Update on EPE's Time Varying Rate (TVR) Pilot

Advisory Group Meeting #2

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Brattle

Objectives of Today’s Meeting

- Recap pilot objectives and expected learnings
- Review proposed TVR options
- Discuss stakeholder feedback
- Review Brattle’s preliminary analysis on TVR time periods and seasons

Meeting Agenda

1. Introduction & Recap
2. Proposed TVR Options & Discussion of AMS Advisory Group Feedback
   - Proposed TVR Options
   - Discussion of Three-Part Rate
   - Enabling Technologies
   - Opt-in vs Opt-Out
3. Preliminary Analysis for TVR Design Elements
   - Proposed Season Definitions
   - Proposed Pricing Periods
4. Next Steps
5. Q&A

1- Introduction & Recap

Pilot Objectives

- **System cost minimization**: Reduce costs to serve customers by improving capacity utilization, encouraging economic conservation and peak shaving.
- **Customer choice**: Offering customers options to help them manage their energy bills.
- **Equity and accessibility:** Design and offer rates and programs that consider needs and effects on low-income/vulnerable populations
- **Realization of AMI benefits**: Provide an opportunity for customers to realize customer-facing benefits of AMI
- **Renewables integration:** Investing in and successfully and economically integrating renewable resources to help EPE meet its RPS goals

What are we expecting to learn from the pilot?

- Valuable insights regarding customers' ability and willingness to respond to price signals
- EPE customers' experience with TVRs once they are on the rate
- Based on the load impacts quantified in the pilot, whether EPE can expect meaningful peak demand savings if deployed at a larger scale
- Low income customer responsiveness and impact
- Small business customer responsiveness and impact
- Whether the price response persists over the course of the pilot
- Effectiveness of customer outreach, education and support
- Whether EPE customers were satisfied with the TVRs as they experience it

High-level Design Elements for the Pilot

- Pilot design will allow testing a few TVRs for residential and small C&I customers
- We will design a statistically valid pilot that will allow EPE to generate internally and externally valid results to inform a potential larger scale deployment
- Pilot design will also involve developing a "Measurement and Verification Plan" for load impact and process evaluation
- EPE will plan to undertake focus groups and surveys to understand customer understanding of and response to these rates
- EPE is committed to incorporating stakeholder feedback throughout the development of the pilots in the next several months

Discussion Questions

We posed the following questions in the first meeting:

1. Which **rate design objectives** should be prioritized by EPE in designing the TVRs?
2. Which **TVR options would best meet the objectives** of the pilot?
3. Which **customer groups** are important to analyze separately through this pilot?
4. Is it important to test the **impact of enabling technologies** (i.e. smart thermostats) in these pilots?
5. How should the rates be offered to the pilot customers: **opt-in or opt-out**?
6. How do you **define a successful outcome** for this TVR pilot initiative?

- ➢ **Stakeholder feedback completely aligned with our proposals for the questions in black (1, 3, 6)**
- ➢ **We revised our strawman proposal for the other questions (2, 4, 5) after considering stakeholder feedback. We will focus on these in the next section**

2- Proposed TVR Options & Discussion of AMS Advisory Group Feedback

TVR Options to be tested

Which TVR options would best meet the objectives of the pilot?

- We propose the following TVR options, after incorporating feedback from stakeholders:
  - 2-period time-of-day (TOD) rate
  - 2-period TOD + demand charge
  - 2-period TOD + critical peak pricing (CPP)
  - 2-period TOD + CPP + enabling technology
- TVR pilot will include **residential** and **small commercial and industrial (C&I)** classes
- We plan to include **low-income residential** customers as a separate subgroup and offer TOD rates for this subgroup
  - Prior experience shows this subgroup respond to and benefit from TOD rates

Proposed Treatment Cells

Customer	2-period TOD	2-period TOD + demand charge	2-period TOD + CPP	2-period TOD + CPP + enabling technology
Residential Low-Income	✓			
Residential	✓	✓	✓	✓
Small C&I	✓	✓	✓	

Basis for the Proposed Treatment Cells

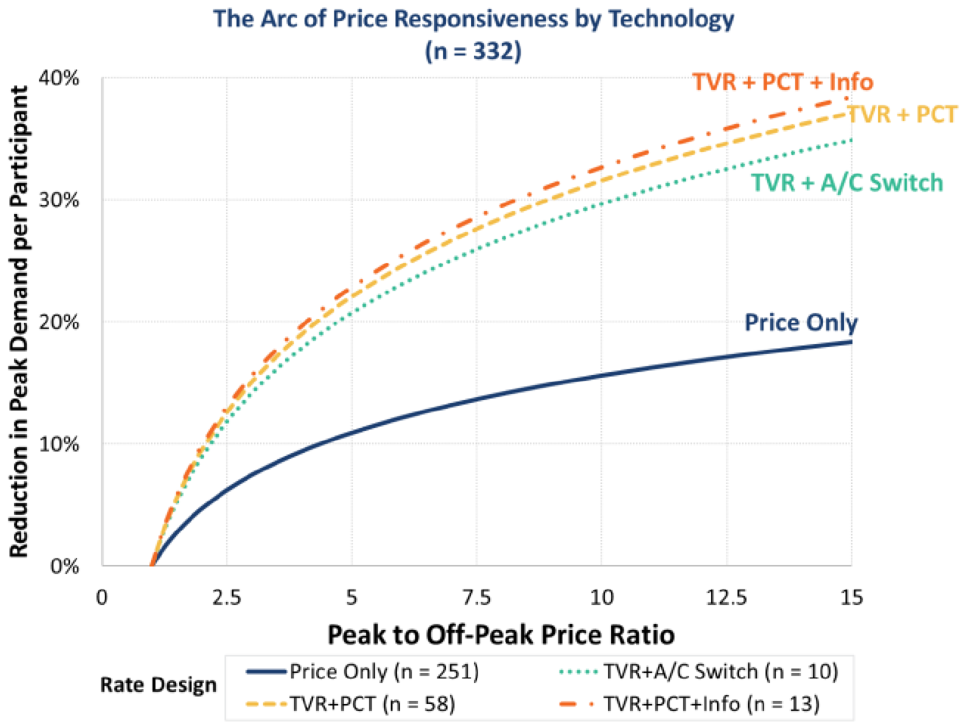
- Stakeholder support for **testing a TOD rate for residential and small C&I customers**
- Important to understand **low-income customer response to TOD** rates
- Important to test EPE customer's interest in and response to **more dynamic rates, such as CPP**, that will be more effective in responding to grid emergency conditions
- While the **effects of enabling technologies** in boosting the customer response are well established, one of the stakeholders specifically asked to see this tested as part of one of the treatments
- **Addition of demand charges** to a TOD rate and testing it side-by-side with a TOD-only rate will provide us with new information on: i) additional peak response (if any); ii) customer ease/difficulty to manage demand charges
  - 3-part rates (including fixed, volumetric, and demand charges) are cost-reflective
  - There is an unsupported belief that demand concept would not be immediately intuitive for residential customers, the EPE pilot could confirm or eliminate this belief
  - There are not many pilots that tested these two treatments side-by-side; this will be the unique element of EPE's pilot and contribution to the body of knowledge
  - Hawaii is scheduled to deploy a default 3-part rate with TOD and demand charges to all of its residential customers

Enabling Technologies

Is it important to test the impact of enabling technologies (i.e. smart thermostats) in these pilots?

- We propose including a treatment cell to test the impact of enabling technologies, i.e. smart thermostats
- Adding an additional treatment cell will increase the pilot sample size requirements; however, EPE plans to take advantage of the customers already enrolled in its smart thermostat program, Energy Wise Savings
- There is empirical evidence on the impact of enabling technologies improving the peak response

Impact of Enabling Technologies on Price Responsiveness



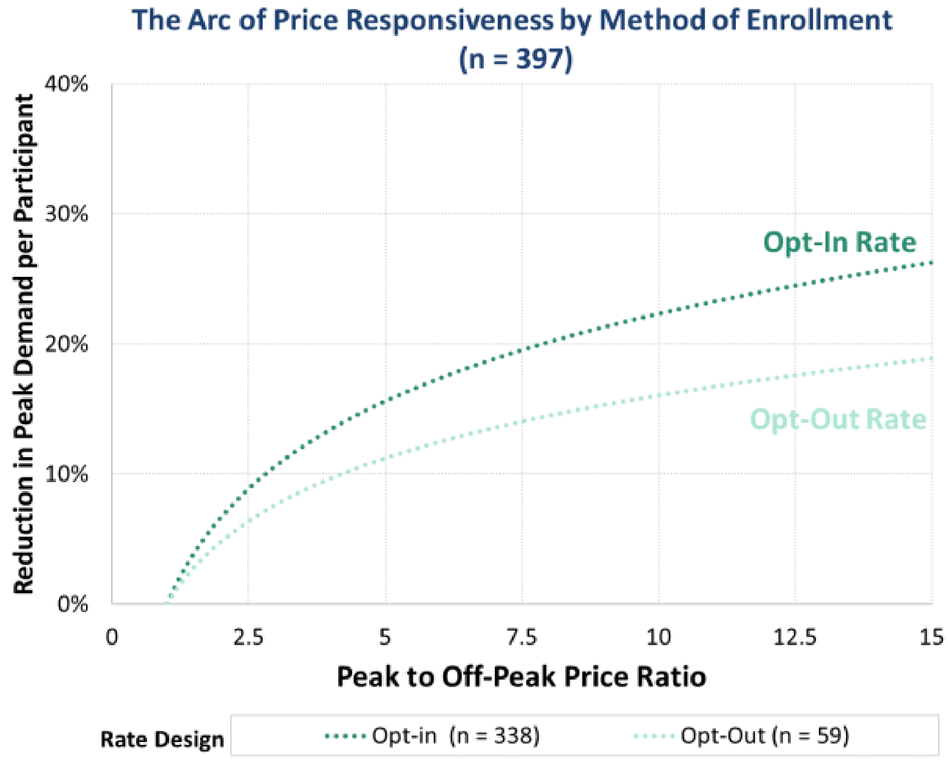
Source: Sergici et al (2023)

Opt-in vs Opt-Out Enrollment in the Pilot

How should the rates be offered to the pilot customers: opt-in or opt-out?

- We propose **opt-in enrollment**, and also estimate what the results would be under an opt-out deployment based on the relationship between impacts from opt-in vs. opt-out programs
- We typically recommend that the pilot deployment approach mimics the full scale deployment (i.e. if the rates will be opt-out in the future, it may be advisable for the pilot to be opt-out as well)
  - However, an opt-out pilot would require much larger sample sizes to be able to detect the impact in a statistically significant way
  - EPE is still in the process of deploying smart meters, and will likely not have a very large pool of customers with sufficient level of pre-pilot AMI data. This may limit the efficacy of a pilot design with opt-out deployment

Impact of Opt-in vs Opt-out Rollout on Peak Impact



Notes: This model does not differentiate between treatments that are price only or paired with technology.

Source: Sergici et al (2023)

3- Preliminary Analysis for TVR Design Elements

Background

The first step in designing TVRs is to define seasons and pricing windows. Peak windows should have the following characteristics:

- Reflect seasonal differences in load and price patterns
- Cover the high load and/or high marginal cost hours
- Should encourage change in customer behavior; not too short (< 3 hours) and not too long (> 6 hours)

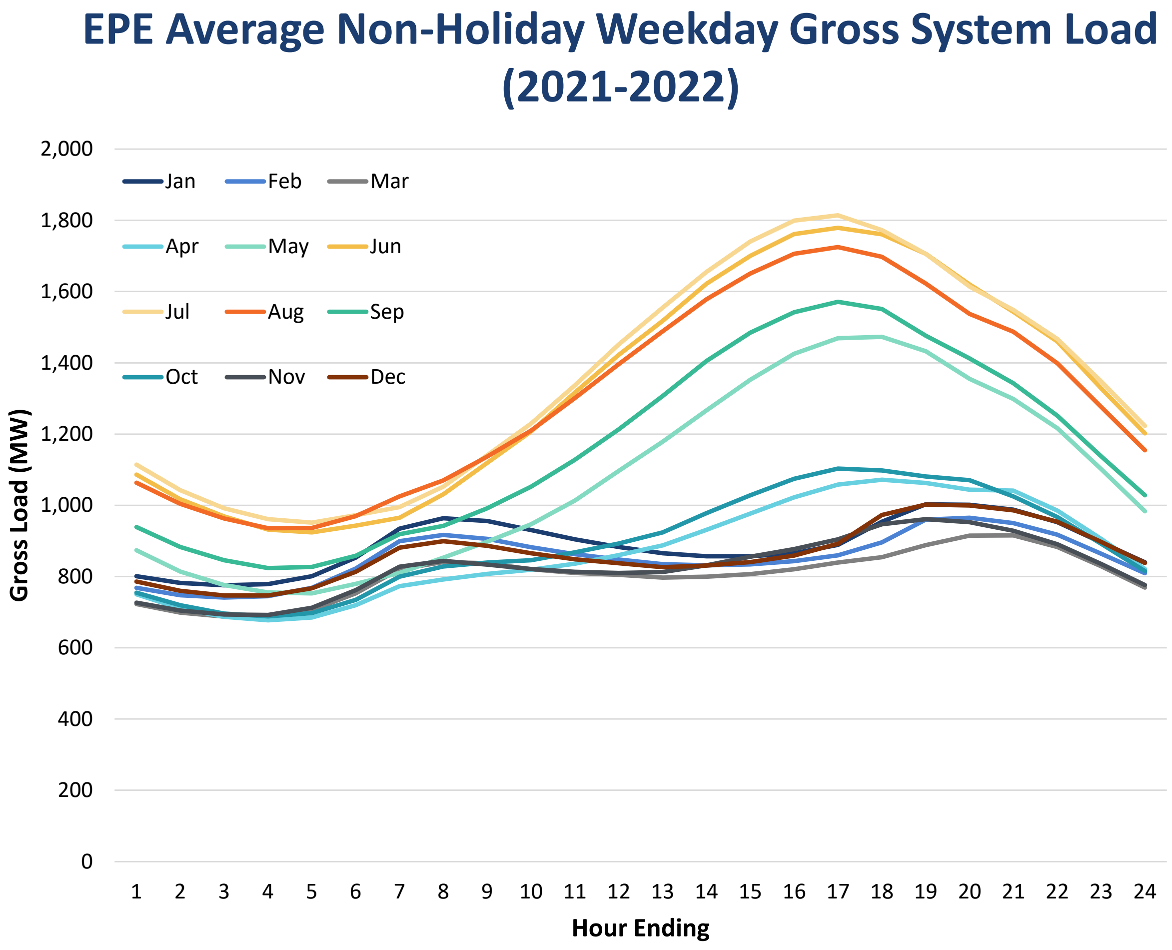
We use a data-driven approach to identify seasons and pricing windows using:

- System level and class load profiles
- Marginal energy costs, or regional energy LMPs

We first look at load profiles provided by EPE to identify seasons

Proposed Seasonal Definition

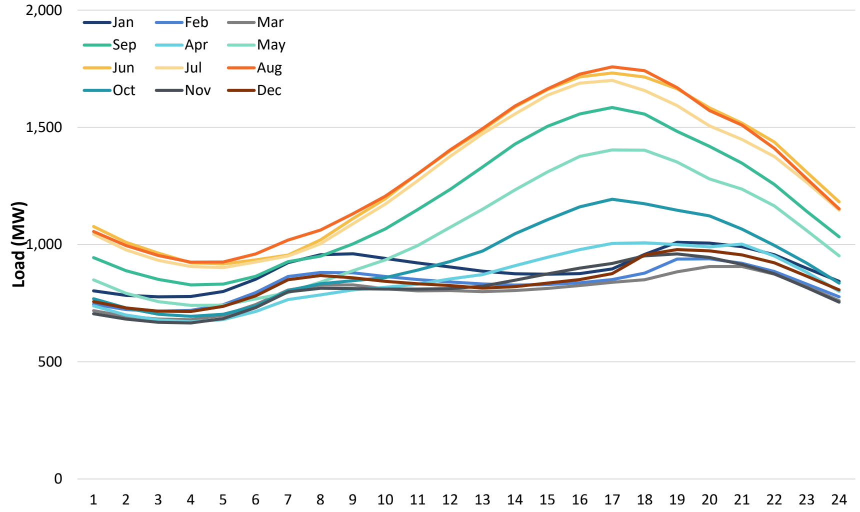
- Our proposed season definitions are:
  - Summer: June to September
  - Non-Summer: October to May
- These are aligned with the season definitions used in EPE's current TOD rates for New Mexico
- Monthly gross load system profiles show that the months of **June, July and August, and September** have the highest load compared to all other months
- We see a similar trend with net load profiles, i.e. gross load minus non-dispatchable generation



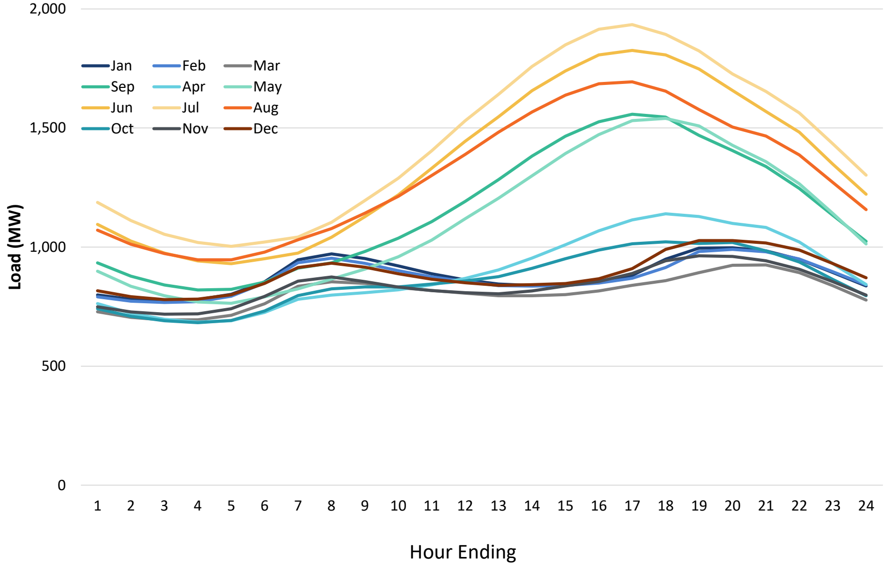
EPE System Gross Load Monthly Trends

Average Non-Holiday Weekday Gross System Load

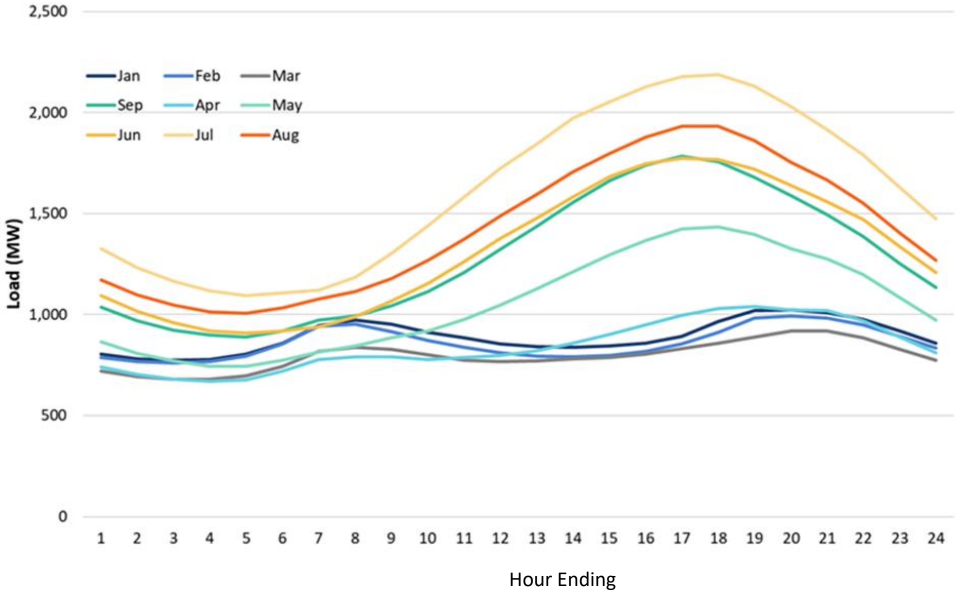
2021



2022



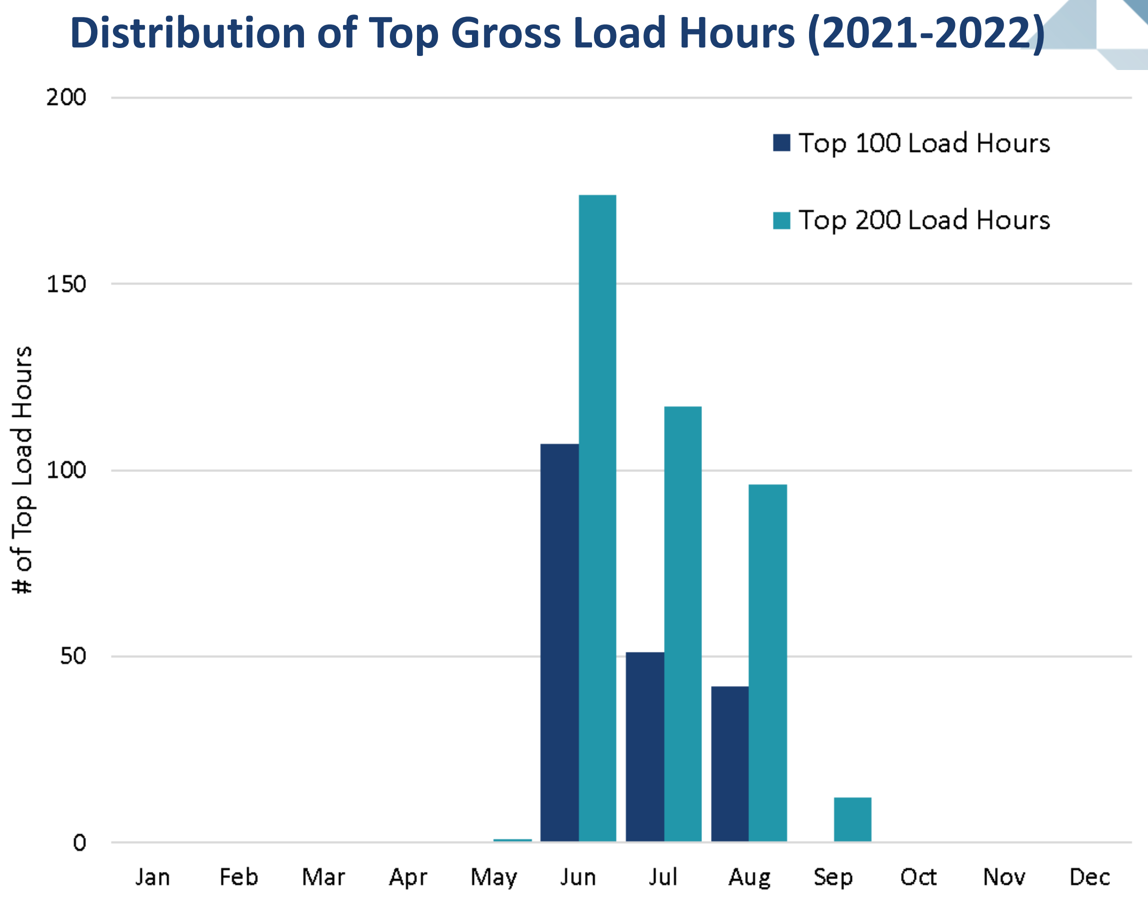
2023



Top 100 Load Hours

Utility capacity costs are driven by the need to meet peak demand during relatively few hours of the year

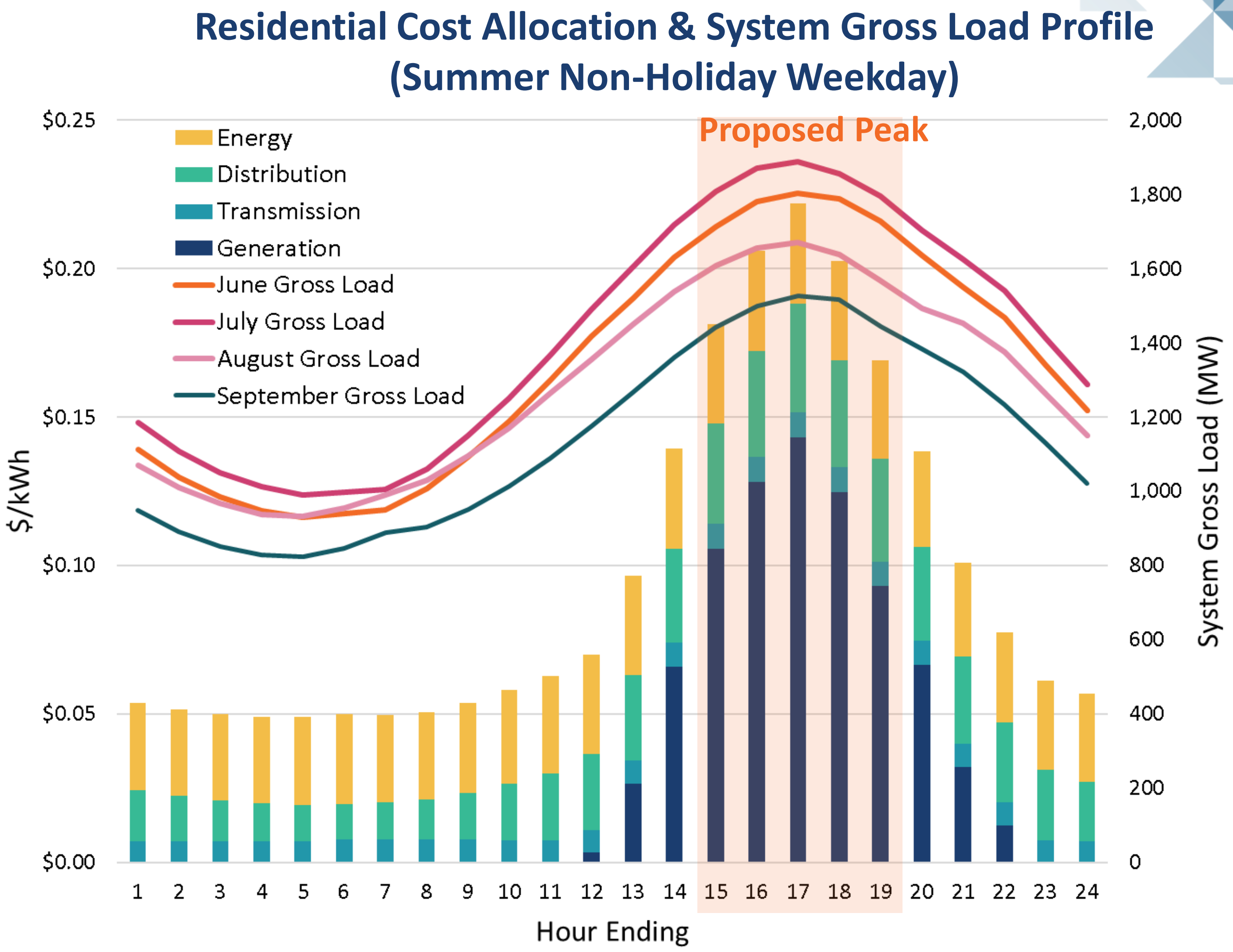
The top 100 EPE system gross load hours occur during the months of June, July, and August. A portion of the top 200 gross load hours occur outside of this three month window, mostly in September



Note: The figure shows the top hours in each year; i.e. the top 100 hour category will have 200 data points, 100 for 2021 and 100 for 2022.

Residential Customers – Cost Distribution

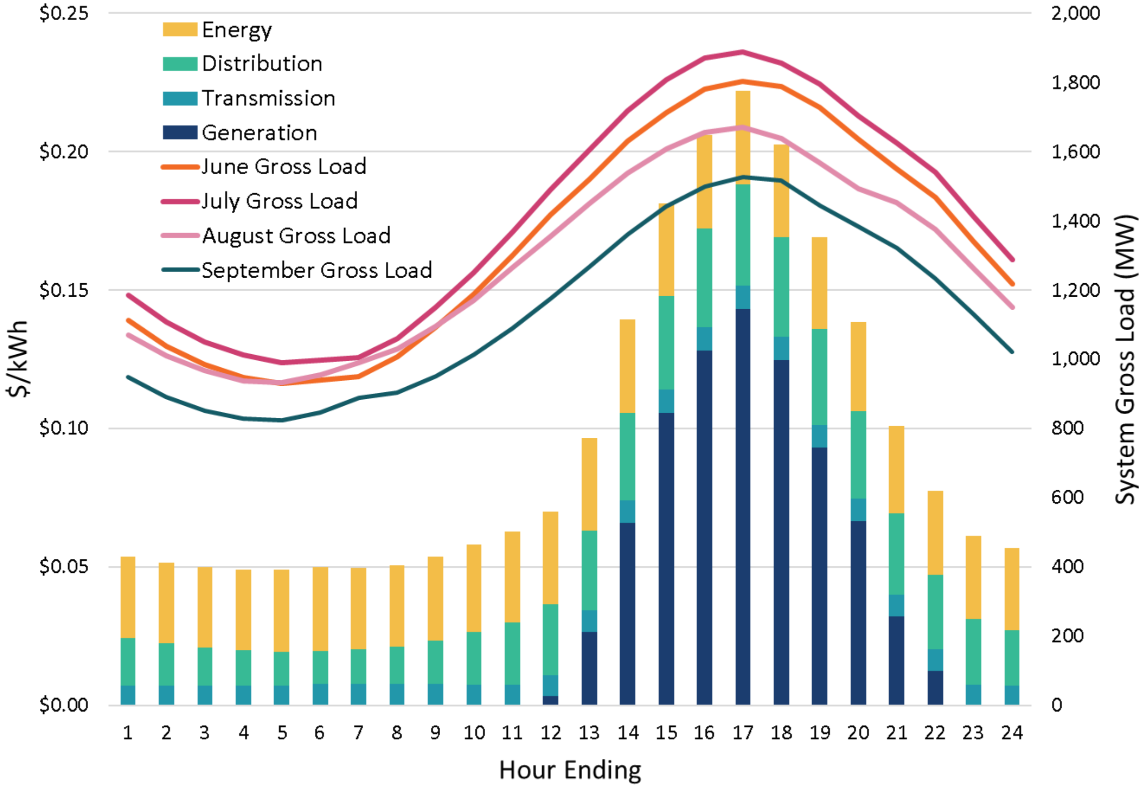
- The cost allocation profile for residential customers supports a peak period from HE 15 through 19 (2 - 7pm MDT)
- This peak period captures the five highest system cost hours in the day



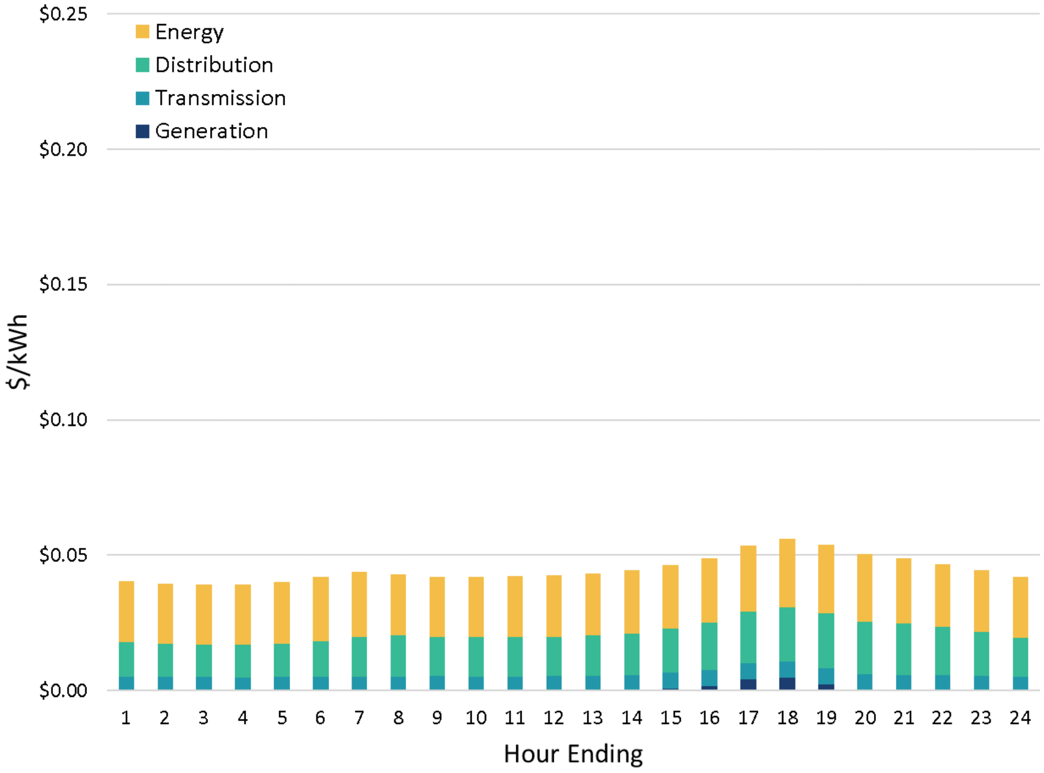
Residential Customers – Cost Distribution: Summer vs. Non-Summer

Since most generation capacity costs are assigned to the summer, overall Non-Summer costs are much lower

Summer Non-Holiday Weekday



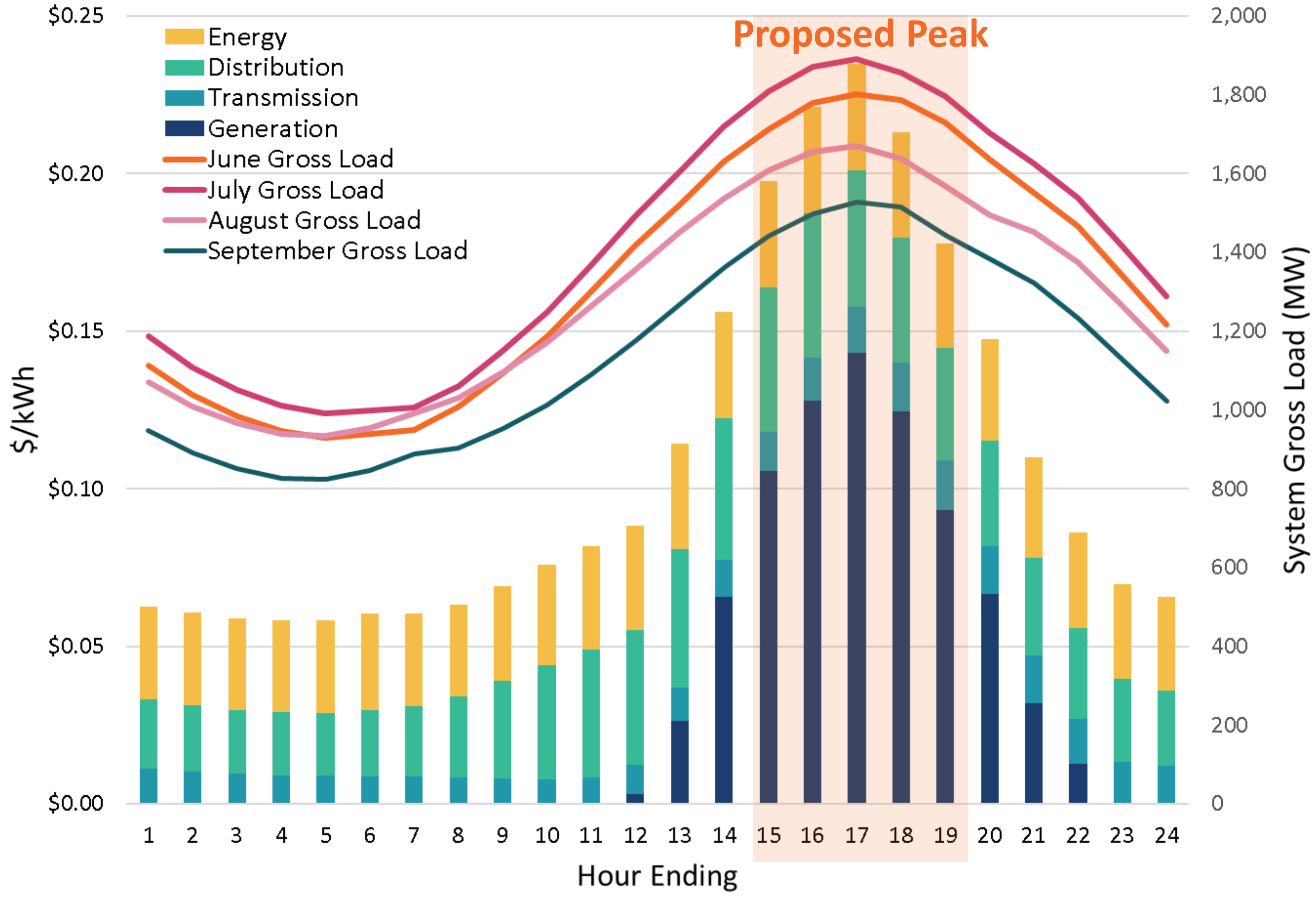
Non-Summer Non-Holiday Weekday



Small General Service (SGS) Customers – Cost Distribution

- The cost allocation profile for small general service customers supports a peak period from HE 15 through 19 (2 - 7pm MDT)
- This peak period captures the five highest system cost hours in the day

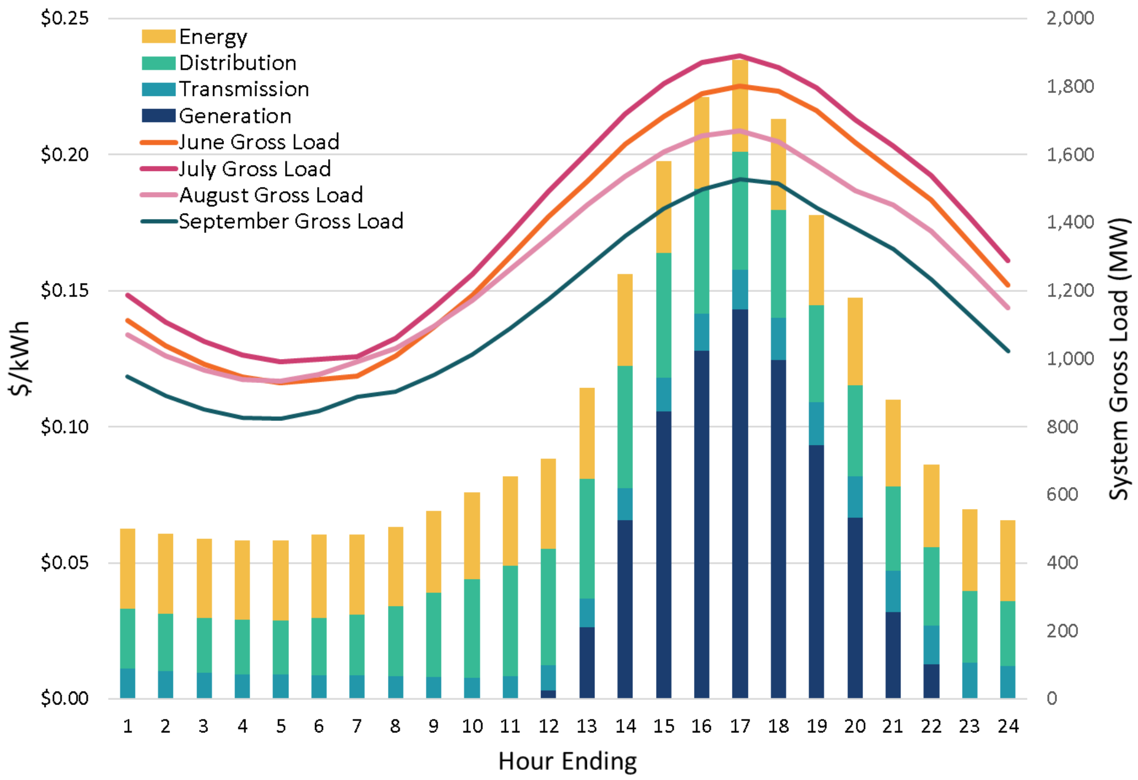
SGS Cost Allocation & System Gross Load Profile (Summer Non-Holiday Weekday)



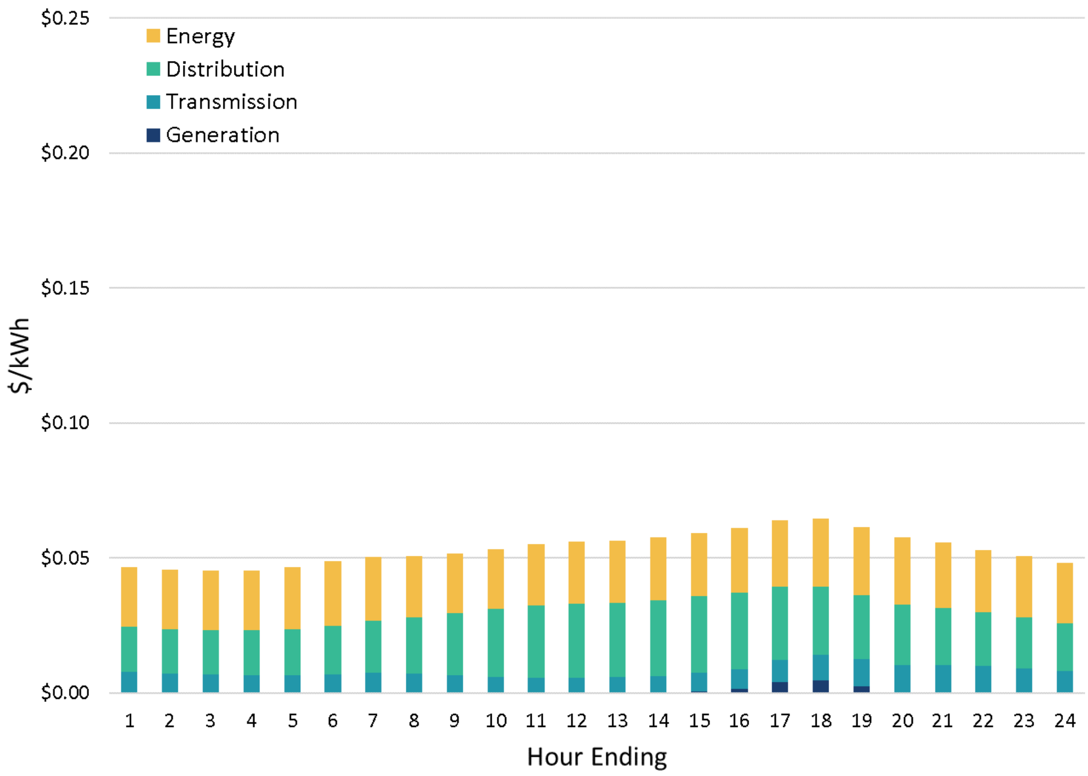
SGS Customers – Cost Distribution: Summer vs. Non-Summer

Since most generation capacity costs are assigned to the summer, overall Non-Summer costs are much lower

Summer Non-Holiday Weekday



Non-Summer Non-Holiday Weekday



4- Next Steps

Timeline

Meeting Schedule	**July 2023 AMS PAG Meeting**	**Oct 2023 AMS PAG Meeting**	**Dec 2023 AMS PAG Meeting**	**Q1 2024**
Meeting Scope	• Review pilot objectives and alternative rates • Discuss general pilot design approach	• Incorporate feedback on alternative rates and pilot treatment cells • Present proposed draft pilot treatment cells • Present analysis of EPE load and cost data to identify seasons and pricing periods for TVRs	• Present draft rates for pilot treatments • Present draft pilot parameters, including sample sizes, recruitment methods, control methodology • Seek stakeholder feedback	• Present final proposed pilot rates • Present final pilot design and implementation plan • File for regulatory approval

5- Q&A

Appendix 1

Alternative Time-Varying Rates

Three-Part Rate Example from Hawaii

Hawaii addressed NEM reform and rate design concurrently in the same proceeding. The new "three part rate design" consists of the following components:

- **Customer charge:** Fixed monthly charge to recover only metering and billing costs
- **Grid access charge (GAC):** Monthly demand charge ($/kW) to recover some grid costs
  - GAC charge is to recover only the cost of the customer's connection to the grid. i.e., the service drop and transformer but not other distribution costs
  - Once AMI is fully deployed this will be *based on each customer's own kW demand*; in the interim all customers will be charged based on the class average non-coincident peak demand
- **TOD Energy Charge:** 3-period schedule to recover energy costs and all other costs not included in the GAC or customer charges. 1:2:3 price ratio for day, overnight, and evening respectively.
- In long-term, all customers will be enrolled in an opt-out TOU rate. All DER tariff customers will be given an AMI upon enrollment, if they don't already have one. All customers on NEM 3.0 tariffs must be enrolled in the TOU rates; the TOU structure will apply to both imports and exports, but the rate levels will be different
- Minimum charge will remain in place for the time being. GAC and customer charges will count towards the minimum charge. When AMI is fully deployed and the GAC is calculated on a customer basis, the minimum charge will be phased out

Discussion Question 2: Three-Part Rate Example from Hawaii

- The following table outlines the proposed residential rates by each stakeholder. The rate decided by the Commission follows the structure of the DER Parties' proposal, but with rate levels yet to be calculated.

Schedule R	Customer Charge	GAC* or Demand Charge**	TOU Energy Charge $/kWh		
	$/Month	$/kW	Mid-Day	Off-Peak	On-Peak
Existing Rates	11.50		0.247		
Hawaiian Electric's Proposal	14.00	3.00** (for Specified Customers)	0.171	0.222	0.241
Consumer Advocate's Two On-Peak Windows With a Demand Charge Proposal	15.89	2.83+	0.143		0.287
DER Parties Proposal	10.18	2.05*	0.132	0.265	0.397

* The DER Parties propose a "GAC," which is conceptually distinguishable from a "Demand Charge," as described in the section below. Both are charged on a $/kW basis and are, therefore, depicted in the same column in these tables.

** Hawaiian Electric proposes a "Demand Charge," which is conceptually distinguishable from a "GAC," as described in the section below. Both are charged on a $/kW basis and are, therefore, depicted in the same column in these tables.

\+ The CA includes rate proposals with a $/kW charge but does not distinguish between a "Grid Access" and "Demand" charge.

Source: Docket No. 2019-0323 Order No. 38680; Similar tables exist for all rate classes

There are various alternatives to standard volumetric rates, most of which are enabled by AMI

	Definition
Time-of-Use *(TOU)*	The day is divided into peak and off-peak time periods. Prices are higher during the peak period hours to reflect the higher cost of supplying energy during that period
Critical Peak Pricing *(CPP)*	Customers pay higher prices during critical events when system costs are highest or when the power grid is severely stressed
Peak Time Rebates *(PTR)*	Customers are paid for load reductions on critical days, estimated relative to a forecast of what the customer would have otherwise consumed (their "baseline")
Real-Time Pricing *(RTP)*	Customers pay prices that vary by the hour to reflect the actual cost of electricity
Two-Part Real-Time Pricing (2-part RTP)	Customer's current rate applies to a baseline level of consumption. A second, more marginal cost based price applies to deviations from the baseline consumption
Variable Peak Pricing *(VPP)*	During alternative peak days, customers pay a rate that varies by day to reflect dynamic variations in the cost of electricity
Demand Charges	Customers are charged based on peak electricity consumption, typically over a span of 15, 30, or 60 minutes
Fixed Bill with incentives	Customers pay a fixed monthly bill accompanied with tools for lowering the bill (such as incentives for lowering peak usage)

Different rate designs meet different objectives

Rate Design	Cost causation	Customer Orientation	Equity	Revenue Stability	Bill Stability
TOU	M	M	M	M	M
CPP	M	L	M	M	L
PTR	L	H	H	L	H
RTP	H	L	L	H	L
Three-part rate	H	L	L	H	L
Fixed bill with incentives	L	H	M	H	H

1- Time-of-Use (TOU) Rate

The day is divided into time periods which define peak and off-peak periods. Prices are higher during the peak period to reflect the higher cost of supplying energy.

Pros	Cons
• Better captures the **natural variation in the cost of supplying electricity** to customers • Helps **raise load factors** and **lower average costs** for all customers • Reduces inter-customer **cross-subsidies**	• **Opt-in deployments create a revenue loss issue** which has to be dealt with either through decoupling (California), a Lost Revenue Adjustment Mechanism (Oklahoma), or building the revenue loss into the TOU rate structure (Xcel Energy Colorado) • There may be **customer dissatisfaction** with having to modify behavior to solve what customers essentially view as the utility's problem • Would raise bills for customers with peakier than average load shapes, who thus may not enroll even though they drive up costs for all customers. Meanwhile, customers with higher than average load factors may receive lower bills without changing their behavior, creating a revenue loss issue for the utility

2- Critical Peak Pricing (CPP) Rate

Customers pay higher prices during critical events when system costs are highest or when the power grid is severely stressed.

Pros	Cons
• Just a few critical events can account for a **high share of demand.** For the typical utility, the top 1% of hours with the highest usage may account for 8%-18% of annual peak load, requiring peaking capacity to be kept idle at high cost to meet this contingency • More **responsive to changing conditions** than TOU, allowing for more timely load reductions during critical events and reducing need for peaking capacity	• Customers tend to become anxious just from looking at the high prices charged during the critical peak hours. While some respond, some will just drop out of the rate