\$0.2835 per kWh
Monday - Friday Midnight - noon	Monday - Friday Noon - 5 PM and 8 PM - midnight	Monday - Friday 5 PM - 8 PM
Weekends and holidays All day		

Share this estimate

Awareness and education campaigns



Targeted outreach: Tactics

Community Partner
Site Activation



Satellite Retail
Locations



Multi-lingual
Outreach



*Develop framework
for calculating
attendance, reach,
& other metrics*

Capture data



*Use a mix of
traditional and
non-traditional
outreach tactics*

Get creative



Lobby Education



**Sign-up Incentives,
Toolkits &
Promotional items**



**Neighborhood
presentations and
workshops**

Targeted outreach to ethnic populations



Lessons learned

Lessons learned

Robust marketing, communications, **education and outreach**. Provide customers with **tools and information** to help them make informed choices.

Over 10-year journey with many **customer-facing and back-office changes** over that period.

Creating “**test drive**” opportunities for staff and obtaining feedback ahead of mass rollout.

Explore **pilot first** to test rate design concepts, systems, use study results in final rate design. Consider **simplicity over complexity**.

Added in-person Cust. Service Rep. (CSR) **tailgates** during rollout – allowed for more fluid conversations and opportunities with CSR’s to resolve issues quicker.

Best customer experience possible through **journey maps** to help identify risks and opportunities for rate adoption and operational impacts.

Q&A

Moving Ahead with Time of Use Rates



AMERICAN
**PUBLIC
POWER**
ASSOCIATION

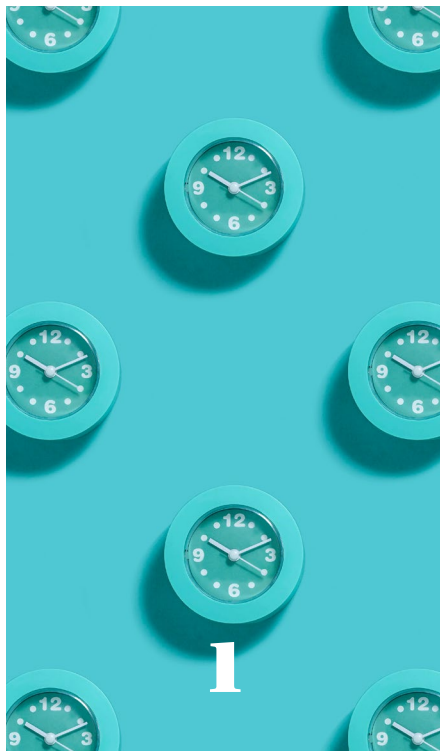
80 Years of Powering Strong Communities

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MOVING AHEAD WITH TIME OF USE RATES

Paul Zummo, Director
Policy Research and Analysis,
American Public Power Association



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PROMOTING EQUITY THROUGH TIME OF DAY PRICING

Randy Reuscher
Diana Royval
Fort Collins Utilities



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REDUCING CARBON, GIVING CUSTOMERS CONTROL

Alcides Hernandez
Melissa Kwong
Karen McCord
Jennifer Restivo

Sacramento Municipal Utility
District (SMUD)



Electric utilities continue to experiment with new rate designs, moving past the traditional rate paradigm.

These rates are enabled by new technologies, particularly advanced metering infrastructure. These designs mean to better align rates with utility costs, incent customers to spread out their electric usage and reduce peaks, and in some cases help the utility meet environmental goals.



Time-Varying Rates Explained

The most widely used new rate design is time-varying rates (TVR). According to the Energy Information Administration, more than 300 utilities offer some type of TVR and approximately 5.5 million customers, or 5% of residential customers, are enrolled in a TVR.¹ Most of the customers are enrolled in pilot, or opt-in rates, though several utilities have now instituted default, or opt-out TVR rates.

There are several categories of TVR:²

- **Real-time pricing (RTP)** — Prices vary over short intervals, such as an hour. The price is intended to reflect the real-time wholesale cost of electricity, although sometimes is set by the day-ahead price of electricity.
- **Time-of-use pricing (TOU) (also called time-of-day (TOD) rates)** — Prices are fixed seasonally and within two to four broad intervals that reflect the utility's typical peak and off-peak times. The peak price usually occurs in the late afternoon and early evening. Off-peak hours are generally in the early morning and at night. There may be an intermediate or interim interval occurring between the off-peak and peak hours.
- **Variable peak pricing (VPP)** — Off-peak and interim prices are the same as TOU, but the peak price varies according to system conditions.

- **Critical peak pricing (CPP)** — Utilities set a high peak price on certain "critical" days. Utilities usually notify customers in advance of critical days and hours, and the amount of such events is often limited.

Benefits of TVR

The overwhelming majority of TVR offerings are TOU rates. These are generally simpler to implement and for customers to understand.

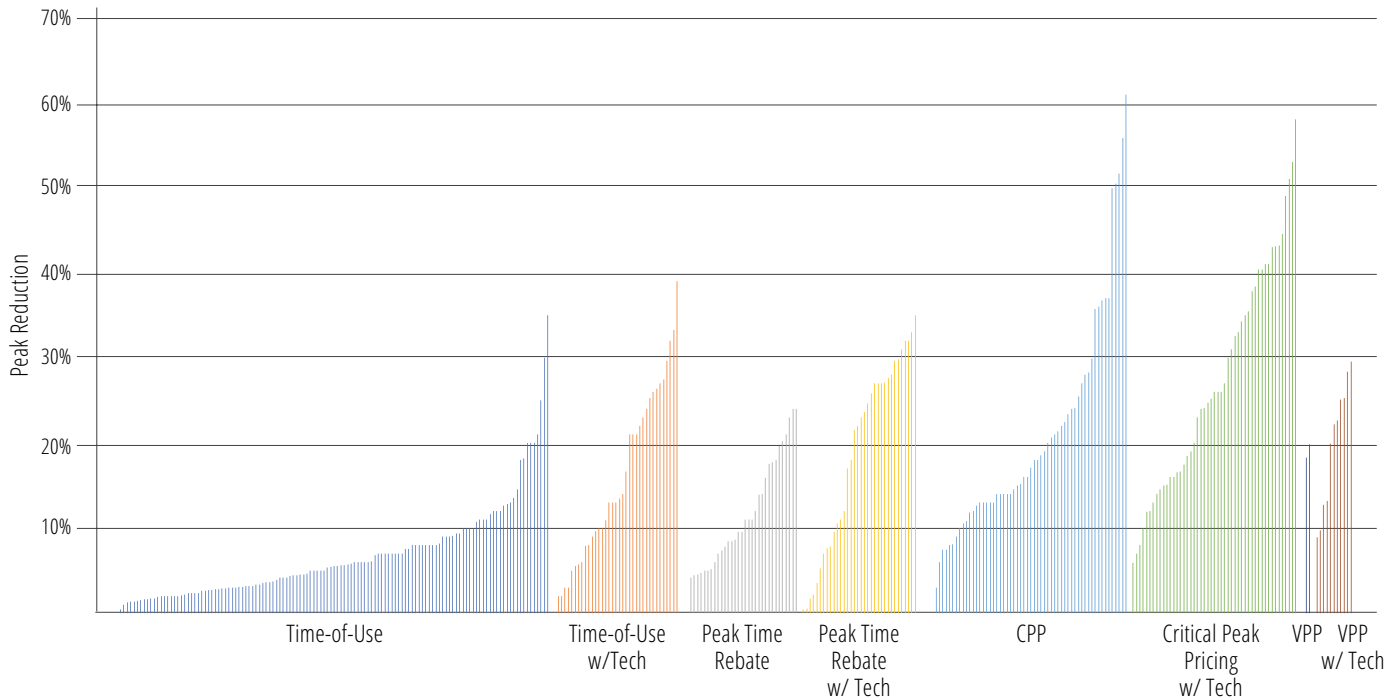
The proliferation of TOU rates has enabled researchers to study the effects of these rates, particularly on load shapes and on customer bills. With regards to load shape, studies continually show that TOU rates lead to decreased electric usage, both at peak periods and overall. An ACEE report summarizes these findings:

These studies provide overwhelming evidence that customers respond to changes in volumetric energy rates. Many of the studies document significant peak demand reductions, especially when customers are equipped with technology such as programmable or learning thermostats. Our review of these studies also shows small reductions in overall consumption. Not all estimates were statistically significant at the 90% level, but the results for each treatment group show a consistent trend in reduced overall consumption, with very few showing increased consumption.³

1 Nova Scotia Utility and Review Board. *Time-Varying Pricing Project Submission*. June 30, 2020, Appendix 2, p. 5.

2 Mina Badtke-Berkow, et al. *A Primer on Time-Variant Electricity Pricing*. (Environmental Defense Fund, 2015), pp. 2-4.

3 Brendon Baatz. *Rate Design Matters: The Intersection of Residential Rate Design and Energy Efficiency*, ACEE, March 2017, p. v. Available at <https://www.aceee.org/sites/default/files/publications/researchreports/u1703.pdf>

FIGURE 1. PEAK LOAD REDUCTION, BY TYPE OF TIME-VARYING RATE

Source: Ahmad Faruqui and Sanem Sergici, The Brattle Group, 2020. Source data is 365 individual pilot treatments from Brattle's Arcturus database.

A Brattle Group analysis came to a similar conclusion.

We have shown beyond the shadow of a doubt that customers do reduce their peak load in response to higher peak to off-peak price ratios. Price-based demand response is real and predictable. It can be relied upon by utilities, regulators, independent system operators and other market participants to plan their activities. The magnitude of demand response is even stronger when the customer is provided with enabling technology such as smart thermostats and in-home displays.⁴

Figure 1 from Brattle's filing on behalf of Nova Scotia Power demonstrates peak reductions across different TVR offerings.

CPP rates generally produce greater peak shavings than TOU rates because they have sharper price differentials. But TOU rates nonetheless consistently incent at least moderately decreased consumption.

Studies for California's three major investor-owned utilities also showed that TOU pilot rates produced load reductions and peak shaving. For example, in the summer of 2016, load reductions for Southern California Edison's participants measured 2.7%, and were 6.1% for customers of Pacific Gas & Electric. Winter load reductions were slightly lower, though still significant, ranging between 1.4% and 3.6%.⁵

⁴ Ahmad Faruqui, Sanem Sergici, Cody Warner, *Arcturus 2.0: A meta-analysis of time-varying rates for electricity*, *Electricity Journal* 30 (2017) 64-72

⁵ Stephen S. George and Eric Bell, *Key findings from California's recent statewide TOU pricing pilots*, *Electricity Journal* 31 (2018) 52-56.

The rates do motivate behavior, as customers with EVs on a TOU rate are much more likely to charge during non-peak hours compared to customers with EVs who are not on a TOU rate.

Results from Pennsylvania IOU PECO's TOU pilot also demonstrated significant load reductions. The average demand reduction between 2 p.m. and 6 p.m. was 6% during the summer months.⁶

Moreover, pilot programs have resulted in bill savings for most customers. Customers in the PECO pilot had 5% lower costs, on average, which was a result of altering the use of large appliances and HVAC systems.⁷ California utilities had similar results. The average cost reduction on the monthly bill was between no savings and 2%, although some SCE customers saw increases, including some low-income customers who had the most increased costs. Also, summer bills were generally higher for all classes of pilot customers compared to their usual bills, while winter bills were generally lower.⁸

Although some low-income SCE customers had higher than average bill increases, reports show that the pilot programs generally did not lead to rate increases for low-income customers. As the ACEE report specifies:

Low-income customers often have a flatter usage profile, implying that any rate design structure with higher rates during peak hours could benefit them, even in the absence of behavioral or technological changes. Although most of the rate design pilots we reviewed did not specifically evaluate impacts on low- or limited-income customers, several did consider this issue.⁹

The results were similar for PECO. As one consultant noted, "the households that reduced their usage the most were ones that held at least one senior citizen, or one resident covered by the Americans with Disabilities Act."¹⁰

TOU rates can also encourage investment in electric vehicles. Many utilities offer TOU to customers with EVs — sometimes as a rate specific to EV charging, but normally for the entire household. These rates provide customers the opportunity to achieve significant bill savings by charging their vehicles overnight at a lower rate.

When customers with EVs shift their charging to off-peak periods, this reduces potential strains on the utilities at system peak. This is especially important if EVs are clustered in a certain neighborhood — as is often the case — because multiple EVs charging at once can overload a feeder. Conversely, one concern with TOU rates is that they can create a new peak when many cars begin charging all at the same time once the peak period ends.¹¹

The rates do motivate behavior, as customers with EVs on a TOU rate are much more likely to charge during non-peak hours compared to customers with EVs who are not on a TOU rate.¹²

Salt River Project, a public power utility in Arizona, conducted a study along with the Electric Power Research Institute that demonstrated that TOU rates were "very effective" at shifting charging times for customers with EVs, thereby shaving peak load.¹³

6 Gavin Bade, "Inside the surprising lessons from PECO's time-of-use rate pilot," Utility Dive, May 22, 2015. Available at <https://www.utilitydive.com/news/inside-the-surprising-lessons-from-pecos-time-of-use-rate-pilot/399629/>

7 Ibid.

8 Key findings from California's recent statewide PILOT pricing pilots.

9 Rate design matters, p. 31.

10 Inside the surprising lessons from PECO's time-of-use rate pilot.

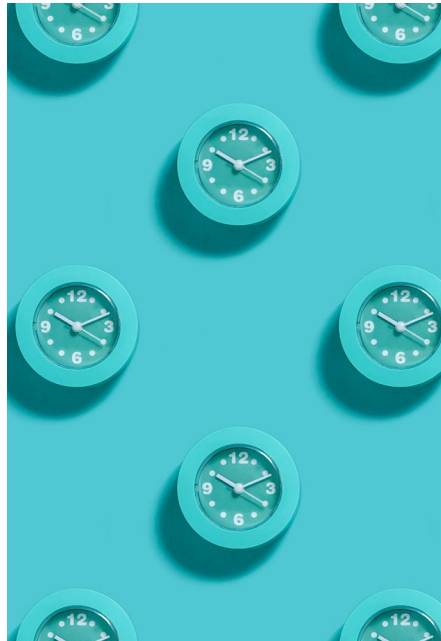
11 Erika Myers, et al, *Residential Electric Vehicle Rates That Work: Attributes that Increase Enrollment*, SEPA, November 2019, p. 12.

TOU rates are also an attractive option in the context of distributed energy resources (DER), because they can align utility costs and revenues more equitably between customers with and without DERs.¹⁴ In other words, TOU rates could mitigate the need to apply special rates to DER customers. A customer using electricity from the grid when supply is constrained, when cost is higher, would be paying a higher rate that better aligns with that cost. Furthermore, because it is widely applicable beyond DER, it could reduce the need to continually refine rates and rate structures.

Potential Concerns

Though these pilots have shown the potential benefits of TOU, there are a couple of shortcomings and drawbacks. Most customers participating in a pilot or who are otherwise on an optional TOU rate have opted-in, meaning customers must voluntarily choose these rates. Customers who choose to adopt TOU rates tend to have higher household income or might be more aware of how electric usage at different times of the day corresponds to costs. As mentioned above, low-income and elderly customers have shown in some studies to be just as adept at altering usage as others. Nonetheless, studies of opt-in customers might not be as representative, and thus might not reflect the same outcomes as if all customers participated.

Customers who opt-in to TOU rates might also predominately include



those who can most benefit from TOU rates. In other words, customers who calculate that they can reduce their bill by adopting TOU rates will opt in, whereas those who project a potential bill increase will remain on a traditional flat charge. Not only can this alter the population of the survey sample, it can also lead to revenue reductions. If only “winners” adopt TOU rates, while high peak-use customers remain on standard rates, then revenues could fall short of utility costs.

Some utilities have now adopted opt-out, or default TOU rates for residential customers. This means that a customer is automatically enrolled in a TOU rate unless that customer takes action to enroll or remain in another rate. Whereas opt-in programs with enrollments in excess of 10% can be considered successful, enrollment rates for opt-out rates often exceed 98%.

Moving to Mainstream

The three major California IOUs have now adopted default TOU rates, and several public power utilities in different states have as well. This series features two of these public power utilities in case studies. Fort Collins Utilities in Colorado was one of the first to adopt a default or standard TOU (or TOD) rate, and Sacramento Municipal Utilities District (SMUD) in California rolled out their opt-out TOU starting in 2018.

Each case offers an overview of the utility’s experience with conducting a pilot and then implementing opt-out TOU rates. These initial insights and analysis show how an entire rate class — and not just a certain subset of it — adapts to TOU rates.

Each case details if and how customers have shifted usage, how customers have been affected by the rate changes, and how well these rates help utilities recover their costs of service. The two utilities also share valuable lessons learned and key insights into customer education and communication to ease the implementation process.

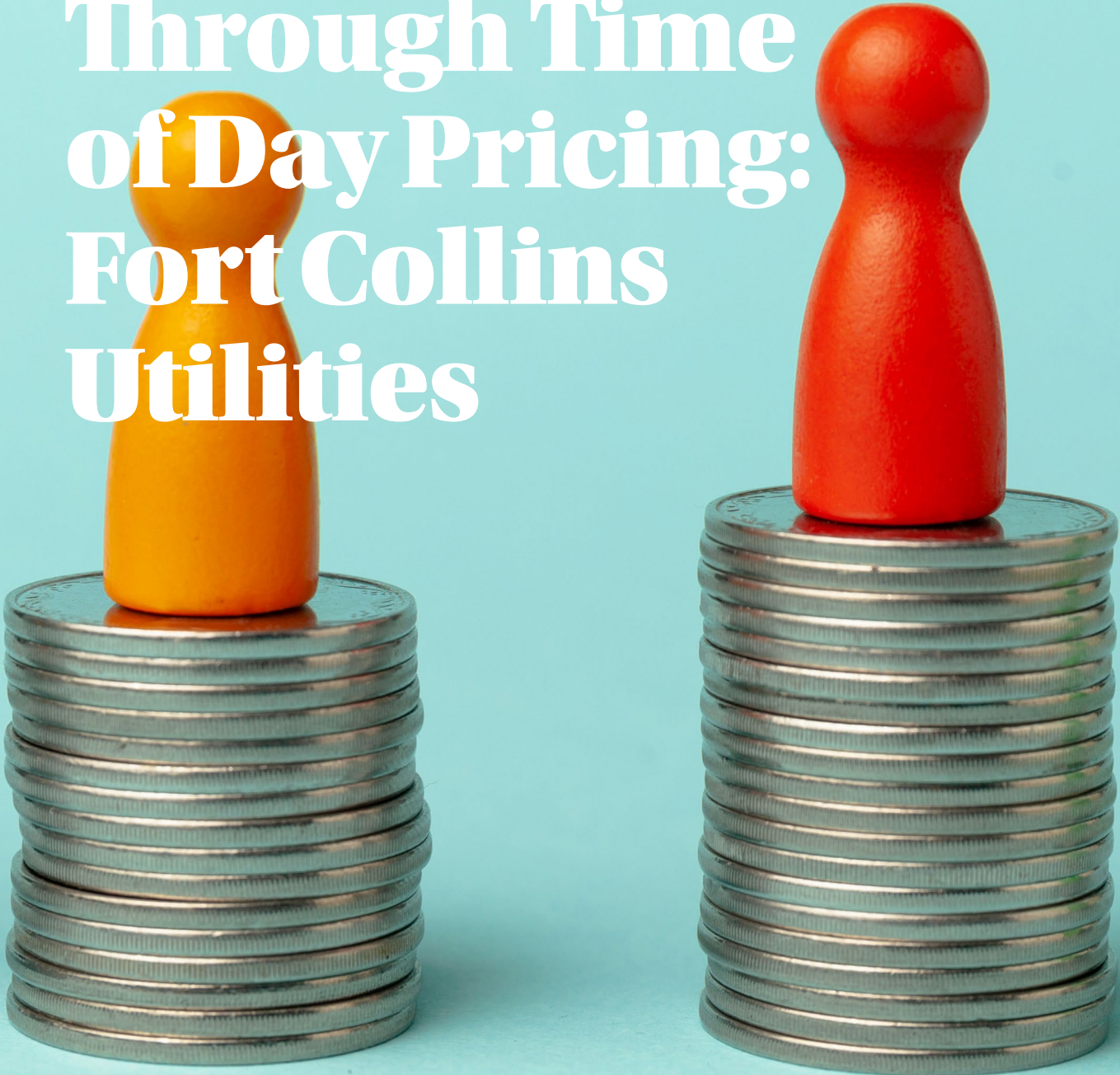
These two utilities’ experiences offer unique insight into how TOU rates impact an entire rate class. Public power utilities considering a move to TOU rates can learn from these two positive experiences, and take the advice and lessons learned to guide their exploration of whether and how such rates could be a fit for their community.

¹² Ibid., pp. 21-25

¹³ APPA, EPRI, *SRP complete study tied to EV drivers’ habits*, Public Power Daily, May 30, 2019. <https://www.epri.com/research/products/3002015601>. See Figure 6.7 for details of load shifting in the study.

¹⁴ American Public Power Association, *Rate Design for Options for Distributed Energy Resources*, November 2016

Promoting Equity Through Time of Day Pricing: Fort Collins Utilities



SERVICE TERRITORY

Fort Collins, CO

CUSTOMERS

76,000

ANNUAL RETAIL LOAD

1.5 million
Megawatt-hours

ANNUAL PEAK (3-YR AVERAGE)

309 Megawatts

GENERATION SOURCES

coal, natural gas, hydro, wind,
solar purchased wholesale
from Platte River Power
Authority

SUSTAINABILITY GOALS

100% non-carbon
resource mix by 2030



TOU PILOT

Conducted 2015-2016 with
1,700+ customers in two tiers
— time of use and TOU with
energy efficiency

KEY PILOT OUTCOMES

1.9% overall reduction
in energy use
7.5% peak demand reduction
more than \$1/month average
reduction in customer bill

TVR USED

Default time-of-day
pricing began 2018

INITIAL RESULTS

\$1.38 average customer
bill reduction
67% of income-qualified
customers saw bill reduction
(100% with utility discount
program)
7.5% peak demand reduction
1.9% reduction in energy use
— preventing 15,800 metric
tons of carbon
emissions



About the Utility

The City of Fort Collins is in Colorado, about an hour north of Denver. Fort Collins Utilities manages four utilities (water, wastewater, stormwater and electric), and the electric utility serves 67,500 residential customers and just under 76,000 total customers. Fort Collins is governed by City Council and has an advisory Energy Board, with final approval for actions granted by the City Council. Fort Collins purchases wholesale power from Platte River Power Authority, which has a wide range of sources, including coal, natural gas, hydropower, wind and solar. Recent projects have increased the share of non-carbon emitting resources to nearly 50% of the total energy provided, with a goal of achieving a 100% non-carbon resource mix by 2030.

Pilot Structure and Results

Fort Collins Utilities was part of the Smart Grid Investment Grant and installed advanced metering infrastructure for all customers between 2011 and 2013. About two years after full-scale implementation of AMI, the utility began a pilot time-of-use project. The pilot placed 2,400 customers into one of two opt-out programs – TOU and TOU with energy efficiency. The study compared

the TOU customers with customers in four control groups, also with 1,200 customers each, for a total of 7,200 customers. Once opt-outs and customer turnover were accounted for, each TOU group included more than 850 customers.

The pilot program spurred a 7.5% reduction in coincident peak hour demand during the summer and a 0.4% overall shift in demand. As demonstrated in the table below, most customers experienced a slight bill reduction in the pilot program, although customers in all-electric homes and customers with solar net metering saw bill increases.

Transition to All TOU

After the conclusion of the pilot, Utilities and its stakeholders adopted a default TOU rate structure in October 2018.

The principal reason for moving to a default TOU rate structure was rate equity within the residential class. Utilities sought to be more transparent in passing on varying time-based costs for electricity to residential customers, especially considering wholesale coincident peak demand charges. New rates also would give customers greater control with two ways to manage bills: reducing overall consumption and shifting when they use appliances and the need for electricity.

TABLE 1. PILOT STUDY RESULTS

Original Rate	Pilot Study Rate	Count	Difference on Average TOU Rate	Change per Month
Tiered Rate	TOU	880	1.6% less	(\$1.14)
	TOU w/EE tier	851	1.9% less	(\$1.38)
All-Electric Homes	TOU	18	1.8% more	\$2.44
	TOU w/EE tier	16	7.9% more	\$10.27
Solar Net Metering	TOU	5	12.4% more	\$2.82
	TOU w/EE tier	9	0%	\$0.07

Another consideration was load management. The pilot study and the 12-month review (after implementation of TOU in October 2018) showed reductions in consumption and load shifting away from peak hours. Overall energy consumption was 1.9% lower (16,775 megawatt-hours), and on-peak electricity use was 7.5% lower than the previous year.

Other reasons given for shifting to TOU:

- Reduces peak demands and increases load factors on the system, creating efficiencies and lower costs
- Better aligns system costs when solar production occurs
- Reduces energy consumption and greenhouse gas emissions
- Encourages use of electric vehicles

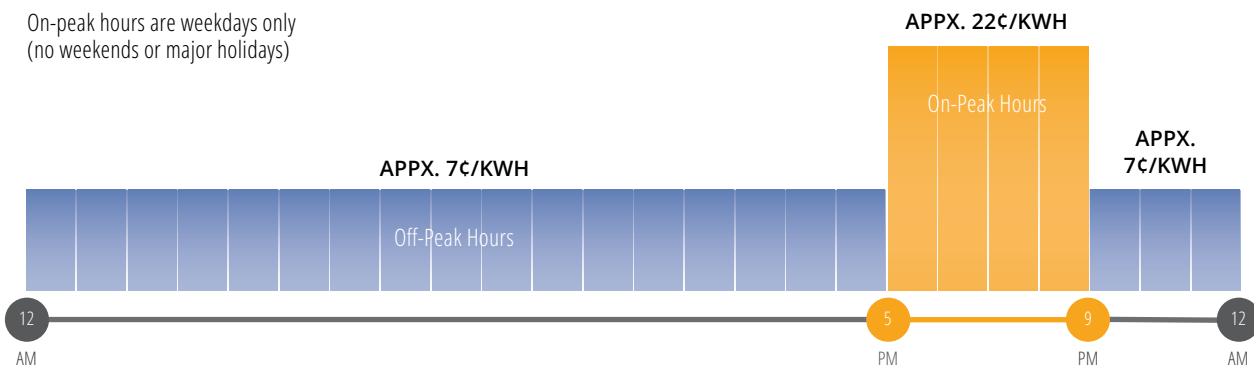
Fort Collins has two time-of-day rates in place (the name changed from the original time-of-use). The rate for gas-heated homes has an on-peak charge plus a tier charge for total monthly consumption that exceeds 700 kilowatt-hours. This additional tier is in place to encourage reduced consumption. Customers in all-electric homes have the on-peak/off-peak charges, but do not have the tier charge because of higher monthly consumption, especially during the winter months when heating needs are highest.

The graphic below shows the different peak hours and corresponding rates.

The hours selected as on-peak are directly tied to historical peak hours when coincident demand costs are incurred.

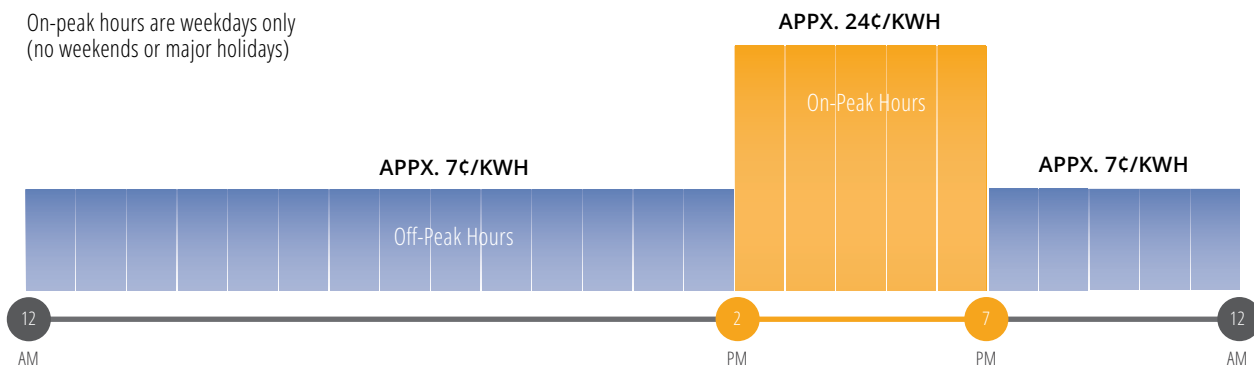
NON-SUMMER OCTOBER – APRIL

On-peak hours are weekdays only (no weekends or major holidays)



SUMMER MAY – SEPTEMBER

On-peak hours are weekdays only (no weekends or major holidays)



Customer Education and Outreach

Prior to the launch of TOD and throughout 2019, Utilities developed and implemented a community-wide communication, outreach and engagement campaign to inform and educate residents about the new rate structure. One of the goals was to provide customers with tips and tools to learn how to better control their electric bills by shifting electric use to the lower-priced, off-peak hours and by reducing overall use. It was also important to convey when the rates would go into effect, how the rate would likely change individual customers' bills, and the reasons why the utility was moving to a time-based rate.

Staff encouraged customer feedback, questions, and two-way conversations via social media, website interaction, printed material, phone calls and in-person discussions. Fort Collins worked with its customer service representatives to ensure they were equipped to field customer questions, provide rate comparison reports, and transfer calls to subject matter experts within Utilities to assist with more in-depth questions. The Community Engagement Team provided presentations and staffed event booths, including giving presentations to homeowners' associations and other organizations (e.g., EV groups, boards) upon request. These presentations were offered virtually in 2020 and will continue as needed.

The team also recognized the importance of educating Utilities employees, many of whom receive their electric service from Fort Collins Utilities, so that employees could answer questions from friends and neighbors about the change. Utilities hosted internal Lunch and Learn sessions and used internal newsletters and email systems to update employees.

Utilities developed a variety of tools and tactics to increase awareness about on-peak hours, prices and savings opportunities. Fort Collins used icons to demonstrate the variety of appliances and electronics that customers use daily, with an emphasis on those that use the most electricity and outlined tips for shifting use of these items to off-peak times.

Utilities also created clings for customers to place on household appliances and electronics that provided reminders of the on-peak hours and savings opportunities. Customers received 12-month bill comparisons of TOD to their previous tiered rate, one-month bill estimates on TOD pricing, and handouts. The most useful outreach piece was a handout with cost-specific details regarding electric use of household appliances and electronics (see sample, at right). Customers had misconceptions about what they needed to turn off, and the awareness of what appliances cost during on and off-peak hours was a very valuable resource.

Other tools, resources, and programs available to customers are:

- In-depth, room-by-room spreadsheet
- Non-adhesive clings that highlight the various seasonal on-peak hours to be placed near higher energy-using appliances
- Printed and direct mail pieces, including letters, bill inserts and postcards
- Interactive presentations and activities posted on Utilities' website
- Seasonal video clips

Fort Collins is also prioritizing underserved audiences through the Income-Qualified Assistance Program (IQAP). Approximately 700 participants enrolled in IQAP receive 23% off their monthly utility bill, as well as a monthly newsletter with easy tips for saving

Fort Collins used icons to demonstrate the variety of appliances and electronics that customers use daily, with an emphasis on those that use the most electricity and outlined tips for shifting use of these items to off-peak times.

TAKE CONTROL OF YOUR ELECTRIC BILL
KNOW WHAT IT COSTS TO USE AN APPLIANCE FOR ONE HOUR

ON-PEAK HOURS (5-9 P.M., OCT-APR / 2-7 P.M., MAY-SEPT / WEEKDAYS ONLY) OFF-PEAK HOURS (ALL OTHER HOURS OF THE DAY, WEEKENDS AND MAJOR HOLIDAYS)

- \$1.06 / 32¢ / \$555 to use an electric water heater
- 78¢ / 23¢ / \$555 to charge an electric vehicle with a Level 2 charger (3.3 kW)
- 71¢ / 21¢ / \$555 to use a central air conditioner
- 66¢ / 20¢ / \$555 to use an electric clothes dryer
- 43¢ / 13¢ / \$55 to use an electric oven
- 35¢ / 11¢ / \$55 to use a space heater
- 33¢ / 10¢ / \$55 (incandescent) / 3¢ / 1¢ / \$5 (LED) to light a string of large bulbs
- 26¢ / 8¢ / \$55 to use a microwave
- 24¢ / 7¢ / \$55 to use a window/room air conditioner
- 12¢ / 4¢ / \$55 to run a furnace fan for a gas furnace
- 10¢ / 3¢ / \$55 to use a dishwasher
- 7¢ / 2¢ / \$55 to use a clothes washer
- 5¢ / 1¢ / \$55 to run a large inflatable holiday decoration
- 3¢ / 1¢ / \$55 to run a slow cooker
- 2¢ / 1¢ / \$55 to run a fan or ceiling fan
- 2¢ / 4¢ / \$55 to play video games
- 1¢ / 4¢ / \$55 to use a computer
- 1¢ / 4¢ / \$55 to watch TV
- 41¢ / 41¢ / \$55 to use an LED light bulb
- 41¢ / 41¢ / \$55 to charge a cell phone

APPLIANCES THAT USE ELECTRICITY 24/7 FOR ONE DAY

- 64¢ / DAY to keep a hot tub warm
- 16¢ / DAY to run a refrigerator
- 2¢ / DAY to run a router

Additional information and tools are available at fcgov.com/TOD. Costs are based on the estimated use of appliances and electronics using an average of 2020 summer and non-summer pricing.

For more information and tools, visit fcgov.com/TOD.

Need help paying your bill? Visit fcgov.com/utilities-affordability.

Learn about efficiency and conservation programs at fcgov.com/residential-conserve.

Auxiliary aids and services are available for persons with disabilities. Esta información puede ser traducida, sin costo para usted.

money, energy, and water. The average open rate for the newsletter in 2019 was 46% (higher than the industry average of 29%).

Fort Collins also developed Spanish versions of many of the TOD materials and IQAP material to better reach Spanish-speaking customers.

Utilities also made use of social media platforms such as Twitter and Facebook. Posted content was based on three strategies:

- Using animations and icons to raise awareness of TOD and seasonal changes
- Reminding customers about off-peak prices on major holidays

- Highlighting actual customer experiences through storytelling

These activities appeared to increase customer understanding in 2019. Overall feedback was neutral, and all direct questions were answered with factual and educational information. The customer profiles (storytelling) approach worked well and did not receive any negative feedback.

Leading up to TOD, staff received several angry emails from customers. However, after the TOD rate went into effect, email feedback became more positive as customers realized their bills were not substantially increasing as they had originally supposed.

Out of 70,000 electric customers, CSRs received calls and emails from approximately 2% of the community (less than 1,500 calls and emails). Talking with customers provided an opportunity to better inform and educate them about why TOD was being implemented and help them understand how it would affect them personally. After interacting with CSRs, most customers walked away with a better understanding. Now, most inquiries are about general information and no longer escalated due to TOD concerns.

Results

After over a year of default TOD rates, the results are consistent with the pilot study.

- 65% of residential accounts showed a decrease in annual electric bills compared to the prior rate structure
- Average monthly bill was \$1.38 lower with TOD pricing
- Overall revenue collected for the residential class was lower by 2.3% on TOD
- Overall energy consumption was 1.9% lower, or 16,775 MWh
- Decreased wholesale electricity expenditures
- Reduced electricity use from TOD saved over 15,800 metric tons of carbon emissions, equivalent to 0.8% of the 2018 community carbon inventory

- On-peak hour electricity use was 75% lower than in the previous year

Most customers, including those in all-electric homes, saved on TOD compared to the traditional pricing structure. Figure 2 summarizes average bill impacts.

As shown in Figure 3, two-thirds of IQAP customers had lower bills on the TOD rate.

Adding the 23% IQAP discount, 100% of customers saw a reduction in their overall bill.

Solar customers paid an overall average of \$2.94/month more, largely due to solar generation not directly aligning with when customers use electricity (especially during the non-summer months when it is dark during the on-peak hours of 5 – 9 p.m.). Because TOD aligns with the time-based costs more accurately than the previous rate, customers do not receive as much in credits for their solar generation during the non-summer months.

FIGURE 2. AVERAGE MONTHLY BILL IMPACT, BY CUSTOMER ATTRIBUTES

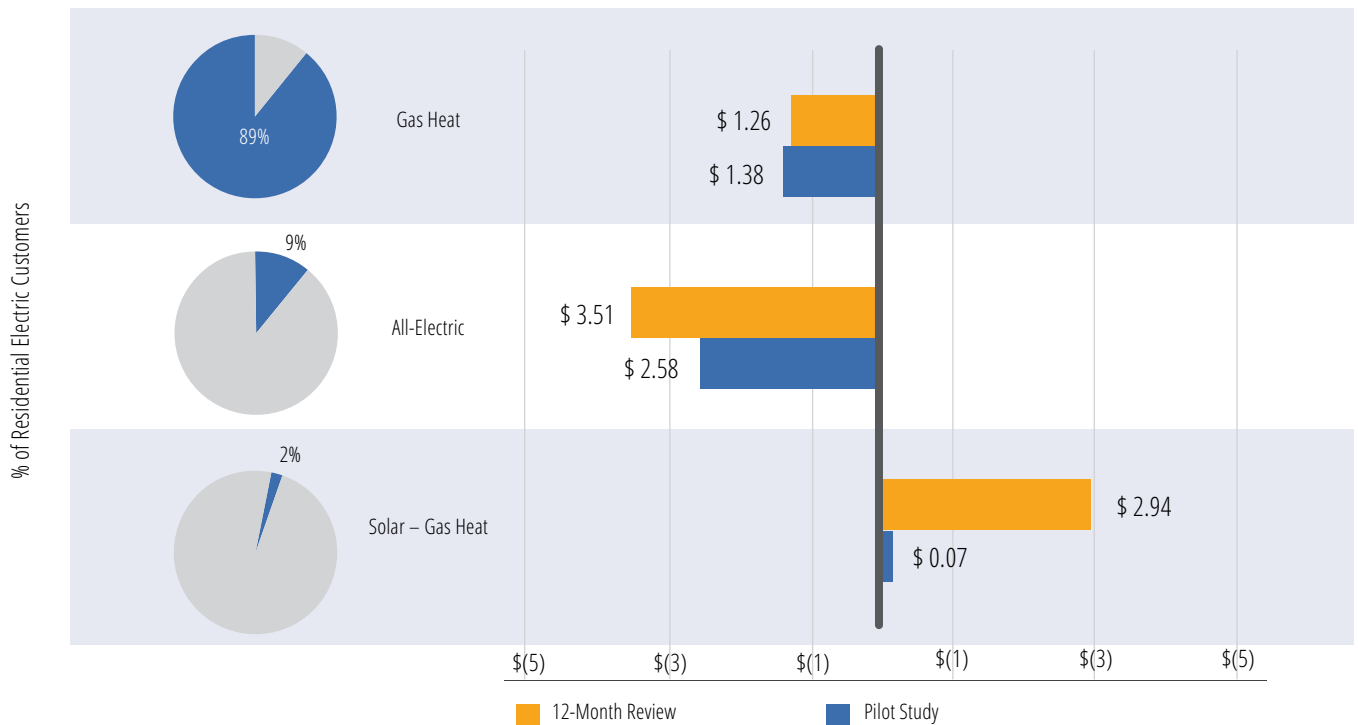
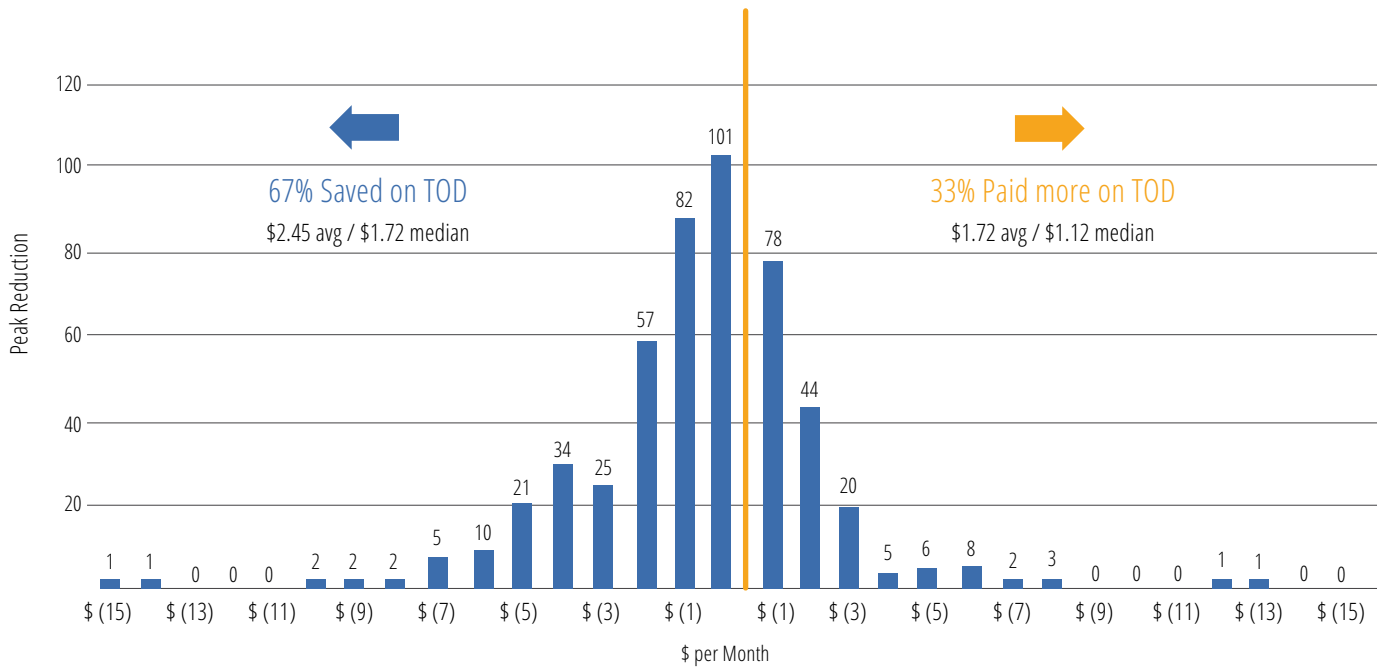


FIGURE 3. AVERAGE MONTHLY SAVINGS, IQAP CUSTOMERS (WITHOUT DISCOUNT)



One of the benefits of a TOD rate is that it encourages the charging of EVs during off-peak hours, when the price for electricity is lower. In doing so, electric vehicles can help increase load factors on the system and use resources in a more efficient manner by drawing energy from the grid during the overnight hours. EV consumption can be easily shifted away from on-peak hours by programming vehicles to charge during the lower priced, off-peak hours.

Looking Ahead

While staff recommended only one TOU rate structure for all customers, City Council approved two rates, one for gas-heated homes and one for all-electric homes. More focus would have been on the importance of a single rate structure to ease the confusion around accurately identifying the heat source of a home and the cost differences associated with having two different rates in place.

There are no significant plans to change the TOD rate structure overall. Both cost and consumption patterns will be continually monitored from year-to-year to understand changes over time.

Reducing Carbon, Giving Customers Control: TOD in Sacramento





SERVICE TERRITORY

Sacramento, CA and surrounding areas

CUSTOMERS

Approx. 640,000

ANNUAL RETAIL LOAD

10,116 Gigawatt-hours

ANNUAL PEAK (3-YR AVERAGE)

3,009 Megawatts

TOU PILOT

6,700+ customers in four categories — default time of use, default TOU with critical peak pricing (CPP), opt-in TOU, opt-in TOU with CPP in summer 2012 and 2013

33% of participants were customers with low incomes. The pilot also tested the use of in-home-displays

KEY PILOT OUTCOMES

Weekday peak load reduction between 5.8%-11.9%

total energy savings between 1.3%-3.5%

GENERATION SOURCES

hydro, natural gas, wind, solar and other purchased power

SUSTAINABILITY GOALS

Carbon-neutral generation by 2030



TIME VARYING RATE USED

Default residential time-of-day pricing began 2018, fully implemented by end of 2019

INITIAL RESULTS

8% peak load reduction

annual equivalent 12,800 tons of carbon emissions avoided

\$5 million annual savings in commodity costs

2% customer opt-out

\$3 average reduction in customers' summer bill

About the Utility

The Sacramento Municipal Utility District (SMUD) is a public power utility serving approximately 640,000 customers within an area of approximately 900 square miles in northern California. The service area includes the city of Sacramento, the populous areas principally to the northeast and south of the city, and the agricultural areas to the north and south. The city is located 85 miles northeast of San Francisco.

SMUD's electric system supplies power to a population of approximately 1.5 million people with a total annual retail load of approximately 10,166 million kilowatt-hours for the year ended December 31, 2019. SMUD's annual peak load has averaged 3,009 Megawatts over the past three years, with a record peak load of 3,299 MW occurring on July 24, 2006. In 2017, SMUD recorded its second-highest peak load of 3,157 MW.

As the capital of the nation's most populous state, Sacramento benefits from the historically stabilizing influence of a large government sector. Sacramento is home to the state government headquarters, the Sacramento County seat, the city government and various special districts that combine to make government the largest single employment sector in the Sacramento area. Information technology, transportation, education and health services, leisure and hospitality, and construction round out the other major sectors of employment and industry in the area.

SMUD uses a combination of generation sources including hydro, natural gas, wind, solar and unspecified purchases. The California Legislature has enacted a number of bills affecting the electric utility industry. In general, these bills regulate greenhouse gas emissions and encourage greater investment in energy efficiency and sustainable generation alternatives, principally through more stringent renewable portfolio standards.

SMUD is governed by a seven-member, independent board of directors. In 2018, the board adopted a new integrated resource plan (IRP), a long-term carbon reduction plan, through a comprehensive public process and filed the approved IRP with the California Energy Commission on April 29, 2019. The approved IRP calls for a reduction in GHG emissions from SMUD's energy supply by more than 60% by 2030 relative to 1990 levels and a goal of net zero emissions by 2040 due, in part, to a significant investment in electrification of the local building and transportation sectors. The IRP is expected to reduce Sacramento's economy-wide GHG emissions by 70% relative to current levels. In July 2020, the board adopted a climate emergency declaration that commits to working toward an even more ambitious goal of delivering carbon neutral electricity by 2030.

Pilot Study and Results

In 2012, SMUD completed the installation of smart technology, including approximately 617,000 digital communicating smart meters, distribution automation systems and equipment to facilitate load management.

After the successful deployment of smart meters, during the summers of 2012 and 2013, SMUD conducted the SmartPricing Options (SPO) pilot program to test experimental time differentiated rate plans for residential customers. These plans were designed to encourage customers to reduce or shift the timing of their energy use.

SMUD implemented the SPO pilot program with four basic rate structures:

- Default TOU
- Default TOU with a critical peak pricing (CPP) component
- Optional TOU
- Optional TOU with a CPP component

The purpose of the pilot was to determine:

- How various types of rates affected electric energy and demand
- Customer characteristics related to energy usage behaviors
- How TOU rates effect customer bills and satisfaction
- Expected market penetration for rate and enabling technology programs
- Which educational and marketing strategies were effective with customers

In marketing the SPO pilot program to customers, SMUD focused on several key messages. Specifically, materials noted that customers could receive discounts on electricity during off-peak hours, would be able to take more control of their summer electricity costs, would be able to better manage their energy usage, and could contribute to a cleaner environment.

After two years of engagement through the pilot, SMUD learned several marketing lessons:

- Messaging for CPP events was more complex than anticipated and required more resources than originally planned
- Customers were interested not only in their own savings, but also in how much everyone in the group saved
- Using pricing plan specific recruitment marketing materials rather than mass marketing materials cost less and resulted in higher than expected enrollment rates

The study also discovered that customers who opted into the TOU rates reduced load at much higher rates than customers who were defaulted onto the rates, especially when offered the in-home displays, and that customers react to price signals and reduce peak and usage during peak periods. More details about these differences can be found in Section 1.2 of the [SPO study](#).

The SPO study was recognized as one of the best studies available in the industry at the time. The investor-owned utilities in California and the California Public Utilities Commission (CPUC) made references to the SPO study findings in subsequent rate proceedings, which guided their policy decision making. Eventually, the CPUC adopted pilot studies for the IOUs. Following SMUD's steps, PG&E, the largest IOU in the state, began the roll out of its time-based pricing plans in the fall of 2020.

Implementing Default TOD Rates

On June 15, 2017, the board approved TOD as the standard rate for residential customers. The residential rate transition began in the fourth quarter of 2018 and was completed in the fourth quarter of 2019.

The TOD rate design was based on the successful SPO pilot study, as well as extensive customer insight and feedback and changes in the energy markets since the study. Using this foundation, SMUD created the TOD rate that was designed to achieve positive results for the environment and support SMUD's carbon reduction goals, increased ability for customers to manage their energy bills and SMUD's ability to reduce commodity costs.

The TOD rates support the board's carbon reduction goals in the following ways:

- Aligns with SMUD's commitment to renewable energy and the environment
- Supports the IRP
- Promotes electrification with lower off-peak prices
- Reflects lower energy prices when clean power is abundant and higher prices when energy is more carbon intensive

FIGURE 4. NON-SUMMER MONTHS (OCTOBER 1 – MAY 1)

Residential Time-of-Day Rates, 2019

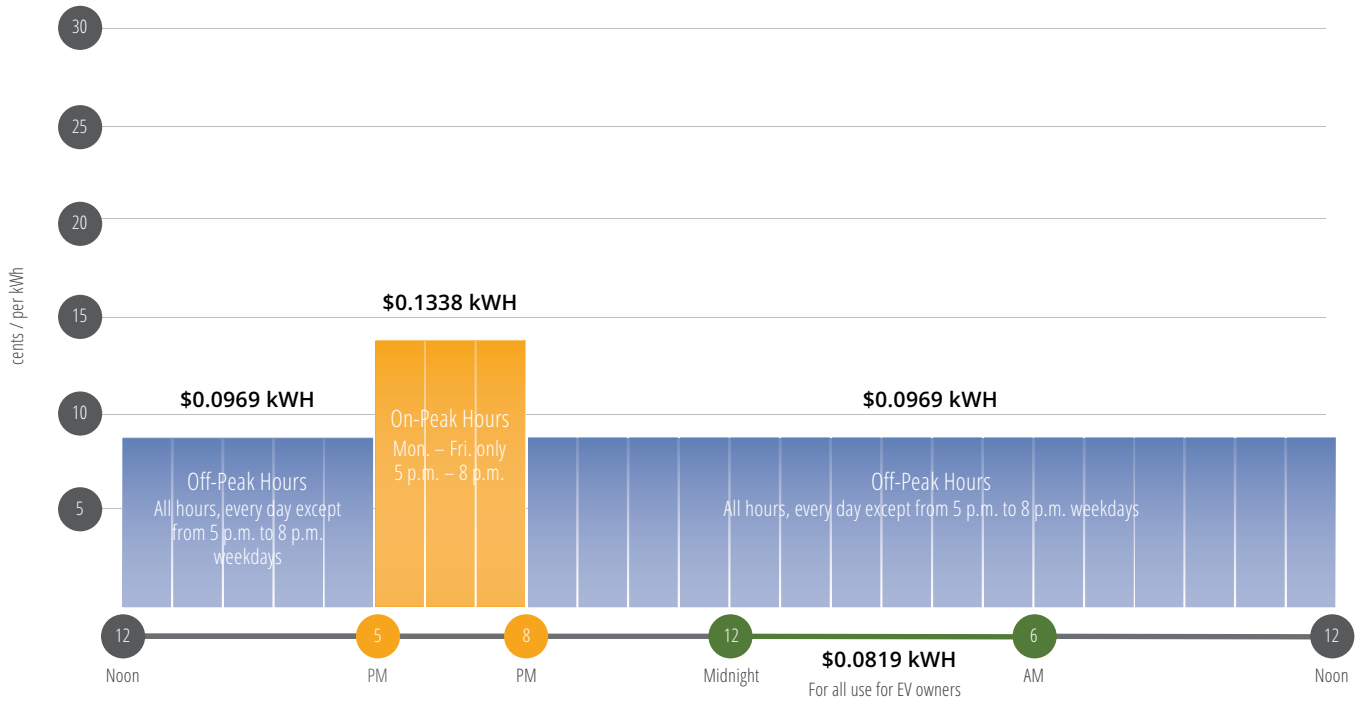
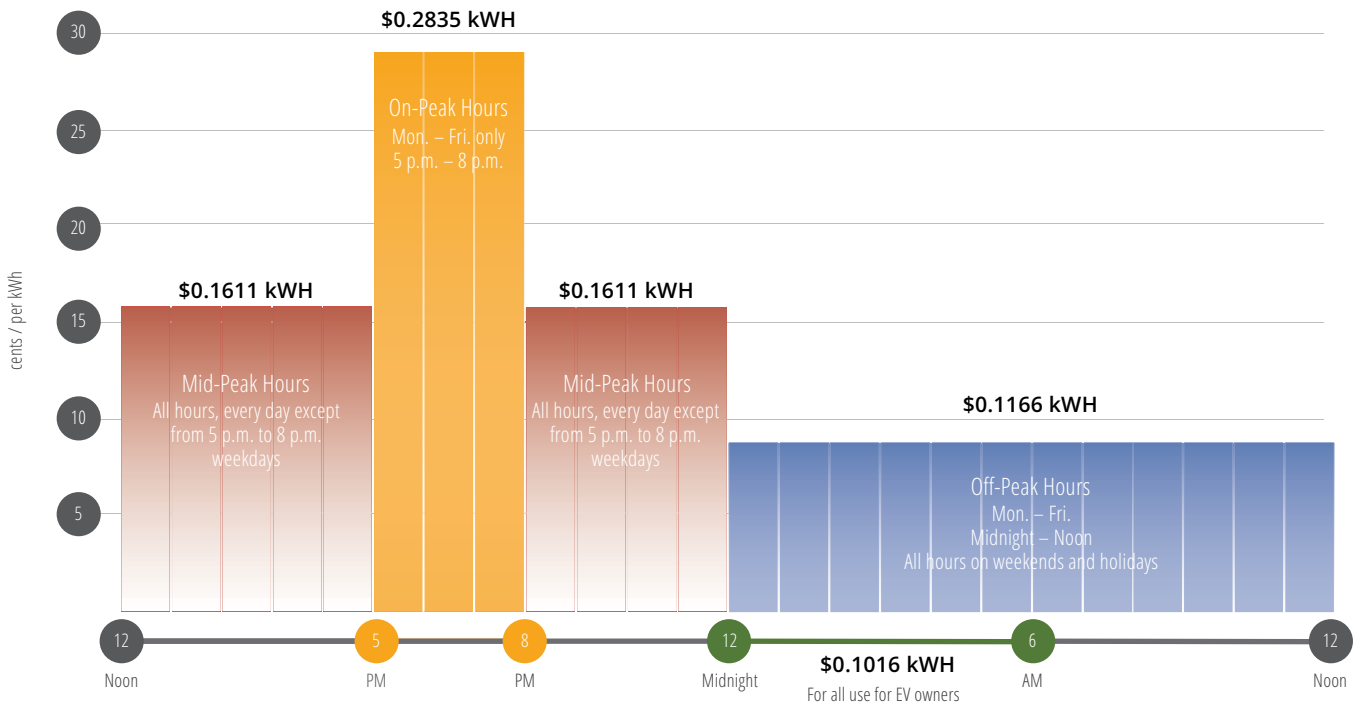


FIGURE 5. SUMMER (JUNE 1-SEPTEMBER 30)

Residential Time-of-Day Rates, 2019



To support the board's direction on rates, the TOD rates must:

- Reflect the cost of energy when it is used
- Reduce use on peak
- Encourage energy efficiency and conservation
- Offer flexibility and options –customers who don't want to participate in TOD rates have the choice to be on an alternate fixed rate
- Be simple and easy to understand
- Equitably allocate costs across and within customer classes

Figures 4 and 5 show the parameters and prices for the residential TOD in 2019.

This rate design was meant to balance simplicity and matching the cost of energy. Hours were chosen to make

them easy for residential customers to remember and took into account feedback from customers and findings from the SPO study. For example, the three-hour peak period was influenced by feedback from customers.

In addition to the parameters for peak hours, customers with electric vehicles receive a discount of 1.5 cents per kWh on all consumption from midnight to 6 a.m.

Customers were offered an alternative fixed rate option if they felt TOD wouldn't work for them. The price reflects the cost of those users with high on-peak usage and is about 4% higher than the standard TOD rate. Currently 2% of customers have elected the Fixed Rate. Table 2 displays the prices effective in 2020.

TOD offers lower prices for most of the year as 82% of the hours in a year are off-peak, which includes weekdays,

all weekend and holiday hours. Summer peak hours represent only 3% of the total hours in a year. The cumulative effect of the changes is that customers will see lower bills eight months of the year and higher bills four months out of the year. TOD was designed to be revenue neutral and was not a rate increase.

Business customers have been on time-based rates for years. On June 24, 2019, the board approved an update and glidepath to the commercial time-of-day rates to improve consistency and better align commercial rates with energy market prices. This commercial restructure rate transition will be implemented in 2022 and will take several years to complete the full transition. The [2019 General Manager's Report on Rates and Services](#) offers more details on this transition.

TABLE 2. 2020 RESIDENTIAL TIME-OF-DAY RATE

NON-SUMMER MONTHS

Time periods (Oct. 1 – May 31)	Price per kWh	Percentage of the total year
Off-Peak (All hours except 5 – 8 p.m., Mon.-Fri.)	\$0.1035	61%
Peak (5 – 8 p.m., Mon.-Fri.)	\$0.1430	6%
Total hours per year		67%

SUMMER

Time periods (June 1 – Sept. 30)	Price per kWh	Percentage of the total year
Off-Peak (midnight – noon)	\$0.1209	21%
Peak (5 – 8 p.m., Mon.-Fri.)	\$0.2941	3%
Mid-Peak (noon-midnight, except 5 – 8 p.m., Mon.-Fri.)	\$0.1671	9%
Total hours per year		33%
Total Non-summer months + summer months		100%



Customer Education

Customer education was a key component of both the pilot program and the full-scale implementation of residential TOD rates. The objectives of providing customers with tools and information were to: 1) help them make informed choices, and 2) ensure the best customer experience possible.

SMUD learned some lessons from the SPO pilot, including that customers want specifics. For example, stating "5 p.m. to 8 p.m." vs "peak hours" in materials. Explaining the "why" behind the change is also important.

SMUD initiated three major campaigns and messages in 2019:

- Introducing time-of-day (3 months prior to start of transition)
- Time-of-day is here (during the 4 months of the transition)
- Summer rates are here (June through September — everyone is

on TOD at this point). In September, messaging changed to Summer rates end September 30.

SMUD used many different communication channels to inform customers:

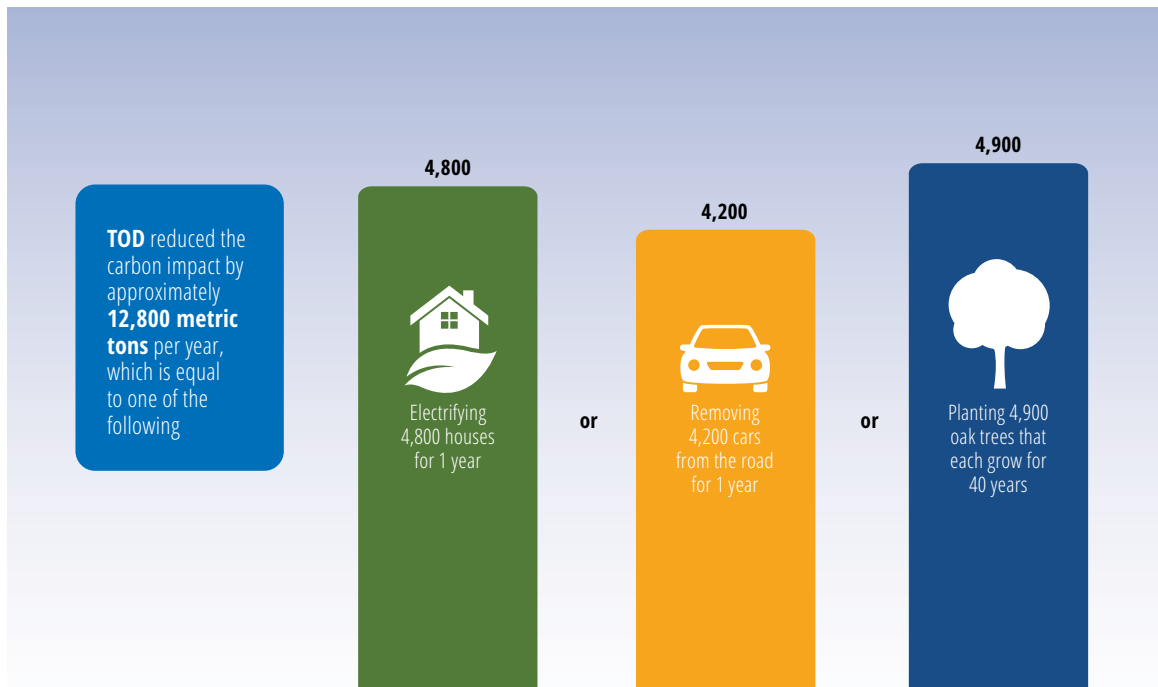
- Digital search and display
- Print publications
- Billboards & buses
- Social media
- TV
- Door hangers
- Radio
- smud.org
- Direct mail

These channels provided 60+ opportunities for customers to hear about TOD. Every customer received a welcome kit, rates report and instructions on how to choose the rate that was most convenient for them; eventually customers were enrolled on the standard TOD rate or they opted out onto the fixed rate.

TABLE 3. RESULTS FROM TOD SHIFT IN 2019

Benefits	Estimated	Actual
Carbon Reduction	3,000-5,000 metric tons	12,800 metric tons (estimated)
Residential peak load reduction	75MW, or 5.8%	~130MW, or ~8%
Financial benefit	\$3.7M annually	\$5M estimated in commodity costs
Selection of TOD	96%	98% (to date)

ENVIRONMENTAL BENEFITS



The SMUD website also featured tools to help customers. A landing page provides information, tips, videos on how customers can reduce their bill, as well as information on programs and services. A TOD Cost Estimator helps customers determine how much their appliances and equipment cost to run at different times of the day, and the interactive Energy Efficiency Home allows customers to explore how to control costs and energy use.

SMUD offers a mobile app providing easy access to customer information. Bill alerts offer options for staying on track with energy use and budget.

Results

SMUD's assumptions and hypothesis were that TOD would be good for commodity costs, its customers and for the environment.

Table 3 provides an overview of the assumptions and TOD results from the first summer in 2019.

In terms of the environment, it is estimated that in the summer of 2019, TOD reduced carbon impact at a rate of about 12,800 metric tons per year, which is the equivalent of powering approximately 4,800 houses for one year, or driving approximately 4,200 cars with internal combustion engines for one year, or planting 4,900 oak trees that would each grow for over 40 years.

FIGURE 6. AVERAGE CUSTOMER ENERGY USE REDUCTION

With TOD, the greatest carbon reduction was achieved on the 12 hottest days in the summer (green line)

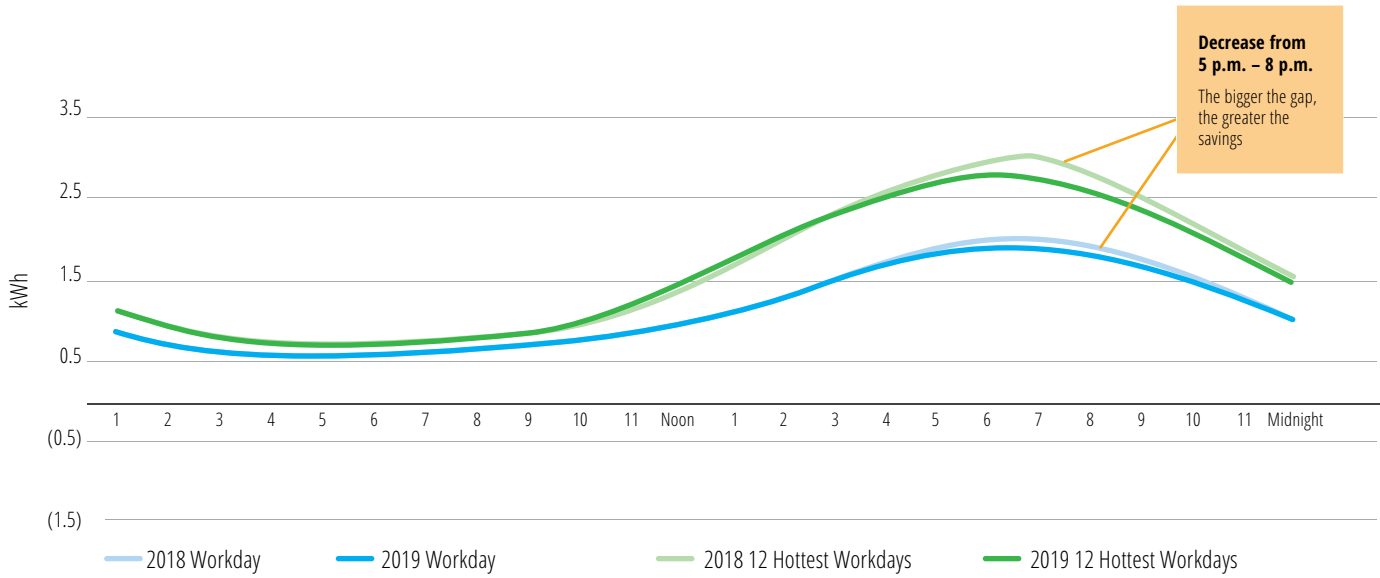


FIGURE 7. SYSTEM IMPACT TO AVERAGE SUMMER WORKDAY

With TOD, customers moved the system peak from 5 – 6 p.m. to 4 – 5 p.m., plus also reduced the peak

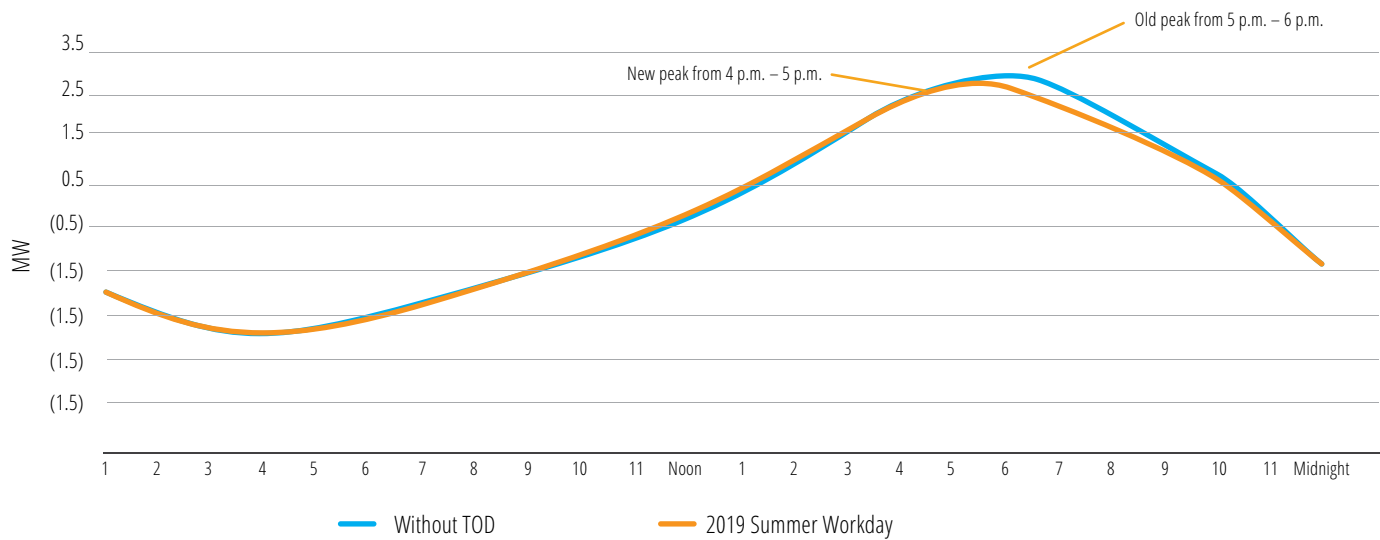


FIGURE 8. AVERAGE BILL SAVINGS, BY MONTH

Customers shifted and reduced their usage in all time periods and saved about 2% or \$3 per month on their summer electric bill

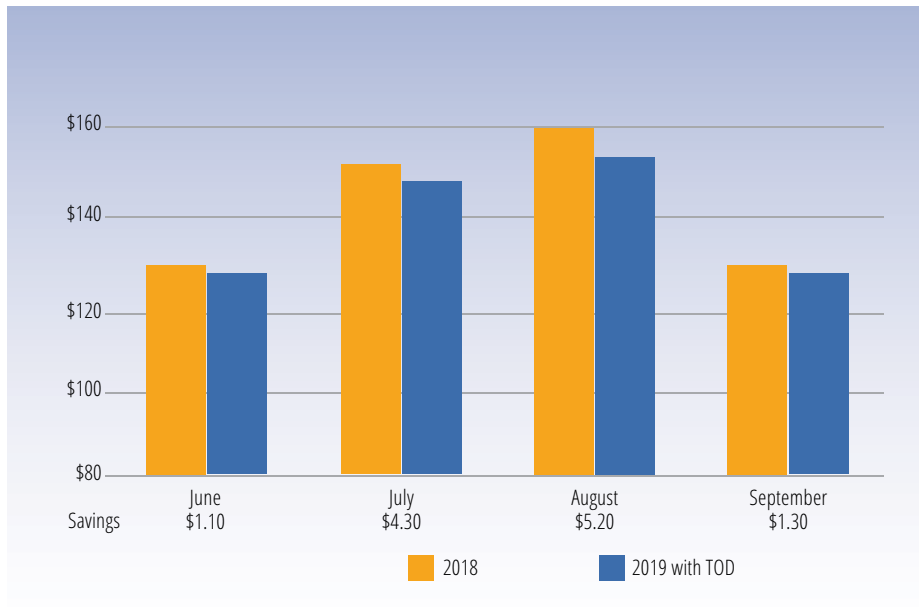


Figure 6 compares energy use and carbon reduction before and after TOD. The blue line reflects differences on a normal day, while the green line shows differences for the hottest days in Sacramento.

The system peak used to occur between 5 pm and 6 pm, per the blue line in Figure 7. During the first summer with TOD rates, in 2019, the system peak occurred between 4 pm and 5 pm, when renewables are plentiful. Prior to implementation of TOD, the peak was moving later into the evening.

As for revenue and bill impacts, on average, customers realized bill savings from the first summer in 2019. Figure 8 shows a breakdown of the savings by month. The orange bar represents average bills before TOD in 2018 and the blue bar is after TOD in 2019. Customers shifted and reduced their usage in all time periods and saved about 2% or \$3 per month on their summer electric bill (energy only).

In summary, SMUD saw better results than staff assumed based on the SPO study, seeing energy savings across all time periods and not just the peak period.

Looking Ahead

One year of data is not enough to make any firm conclusions. Sacramento did not have any really hot days (105°F+) in 2019, so it is unknown how customers will respond to extreme temperatures.

Having time-based pricing is helpful when utilities need customers to conserve electricity. In August and September of 2020, the Sacramento region, along with the entire state of California, experienced an historical heat wave. The neighboring IOU, PG&E, was forced to schedule rotating power outages due to energy shortages. In response to the heat emergency, the Governor urged residents to conserve electricity between 3 p.m. and 10 p.m. SMUD's residential peak period falls within those hours. SMUD did not perform any rolling blackouts during that period. SMUD [published information on its website](#) advising customers to limit the use of electricity during the week's heat wave.

SMUD also does not know how customers will respond during year two when there is less marketing — they could either improve load shifting or get complacent and shift less. Plus, it's unknown how the COVID-19 crisis will affect customer behavior in 2020 and beyond.

Strong executive and board support and communication are necessary in making the shift to a TOU or TOD rate. This is a long process, taking several years to plan, perform pilots and eventually implement the standard TOD rate. Having a pilot to refer back to is very helpful during the rate process. Implementation of a TOD rate requires a lot of technology and resources to support giving customers enough data to make decisions about when to use energy (online tools, analysis of choice, etc.). Utilities should consider a rate roadmap when making this type of decision; SMUD conducted a rates roadmap plan and it was very helpful.



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