SRP Integrated System Plan

Technical Working Session: Evolution of Time-of-Day Programs

July 12, 2023

Welcome

Angie Bond-Simpson
Director, Integrated System Planning & Support (SRP)

Welcome SRP Board and Council Observers

John Hoopes
SRP Association Vice President

Chris Dobson
SRP District Vice President

Anda McAfee
SRP Board Member

Jack White
SRP Board Member

Larry Rovey
SRP Board Member

Krista O'Brien
SRP Board Member

Suzanne Naylor
SRP Council Member

Rocky Shelton
SRP Council Member

Mark Mulligan
SRP Council Member

Safety & Sustainability Minute

Meeting Objectives:

- Discuss how Time-of-Day price plans could evolve to better align with the needs of a changing grid and provide greater value to customers
- Discuss key considerations for designing and implementing new Time-of-Day price plans
- Identify strategies to advance SRP's Time-of-Day price plans in future pricing and planning processes

Agenda

Time		Topics	Presenter
1:00-1:05	5 min	Welcome and Meeting Overview	Angie Bond-Simpson (SRP)
1:05-1:20	15 min	SRP's current Time-of-Day price plan offering and shifting system dynamics	Adam Peterson (SRP)
1:20-2:20	60 min	Presentations from panelists (**15 min each**)	Panelists
		(1) Environmental & Power Systems/Engineering Perspective	Debbie Lew (Energy Systems Integration Group (ESIG))
		(2) Research/Academia Perspective	Mark LeBel (Regulatory Assistance Project)
		(3) Regulatory Perspective	Paul Phillips (California Public Utilities Commission (CPUC))
		(4) Utility Perspective	Alcides Hernandez (Sacramento Municipal Utility District)
2:20-2:25	5 min	Coffee Break	
2:25-3:20	55 min	Facilitated panel discussion and Q&A with participants	Panelists & SRP participants Arne Olson (E3) as moderator
3:20-3:30	10 min	Wrap up and closing remarks	Angie Bond-Simpson (SRP)

How to Ask for Technical Help in the Technical Working Session

You can also enable captioning.

Having technical issues during the meeting?

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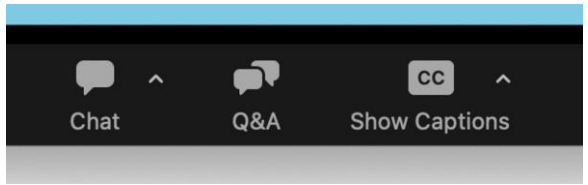
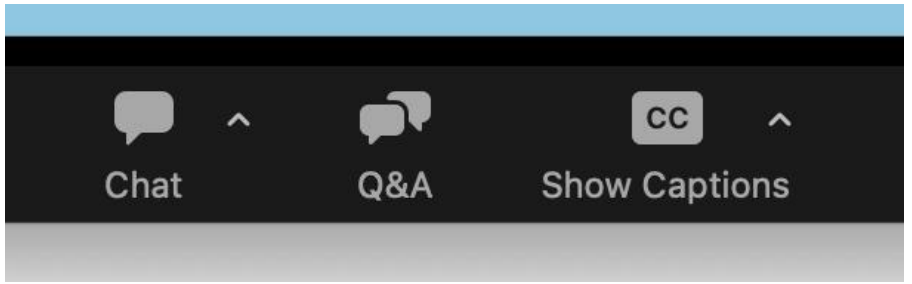


How to Ask a Question in the Webinar

Please submit questions for the panelists using the Q&A box.



SRP's Current Time-of-Day Price Plan Offering and Shifting System Dynamics

Adam Peterson
Director, Pricing (SRP)

Areas of Focus for this Presentation

- The concept of Time-of-Day price plans and SRP's current offerings
- Changing dynamics on SRP's system
  - Graphics on slides 13-15, showing midday solar generation, EV charging and net load (could show current state and potential range in the future)
- SRP's ongoing activities related to Time-of-Day price plans
  - Pilot
  - Pricing process
- Ways to save energy during peak hours and enabling technologies

Purpose of Time-of-Day (TOD) Rates

TOD rates divide the hours of the day into high and low-cost periods based on costs that the utility incurs. This provides customers with the ability to shift their usage away from high-cost hours and towards lower cost hours creating a “win-win” situation where everyone benefits.

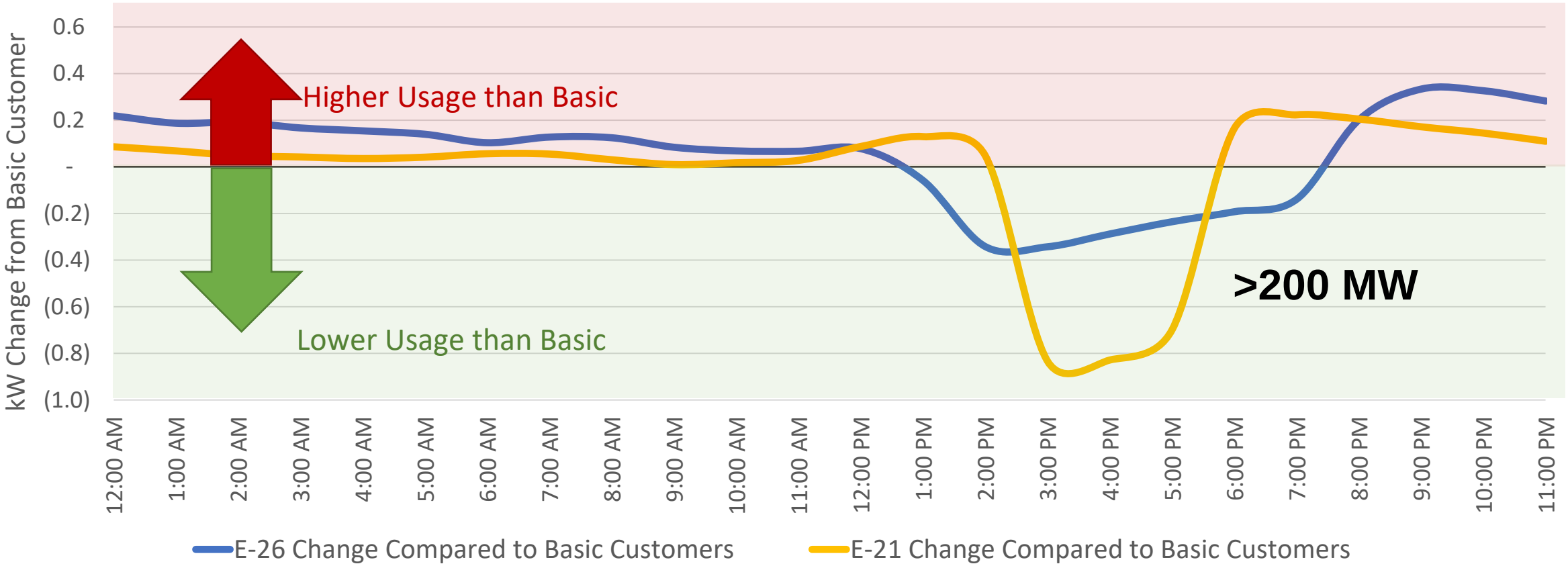
- Utility benefit – lower costs incurred
- Customer benefit – bill savings
- New opportunity – ability to reduce system emissions

SRP's Current Residential Programs

- **TOU: 2-8pm* (E-26) – 112,100 Customers**
- **EZ-3: 3-6pm (E-21) – 182,500 Customers**
- EZ-3: 4-7pm (E-22) – 13,000 Customers
- EV: 2-8pm* (E-29) – 6,500 Customers
- E-27P 2-8pm* (E-27P) – 2,900 Customers
- Solar Price Plans: 2-8pm* (E-13,14,15,27) – 36,300 Customers

*2-8pm summer on-peak hours; 5-9am/5-9pm winter on-peak hours; E-29 also includes 11pm-5am super-off-peak hours year round

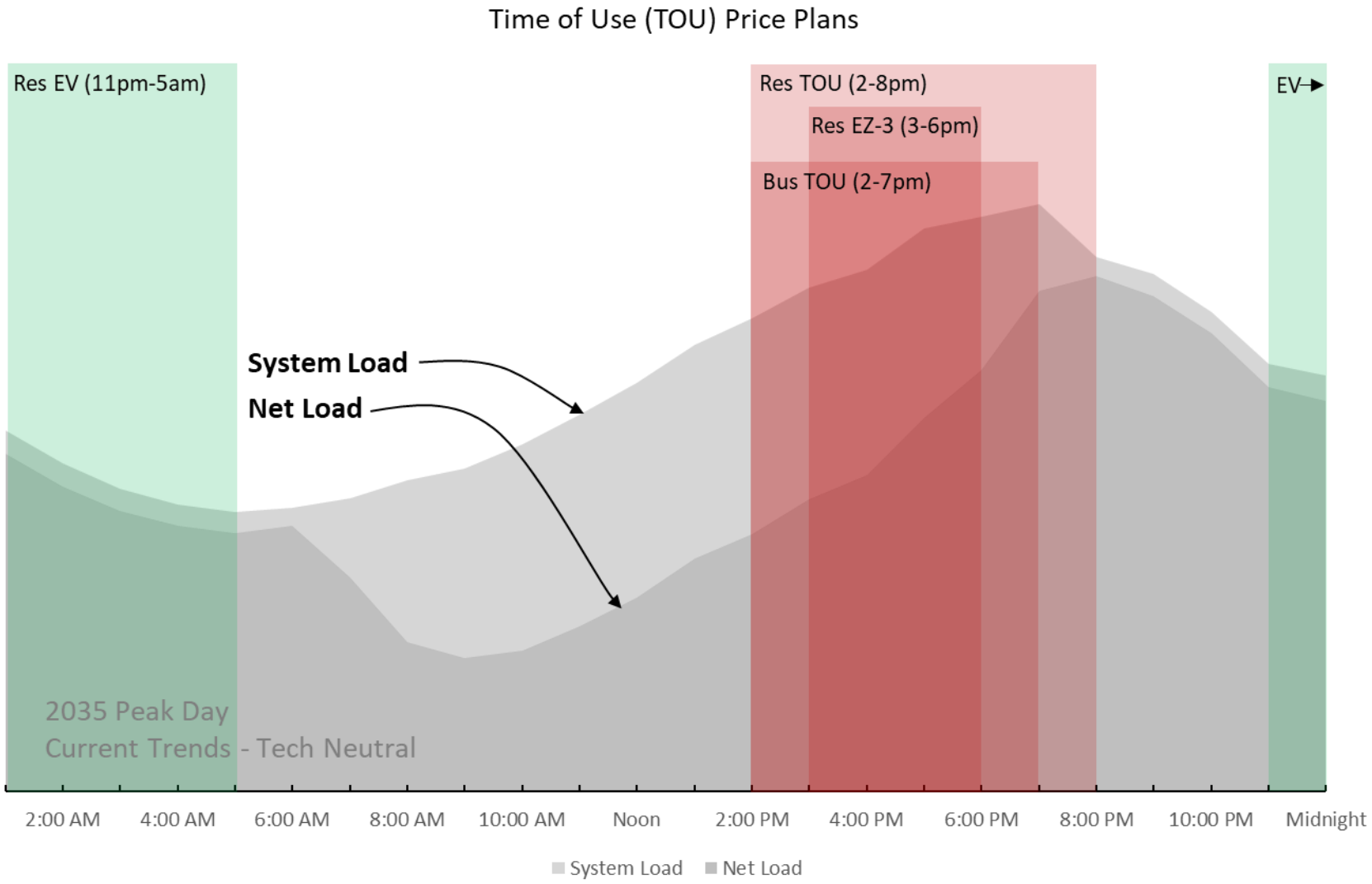
Summer Weekday Time-of-Use Plan Impact



Grid is Evolving

Takeaways:

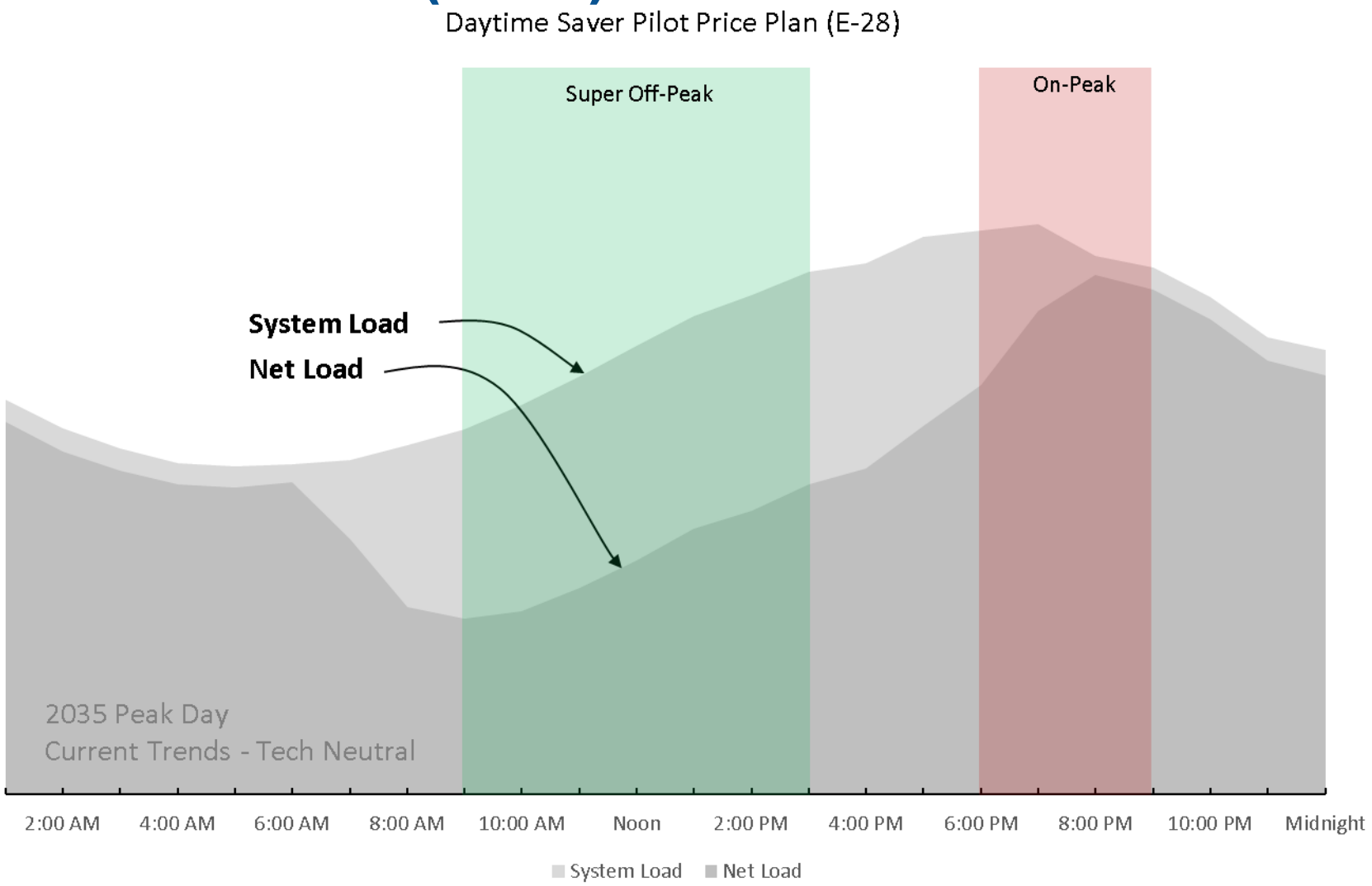
- Hours we are building generation to serve capacity have changed
- Emergence of low/no cost hours that coincide with low emission hours
- Need to manage instantaneous cliffs/climbs



Daytime Saver Pilot Price Plan (E-28)

Considerations:

- SRP's Daytime Saver Pilot signals to customers to access cleaner, more affordable energy
- Super off-peak of 4.3 cent per kWh is about 50% lower price compared to the lowest price on most other price plans



Increasing Opportunities to Shift Load

Historic Opportunities

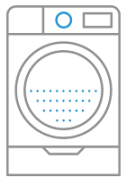
Air Conditioning

Dishwasher

Oven

Pool Pump

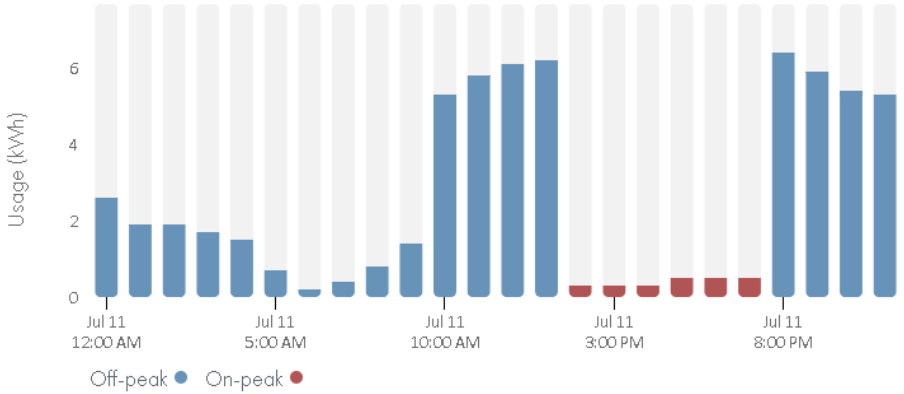
Water Heater



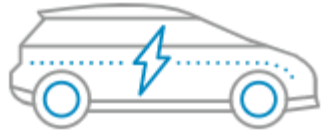
Washer/Dryer

Peak Day 2022

Actual Customer



Future Opportunities



Electric Vehicles

Preset Smart Thermostats

Conclusion

- Time-of-Day (TOD) has been a valuable tool for customers
- Grid is evolving and TOD rates will need to as well
- Daytime Saver Pilot (E-28) will give us better understanding and insights
- We believe TOD has potential to have even greater impact going forward

Panelist Introductions

Arne Olson- Moderator

Senior Partner
Energy + Environmental Economics

External Panelists

Environmental, Power Systems and Engineering

Debra Lew

Associate Director

Energy Systems Integration Group (ESIG)

Research and Academia

Mark LeBel

Senior Associate

Regulatory Assistance Project (RAP)

Regulatory

Paul Phillips

Supervisor, Electric Rates Energy Division

California Public Utilities Commission California (CPUC)

Utility

Alcides Hernandez

Revenue Strategy Manager

Sacramento Municipal Utility District (SMUD)

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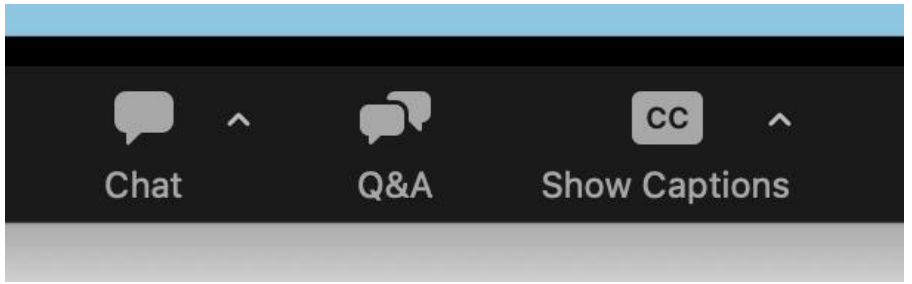


Environmental & Power Systems Perspective

Environmental, Power Systems and Engineering

Debra Lew

Associate Director

Energy Systems Integration Group (ESIG)

Aligning Retail Pricing with Grid Needs

ESIG
ENERGY SYSTEMS INTEGRATION GROUP

Debra Lew

Associate Director, ESIG

SRP Integrated System Plan Technical Workshop

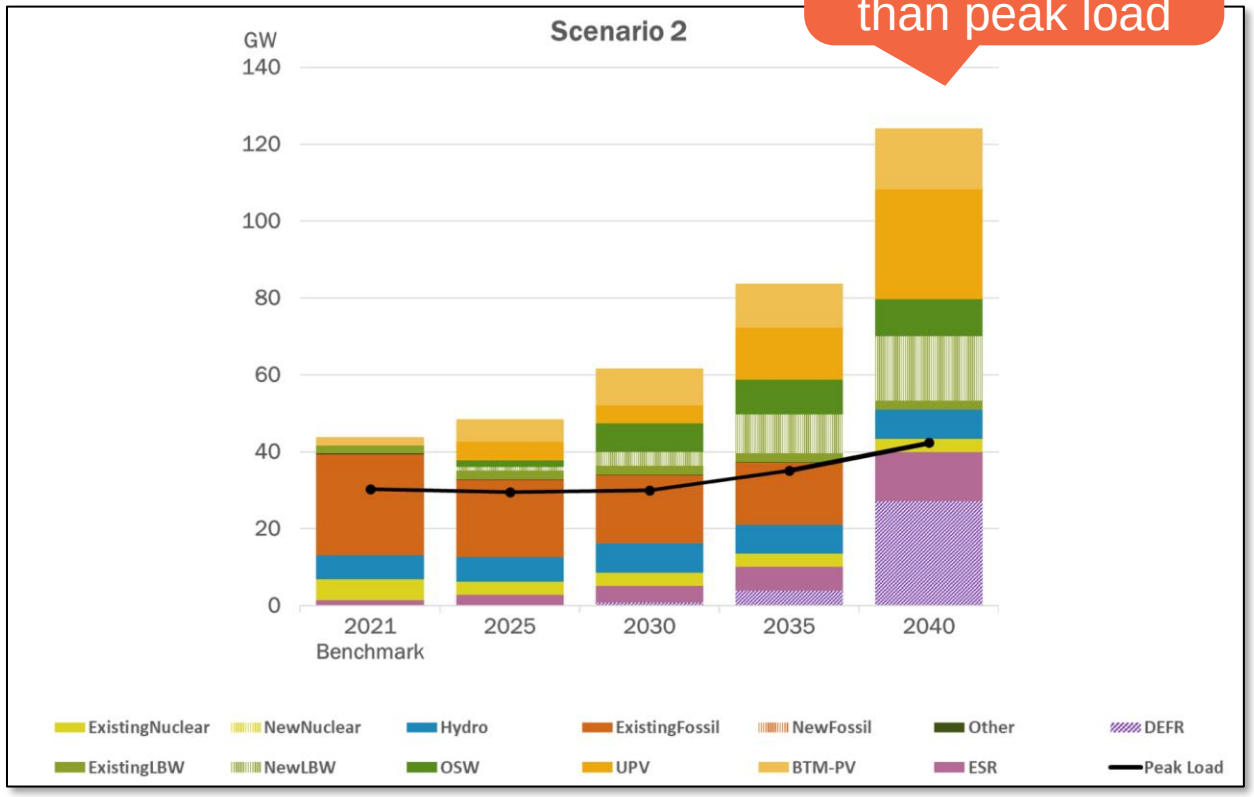
July 12, 2023

How do we expect the grid to evolve?

- Climate change is leading to goals for decarbonized electricity systems and electrification of other energy sectors.
- Cheap wind and solar mean that these resources will likely dominate the decarbonization of electricity systems.
  - We'll need more flexibility from the grid to integrate the wind/solar.
  - Systems will need to be 'overbuilt' in terms of MW capacity compared to peak load

NYISO - Zero electricity emissions by 2040

MW capacity is much higher than peak load

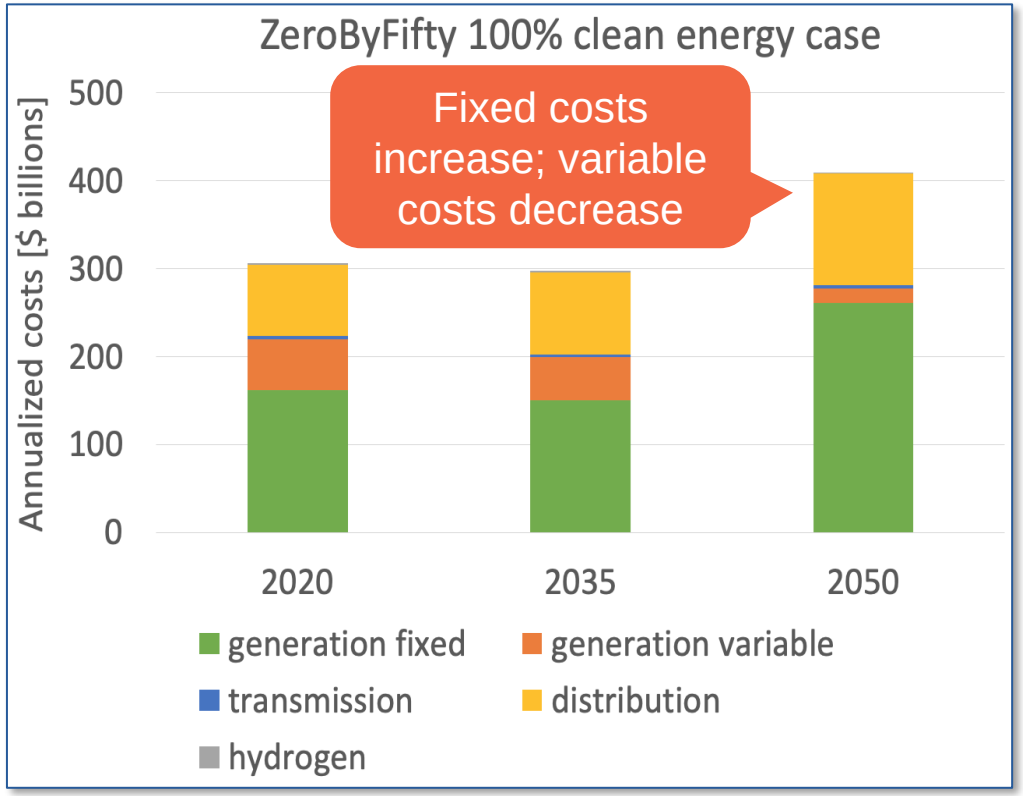


NYISO Outlook 2021-2040

How do we expect the grid to evolve? (cont.)

- We'll need more transmission infrastructure partly to connect these resources and partly to provide geographic diversity for this weather-dominant system.
- We'll need more distribution infrastructure partly because high electrification and distributed solar will stress distribution systems, and partly to access demand flexibility.

- This system would have higher fixed costs (G&T&D) and lower variable costs than today.
- Intervals of high real-time prices and intervals of low real-time prices would increase.

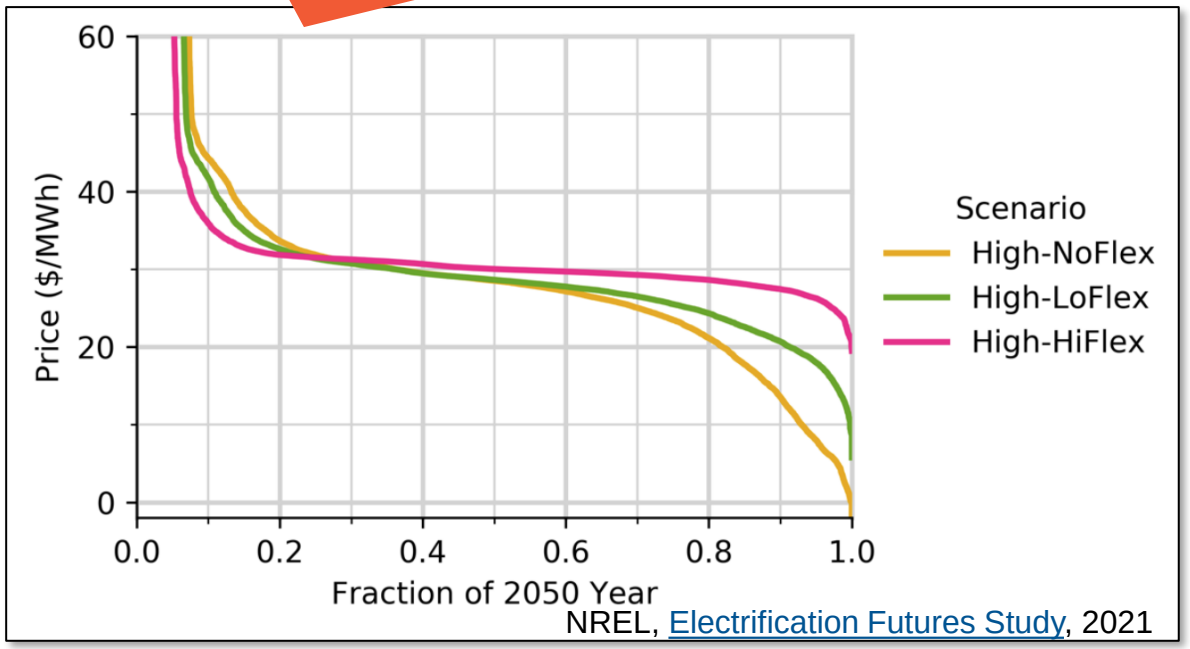


Data from Clack, VCE, ZeroByFifty Study, 2021

Why is retail pricing so important today?

- Variable renewables increase the need for flexibility to balance the system and for resource adequacy. Responsive demand is one source of flexibility, and competes with thermal generation, hydro, storage. Retail pricing can act like a grid resource.
- Electrification of buildings, transportation and industry increases the flexible demand potential.
- We have enabling technologies today: automated control and communications that allows us to manage demand.
- Electrification may stress grid infrastructure, especially distribution systems.

Demand flexibility takes a high renewables price duration curve and makes it look like a low renewables curve



NREL, Electrification Futures Study, 2021

ESIG convened a task force of experts with rate-making, grid, and customer perspectives to examine options and solutions

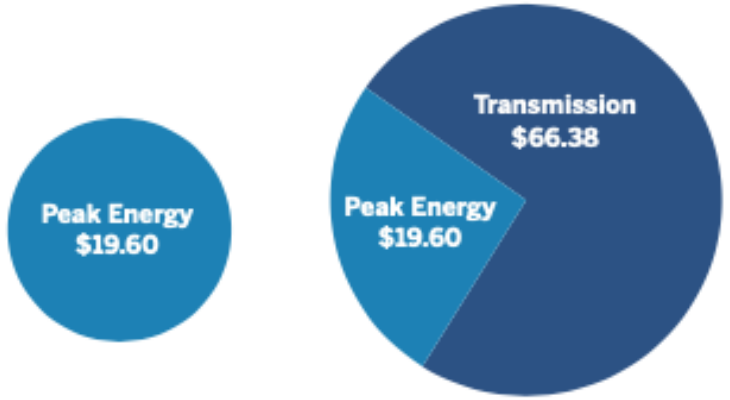
Seven whitepapers discuss options

- *Why is the smart grid so dumb? Missing Incentives in Regulatory Policy for an Active Demand Side in the Electricity Sector.* Travis Kavulla of NRG on regulatory changes so that load-serving entities are incentivized to reduce costs of supply and customers are exposed to prices that reflect cost causation.
- *Treating Demand Equivalent to Supply in Wholesale Markets: An Opportunity for Customer, Market and Social Benefits.* Dick O'Neill of DOE on customers submitting price bids into wholesale markets and being exposed to wholesale prices to incent flexibility.
- *Rate Design for the Energy Transition: Getting the Most out of Flexible Loads on a Changing Grid.* Arne Olson and the E3 team on the need for multi-part rates potentially including income-dependent fixed charges .
- *Heat Pump-Friendly Cost-Based Rate Designs* Sanem Sergici and the Brattle team on rate design that can encourage rather than discourage electrification, using heat pumps as a case study.
- *APS Customer-centric approach to achieve 100% clean energy* Tom Hines and the Tierra Resource Consultants/APS team on APS' experience orchestrating demand through pricing plus DER programs.
- *Tapping the Mother Lode: Employing Price-Responsive Demand to Reduce the Investment Challenge.* Mike Hogan of RAP on embedding demand curves in long-term investment instruments and planning.
- *Leveraging Locational and Temporal Flexibility in Transportation Electrification to Benefit Power Systems.* Jennie Chen of WRI on siting EV charging for both transportation needs as well as good electricity prices.

https://www.esig.energy/aligning-retail-pricing-with-grid-needs/

Some key points from the whitepapers

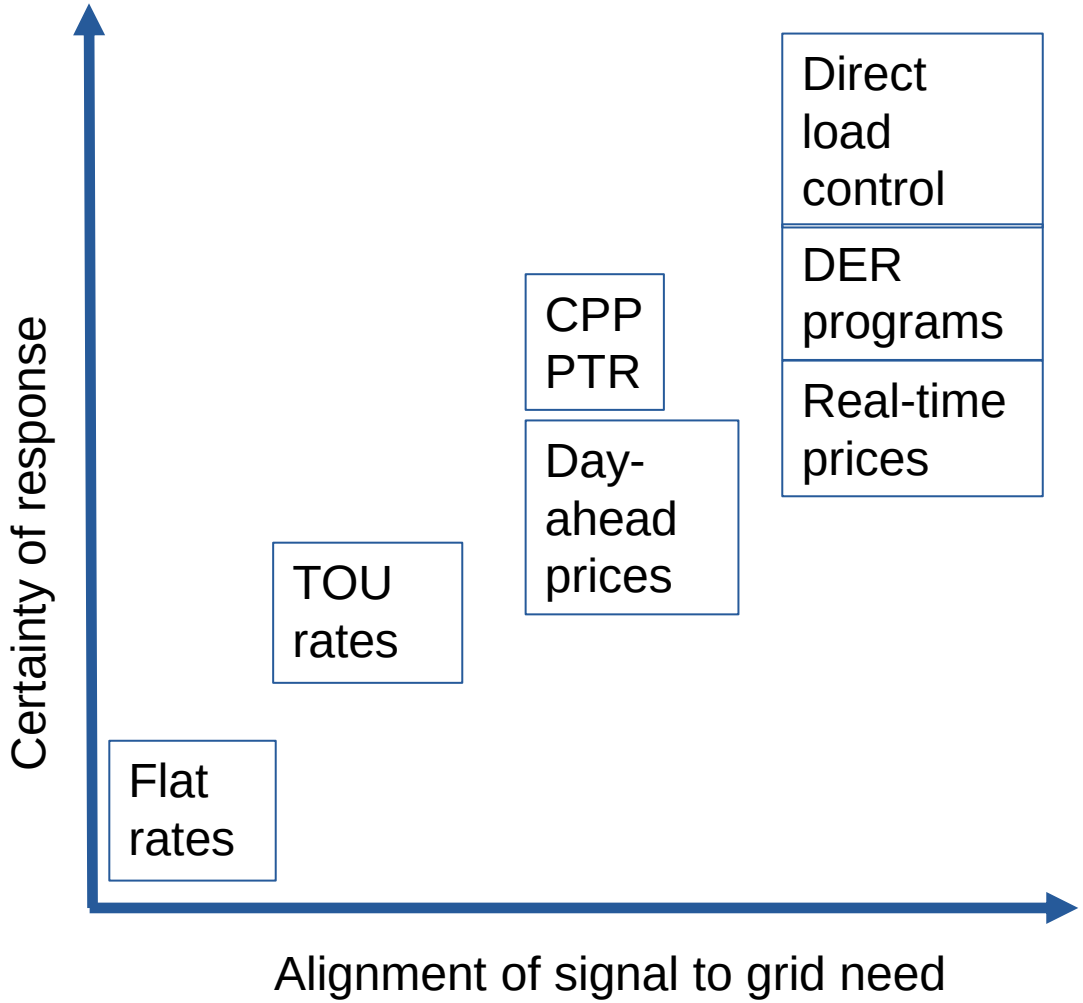
- The future requires flexibility. If you only consider flexibility from generation you are missing half of the equation.
- Wholesale market prices reflect grid needs, while retail prices generally do not.
- If we want demand flexibility, we need to expose customers/retailers/load serving entities to price signals that better reflect cost causation and grid needs.
- Price signals include energy but also capacity, transmission, and *distribution*.
- Alternative cost-based rates can help customers electrify without increasing overall bills and without subsidies.
- Rates that are defined years in advance cannot reflect real-time grid conditions.
- Pricing and programs can be complementary.
- We need to start treating demand as demand rather than treating reduced demand as supply.
- Customers are not monolithic. They need options.
- Better retail pricing can reduce total system costs that are ultimately borne by ratepayers.



Kavulla, Why Is the Smart Grid So Dumb? 2023

Evolution of retail pricing to support variable renewable integration and electrification

- Time: how dynamic should prices be? More dynamic prices can support real-time grid needs
- Space: how locational prices be?
- Magnitude: how strong should the price signal be?
- Certainty/reliability/predictability of response – some grid needs require *very reliable* responses
- Fixed vs demand vs volumetric charges – how cost of service is recovered is critical to whether electrification is penalized



This graphic is illustrative. Rankings would depend on details such as prices, override rules, number of calls, etc.

What's in the future?

- Bid-in demand for large customers that can manage their load: customer submits a price curve to ISO and receives a day-ahead schedule; customer can bid into real-time market and be dispatched to 5 minute setpoints, within customer constraints.
  - If all customers did this, we wouldn't need capacity obligations.
  - Customers are only dispatched/scheduled to their "willingness to pay"
  - No baselining needed. Customers pay for what they use.
  - Dispatching load can make it easier for system operators to balance the system.
  - ERCOT does this today with their Controllable Load Resources
- Distribution pricing
  - With an active distribution network, we may need pricing (such as DLMPs) to manage congestion.
  - Even just a price or a signal for critical peak events on the distribution system can help reduce the need for upgrades. Pilots are underway (PGE, Xcel). A utility that already had CPP/PTR to manage bulk power system peaks could add local distribution events to those customers at that location.
- Denmark has been managing high electricity prices (due to the war) with real time pricing; retailers and apps provide pricing information and can schedule appliances

Image by brgfx on Freepik; Image from Min Strom

THANK YOU

Debra Lew

Debbie@esig.energy

(303) 819-3470

Research & Academic Perspective

Research and Academia

Mark LeBel

Senior Associate

Regulatory Assistance Project (RAP)

July 12, 2023

Advancing Time-Varying Rates

Salt River Project Technical Working Session

Mark LeBel
Senior Associate

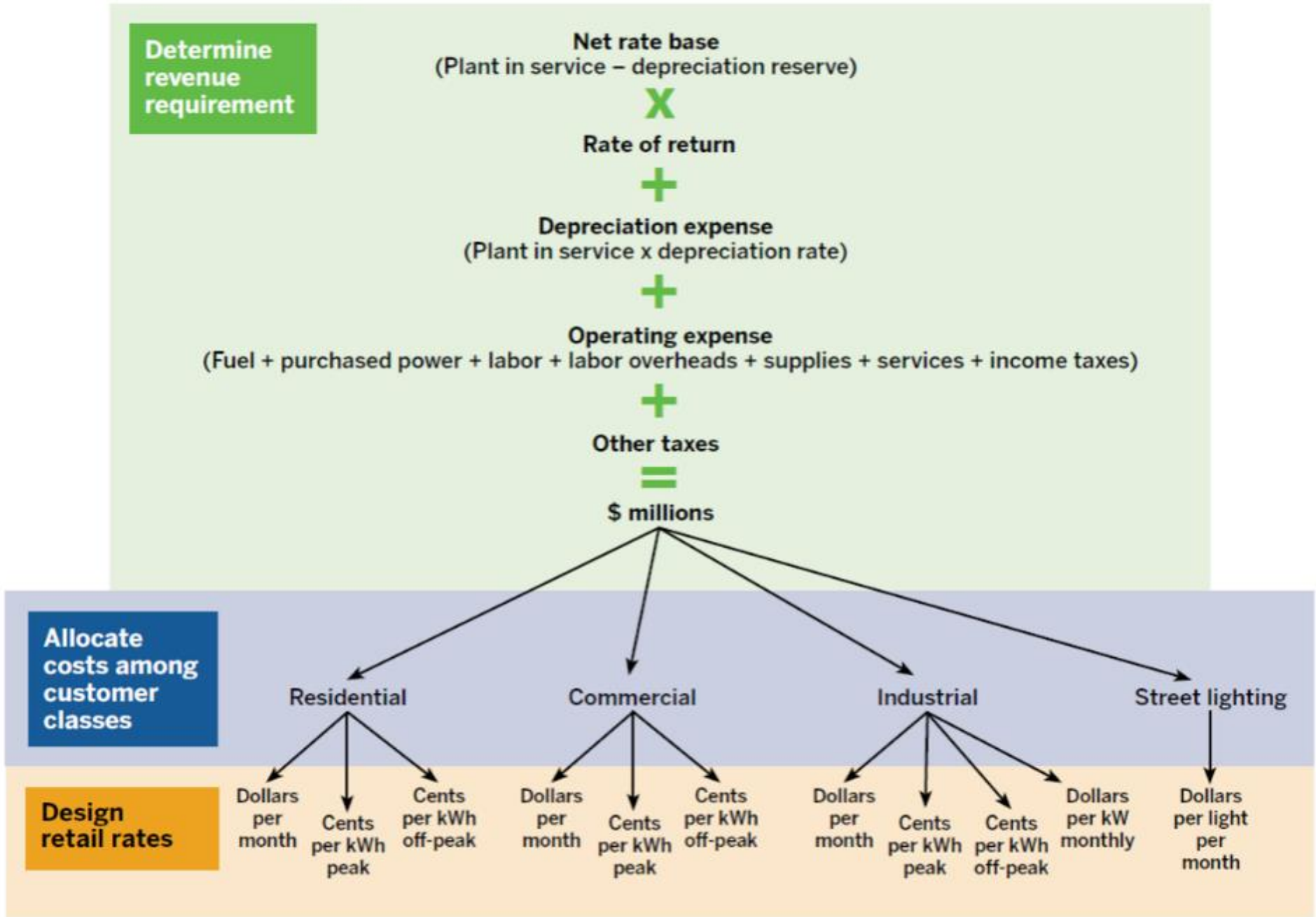
mlebel@raponline.org

1 Principles and Background

Goals and Principles for Ratemaking

- Public policy goals
  - Efficient competition and control of monopoly pricing
  - Reliable provision of service
  - Societal equity (e.g., universal access and affordability)
  - Environmental and public health requirements
- Principles for setting utility prices
  - Effective recovery of revenue requirement
  - Customer understanding, acceptance, and bill stability
  - Equitable allocation of costs
  - Efficient forward-looking price signals

Simplified rate-making process

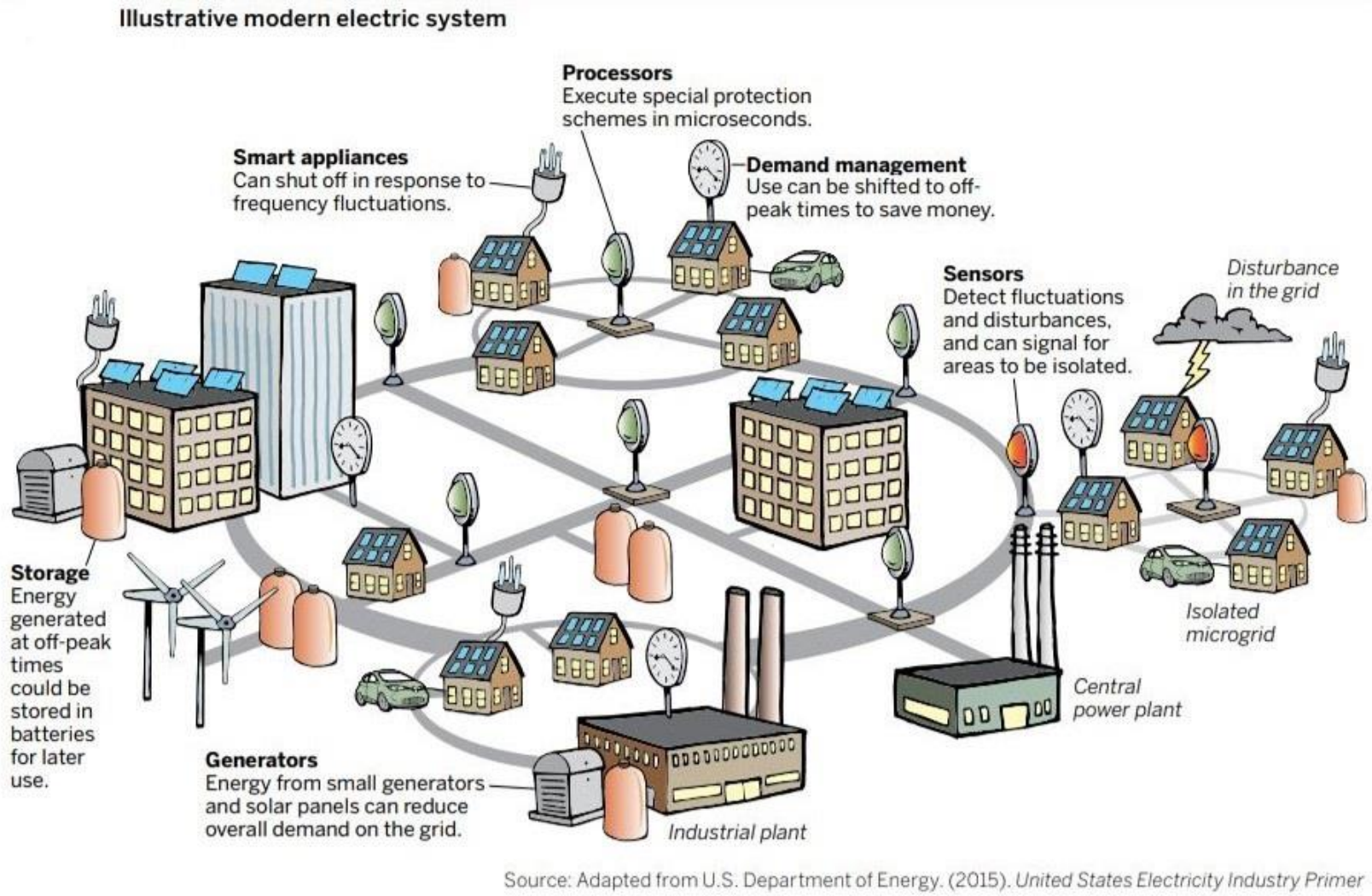


The Regulatory Prerequisite: Data

- Cost data
  - FERC Uniform System of Accounts
- Overall system load and generation data
- Location-specific T&D data have become more sophisticated
- Customer-specific data
  - Load sampling is no longer necessary with AMI

To Infinity and Beyond…

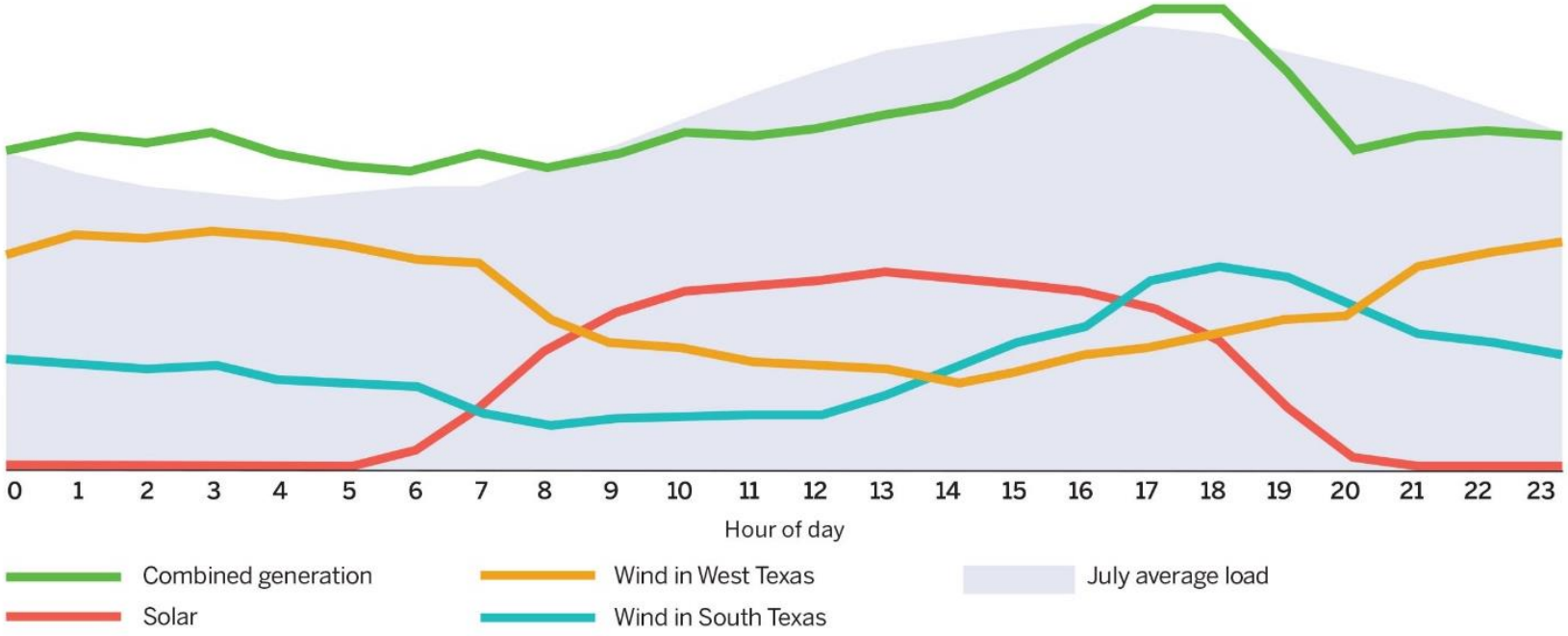
- Massive increases in computing power and data storage capabilities
- High penetrations of variable renewable resources change operation and economics of electric system
- Energy management technology becomes cheap and widespread
- Electrification of transportation and heating may increase load
- Continued cost declines for clean distributed generation and energy storage



Source: Adapted from U.S. Department of Energy. (2015). *United States Electricity Industry Primer*

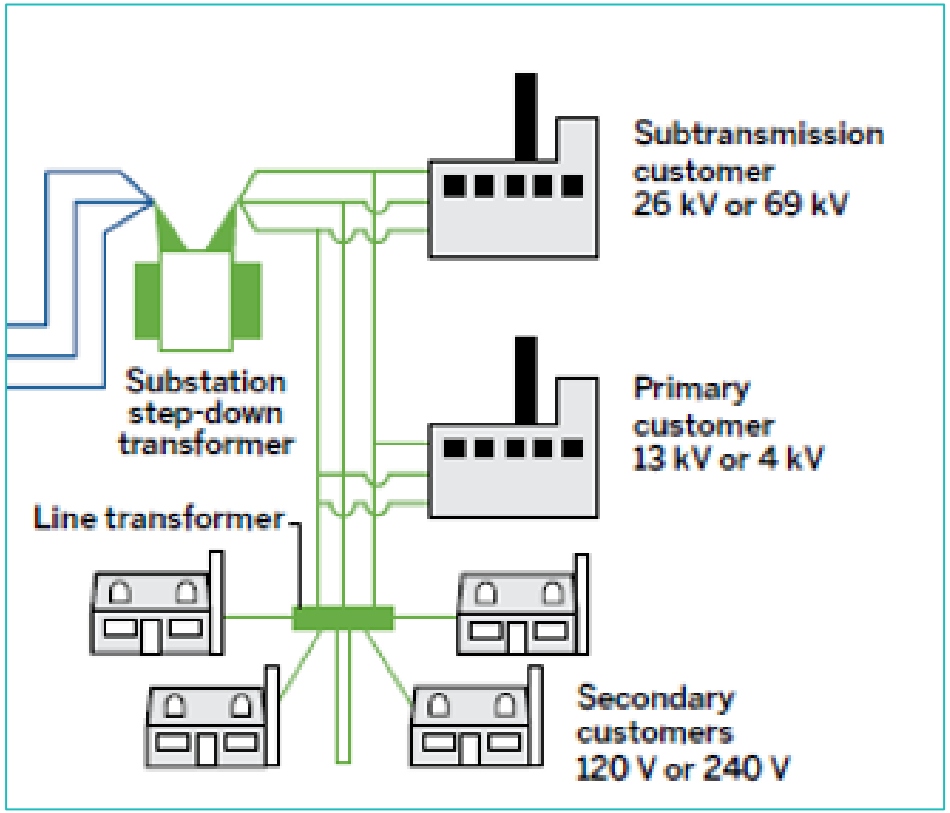
Decarbonized and decentralized!

Overall resource mix matters!



Sources: Adapted from Slusarewicz, J., and Cohan, D. (2018). *Assessing Solar and Wind Complementarity in Texas* [Licensed under http://creativecommons.org/licenses/by/4.0]. Load data from Electric Reliability Council of Texas. (2019). *2018 ERCOT Hourly Load Data*

Determining Customer Classes



Types:

Residential

- Single-Family
- Multi-Family
- Heating?
- Other distinctions?

Commercial

Industrial

Irrigation

Street Lighting

Cost Causation in General

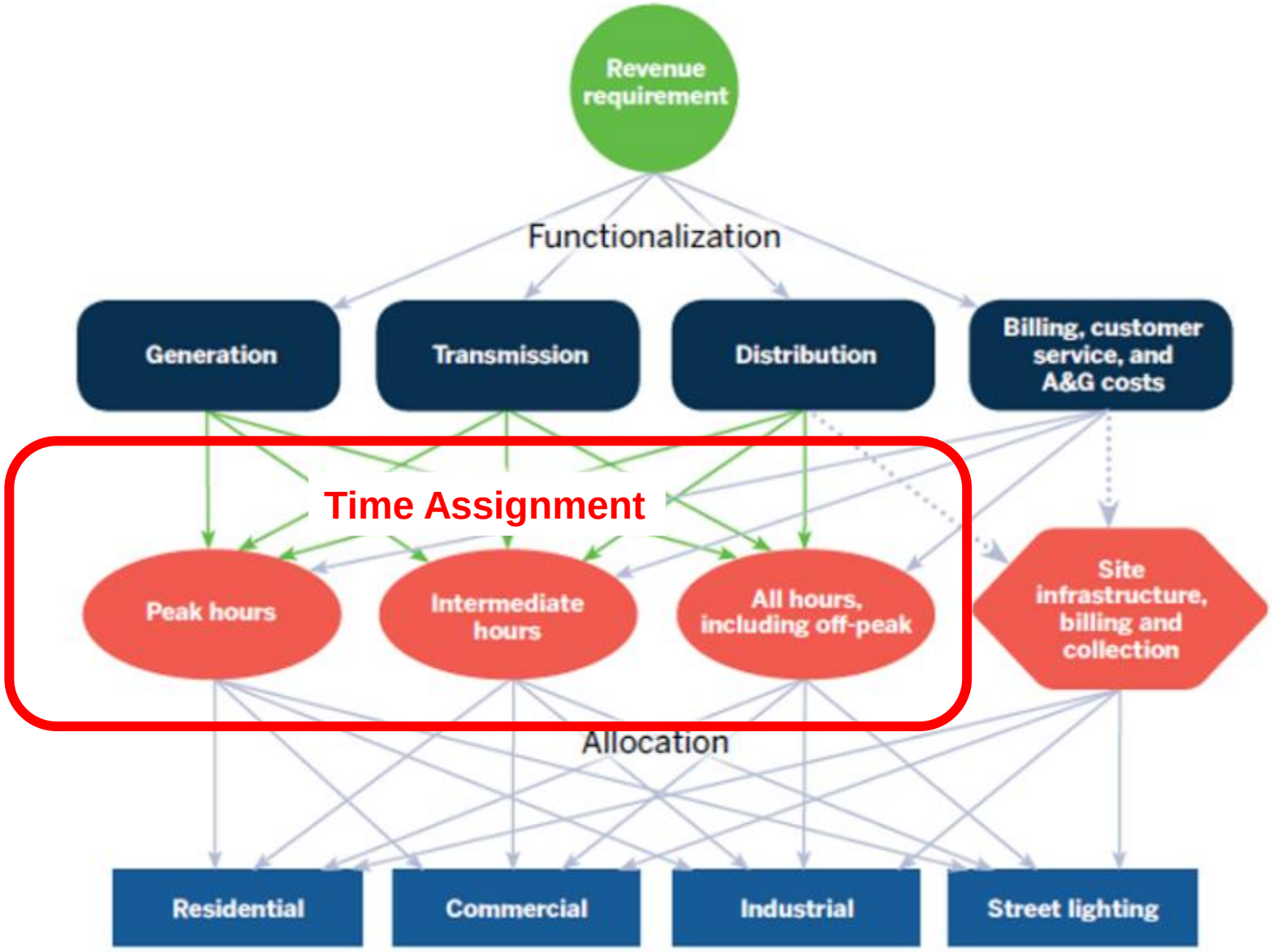
- Nearly every element of the electric system is driven by the shared requirements of many customers
  - Exceptions: basic meters, most service drops, some transformers
- Each function has distinct cost drivers
  - Fuel, spot energy and some contract purchase costs vary by time
  - Coincident peaks drive the amount of generation capacity, while year-round load patterns determines capacity mix and thus costs
  - Coincident peaks matter in T&D sizing, but line losses are another important consideration
- Tradeoffs exist between capital, labor, fuel, and other expenses

Technology and engineering matter!

Issues with Traditional Demand & Energy Classifications

- What is the proper split between demand and energy for capital assets?
- Demand at what hours?
  - System peak, equipment peak, or class peak?
  - Demand allocators typically only use a subset of the relevant hours
- Energy-classified costs are usually allocated using annual kWh usage
  - Fails to reflect time-varying energy costs

Modern embedded cost of service study flowchart



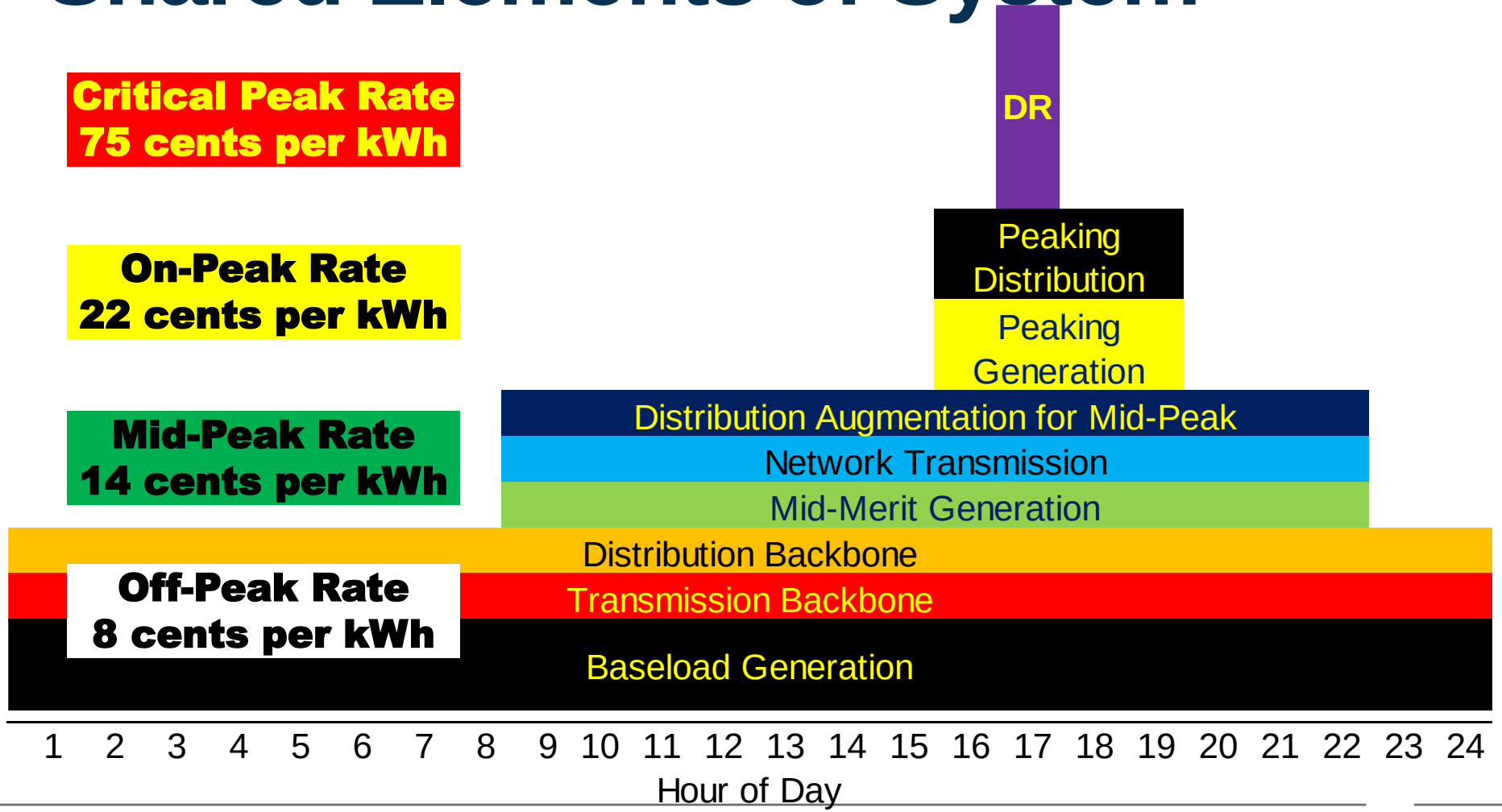
2 Rate Design

Smart Rate Design for Today

	Residential	Medium C&I
Customer charge ($/month)	$5	$100
Site infrastructure charge	Multifamily: $3/month Small single-family: $7/month Large single-family: $15/month	$2/kW
Off-peak (cents/kWh)	8 cents	7 cents
Mid-peak (cents/kWh)	14 cents	13 cents
On-peak (cents/kWh)	22 cents	21 cents
Critical peak (cents/kWh)	75 cents (peak-time rebate)	75 cents

Volumetric components reflect both import charges and export credits, which should be netted by TOU period

Build a Cost-Based TOU Rate for Shared Elements of System



TOU Design Parameters

- Goals of TOU rate design
  - Lower system costs
  - Improve cost causation basis of rates and intra-class cost allocation
  - Avoiding adverse impacts to revenue stability and individual customer bills
  - Keep rates understandable and allow customers to manage their bills
- Key design choices
  - Which customers?
  - What time patterns and seasonal distinctions?
  - Which costs?
  - How do you ensure customer understanding and minimize adverse bill impacts?

Designing TOU Periods

- Tradeoffs
  - Too narrow risks missing or shifting peak without reducing it
  - Too broad makes shifting load difficult for customers and penalizes those without movable load
  - Adding time periods tends to be more accurate, but more complex
- Options
  - Different peak periods for different rate classes
  - “Feathering” – allowing customers to choose between different 3-hour periods
    - E.g., 3 pm to 6 pm, 4 pm to 7 pm, 5 pm to 8 pm
  - Start simple but add complexity as customers gain understanding and technology improves

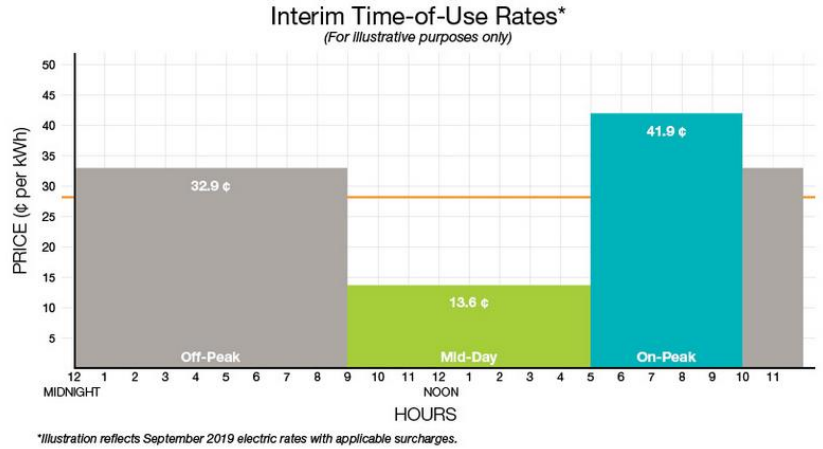
Understandability and Transitions

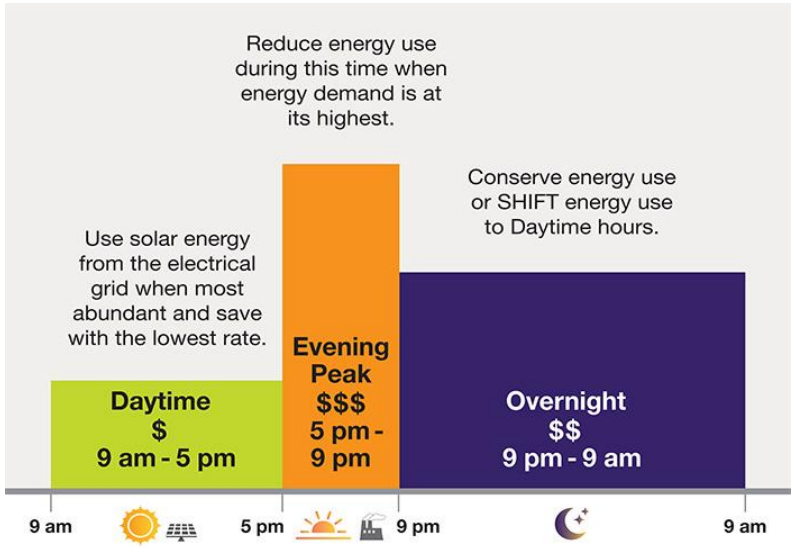
- Customers must be able to understand their rates and manage their bills
  - Basic explanations and educational materials
  - Data provision and online tools can help
- Gradual transitions can diffuse knowledge and help acceptance
  - Start with opt-in and move to opt-out or mandatory
  - Shadow billing and hold harmless protection
  - Segment customer classes with selective application of more complex rates
- Companion programs are important
  - Cost-effective energy management technology programs to enable customer response and minimize risk of negative bill impacts
  - Special low-income programs can be as simple as timers for electric water heaters offered for free

Burbank Municipal Power Optional TOU for EV Owners

Customer Charge ($/mo.)	$12.07	
Site Infrastructure ($/mo.)	Small: $1.70 Medium: $3.47 Large: $10.38	
	Non-Summer	Summer
Off-peak (cents/kWh)	11 cents	11 cents
Mid-peak (cents/kWh)	19 cents	19 cents
On-peak (cents/kWh)	N/A	29 cents

Hawaiian Electric TOU Structure





Oklahoma Gas & Electric: Variable Peak Pricing

Customer Charge ($/month)	$13.00

Off-Peak (cents/kWh)	3.27
On-Peak (cents/kWh)	
Low	3.60
Standard	8.50
High	19.70
Critical	41.60

3 Takeaways

Key Takeaways

- Electricity system of the future will be different than the past and regulatory innovations will be necessary to achieve optimal results
- Rate design and net metering reform will inevitably involve tradeoffs between key ratemaking principles and policy goals
- New analytical processes may be needed to guide substantive ratemaking reforms

The Virtues of Gradualism and Thinking Ahead

- “A stitch in time saves nine.”
  - Traditional proverb
- “Don’t panic. There will be plenty of time for that later!”
  - Gregg Easterbrook, NFL writer

Resources

- Electricity Regulation in the US: A Guide—Second Edition
- Smart Rate Design for a Smart Future
- Smart Rate Design for Distributed Energy Resources
- Smart Nonresidential Rate Design for a Smart Future
- Electric Cost Allocation for a New Era: A Manual

- raponline.org

About RAP

The Regulatory Assistance Project (RAP)® is an independent, non-partisan, non-governmental organization dedicated to accelerating the transition to a clean, reliable, and efficient energy future.

Learn more about our work at raponline.org

Mark LeBel
Senior Associate
The Regulatory Assistance Project (RAP)®

50 State Street, Suite 3
Montpelier, VT 05602
USA

802-498-0732
mlebel@raponline.org
raponline.org

Appendix

The 1992 NARUC Manual on Embedded Cost Methods

Typical cost classifications used in cost allocation studies are summarized below.

Typical Cost Function	Typical Cost Classification
Production	Demand Related Energy Related
Transmission	Demand Related Energy Related
Distribution	Demand Related Energy Related Customer Related

1992: NARUC Electric Utility Cost Allocation Manual, p. 21

What is “Customer-Related”?

- The marginal costs of adding a residential customer are relatively modest
  - Billing, simple metering for billing, service line in many cases, dedicated line transformer in a limited number of cases, and part of customer service
- Long line extensions are paid for by the customer

Minimum System Fallacy

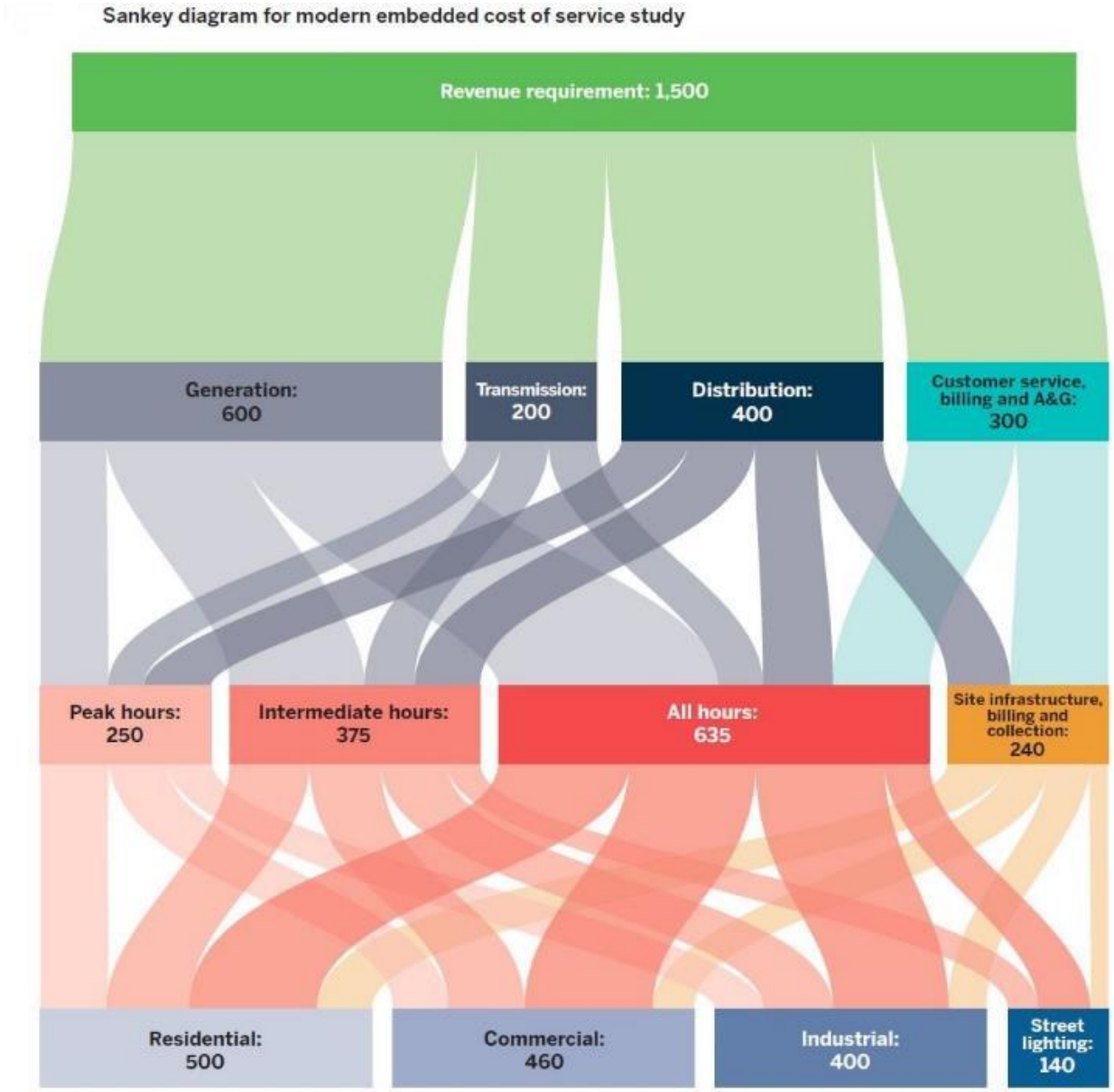
- Shared distribution system expenses, such as primary voltage wires, poles and substations, do not meaningfully depend on the number of customers
  - A building can be one big house or four condos.
- The cost of a “minimum system” does not vary with the number of customers, but rather area/miles spanned

Site Infrastructure Economics

- Shared service drops, secondary voltage lines and shared line transformers are sized for the combined peak of smaller groups of customers
  - Nearly impossible to allocate (or price) locationally, but class-specific tracking and using weighted averages can help
  - Significantly less load diversity than broadly shared elements of system
- For larger customers, dedicated service lines and dedicated line transformers are sized to the individual customer
  - May have diversity of usage behind the individual meter, but could plausibly be managed by the overarching entity

Fixed v. Variable Example

- Multiple ways to serve an increase in peak demand
  - Peaker – mix of fixed and variable costs
  - Utility-owned battery storage – almost entirely fixed costs
  - Demand response – primarily variable expenses


Sankey diagram for modern embedded cost of service study
Revenue requirement: 1,500
Generation: 600
Transmission: 200
Distribution: 400
Customer service, billing and A&G: 300
Peak hours: 250
Intermediate hours: 375
All hours: 635
Site infrastructure, billing and collection: 240
Residential: 500
Commercial: 460
Industrial: 400
Street lighting: 140

Burbank Water and Power – Tiered Service Size Charges

- Customer Service Charge - $12.07/month
- Service Size Charge
  - Small - $1.70/month
    - Two or more meters per service line
  - Medium - $3.47/month
    - Panel size <= 200 amps
  - Large - $10.38/month
    - Panel size > 200 amps

Nevada Power Residential Customer Classes

- Residential Multi-Family – separately metered in a permanent single-family dwelling in a multi-unit complex (like an apartment)
  - Monthly customer charge of $7.70
- Residential Single-Family – separately metered in a permanent single-family dwelling
  - Monthly customer charge of $12.50
- Large Residential Service – three-phase service to a separately metered, permanent, single-family dwelling
  - Monthly customer charge of $70.70

Regulatory Perspective

Regulatory

Paul Phillips

Supervisor, Electric Rates
Energy Division

California Public Utilities Commission California (CPUC)

California Public Utilities Commission

Salt River Project
Technical Working Session
July 12, 2023

California TOU Rates and Pricing Designs for the Grid of the Future

Paul Phillips
Energy Division | California Public Utilities Commission

Overview of California Electric Rates and Affordability: "A Tale of Two States"

- **Residential Rate Challenge: Up to 40% of Californians are experiencing a range of affordability issues.**
  - NEM / DER customers tend to be disproportionately wealthier homeowners that can arbitrage advanced rate offerings and reduce bill impacts.
  - Our forecasts show rates rapidly outstripping inflation over the next decade.
- **Geographic Split Screen:**
  - Coastal, cooler to moderate climate zone, wealthier, higher EV / DER adoption versus:
  - Inland, hotter climate zones, higher wildfire threat, greater affordability issues.
- **Silver Linings, Not Silver Bullets:**
  - EV sales momentum + greater electrification should lead to lower household energy costs.
  - **A Flexible Unified Signal for Energy** (CalFUSE) aims to reform rates to create more value for all customers.

Household Energy Costs Are Projected to Increasingly Exceed Inflation Over the Next Decade

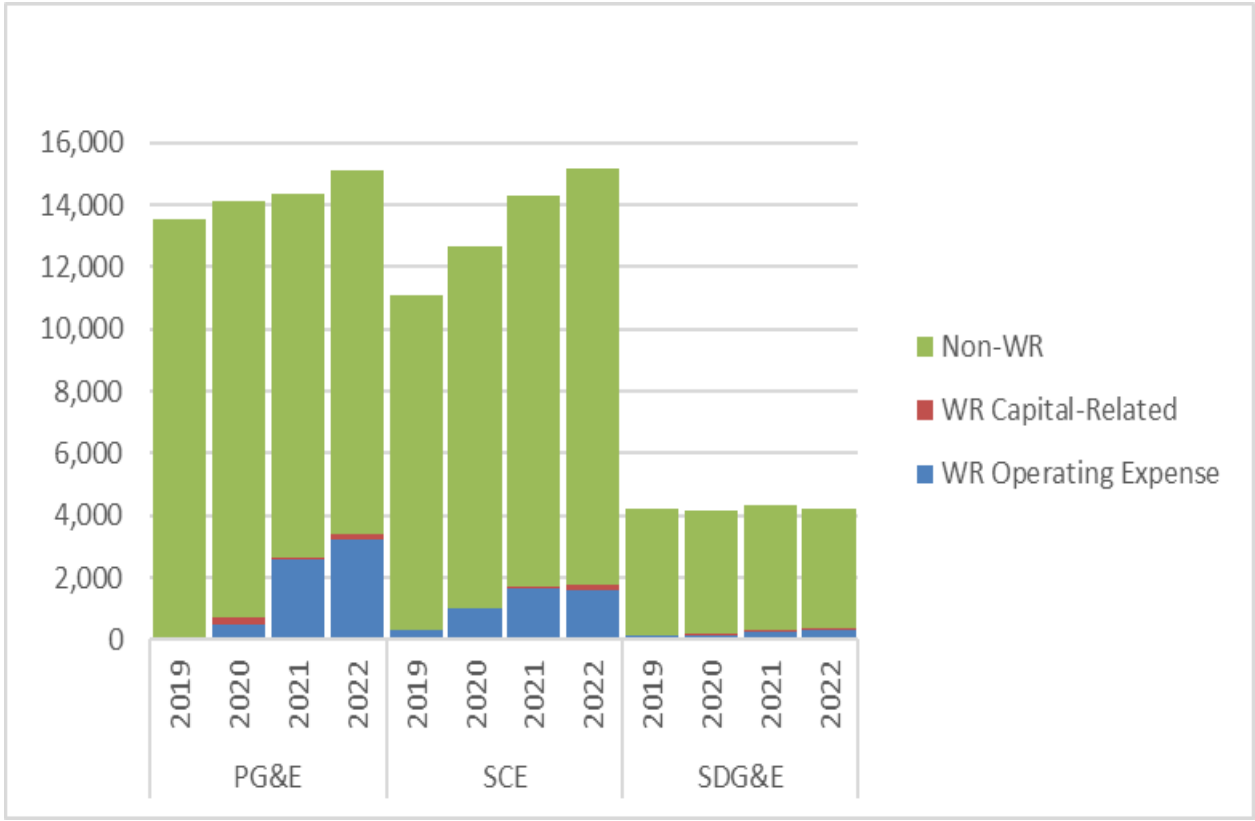
Main Cost Drivers

- **Wildfire related and transportation electrification capital expenses** are the current primary drivers of revenue requirement and rates.
- 23% of PG&E's regulated revenue requirement goes toward wildfire related expenses (2022).
- New Kevala Study: > $50 billion in costs needed to reach electrification goals by 2035.
- **Other factors:** kWh sales decline, behind-the-meter resources; load departure, economies of scale issues (SDG&E – sensitivity to big capital investments).

Silver Lining

- However, increased electrification and decreasing reliance on natural gas and gasoline should greatly increase load to offset climbing revenues.

Wildfire-Related (WR) Revenue Requirement
Relative to Total Revenue Requirement ($ millions)



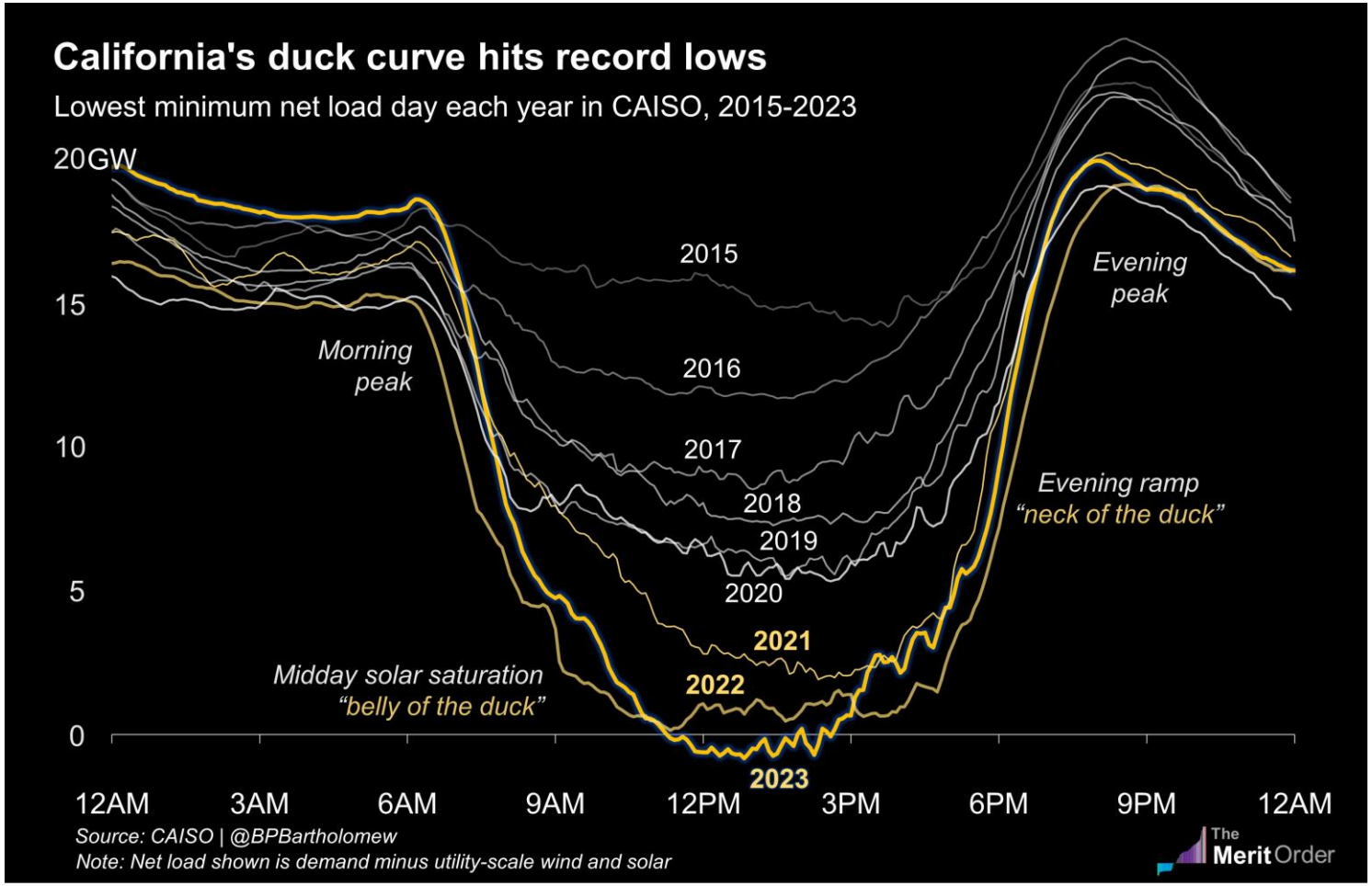
Curtailment and Evening Ramp Cost Trends Require Greater Precision and Efficiency in Electricity Pricing

Potential System Trends Ahead (2030):

- 60% increase in evening ramp anticipated.
- 15x increase in renewables curtailment
- Reliability and stability challenges both drive and are a result of cost-of-service distortions and pricing inefficiency.

Advanced TOU and CalFUSE as Key Tools:

- Integration of DR and advanced rate design is a more cost-effective approach to demand flexibility and electrification.
- Includes improved three-part TOU rates with stronger peak to off peak differentials and low statewide super off peak rates.
- Scalability of a more versatile integrated solution (CalFUSE) will depend on enrollment, technology availability and customer equity.



California IOU Default Residential TOU Schedules (Summer)

- Summer season rates (June through October), including baseline credit tier.
- SDG&E has the more complex and highest rates – Super Off Peak (SOP) should be extended to all IOUs.

		Weekdays			Weekends		
Utility		**8AM-4PM**	**4PM-9PM**	**9PM-8AM**	**8AM-4PM**	**4PM-9PM**	**9PM-8AM**
SCE	Above Baseline	37c	59c	37c	36c	52c	40c
	Baseline Credit	28c	50c	28c	27c	43c	31c
PG&E	Above Baseline	45c	53c	45c	45c	53c	45c
	Baseline Credit	36c	45c	36c	36c	45c	36c
		12AM-6AM	4PM-9PM	**2PM-4PM**	**12AM-2PM**	**4PM-9PM**	**2PM-4PM**
		10AM-2PM (Mar & Apr)		**9PM-12AM**			**9PM-12AM**
SDG&E	Above Baseline	35c	83.3c	52c	35c	83.3c	52c
	Baseline Credit	23.8c	71.6c	40.3c	23.8c	71.6c	40.3c

Peak
Off-Peak
Super Off-Peak

California's Path to Default Residential TOU and Equity Considerations

Past: A Cautious Approach to Residential TOU

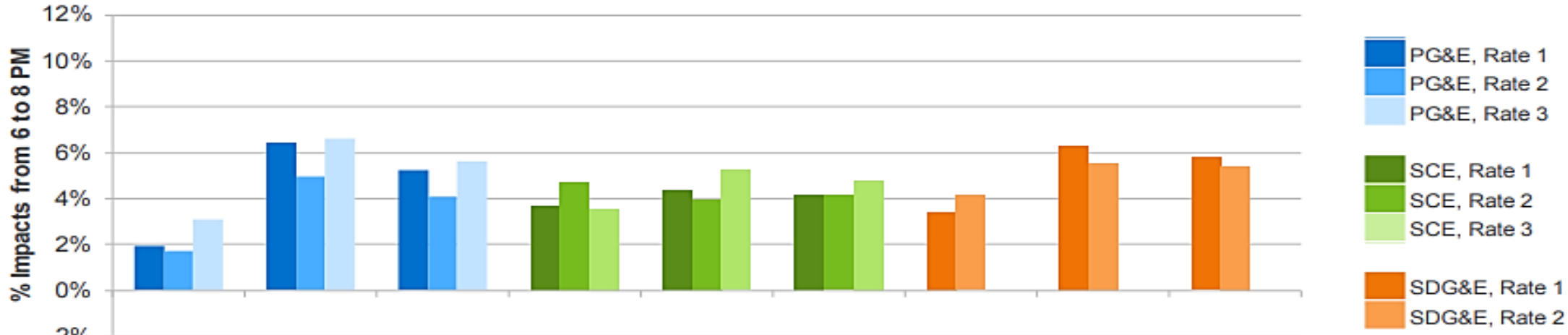
- **Default TOU with mild to moderate POPP differentials** backed by inclining optional block tiered rates.
- **Slow transition to TOU:** starting with inclining block tiered rate collapse / consolidation from 4 tiers to 2
- **Optional and Default Pilots (through 2019):** A period of study of load response, emphasis on protecting vulnerable customers in hotter climate zones.
- **One year of bill protection**, ability to opt out to two-tiered rate, targeted "hard to reach" customers.
- **Lengthy Marketing Education & Outreach (ME&O) Campaign**: statewide "air cover" + local IOU.
- **Leadership / Vision:** A larger "menu" of rates to address market segmentation and protections.
- **10 Rate Design Principles** including adherence to **cost causation** and heavy emphasis on simplicity and customer understanding.

Future: Less Conservatism, More Reliance on Tech and Successful TOU Experience

- **Opt-out and Optional CalFUSE Day ahead hourly RTP** backed by mandatory and default TOU with high POPP differentials + lower SOP to encourage electrification and mitigate curtailment.
- **Initial income graduated fixed charge (IGFC)** to reduce OP/SOP rates and increase POPP spread to maximize signal and load response.
- **CalFUSE subscriptions / hedges** to mitigate RTP risk and protect customers.
- **ME&O** + automation and third party **energy management service providers (EMSPs)**.
- **Leadership / Vision:** Streamlined menu of improved TOU and RTP designs.
- **Revamped Rate Design Principles and Demand Flexibility Principles** that stress equity, avoiding subsidies and cost shifts, CCA participation, etc.

TOU Rates Are A Successful Foundation for the Grid of the Future

- **Load Impact Study Results** on recently implemented TOU rates show moderate to significant load shift and bill impacts.
  - **Approximately 1.7% – 6.6% interior peak (6-8 pm) load shift for default residential below, but 1.2% to 7.7% from 4-9 pm.**
  - 14-20% for SCE TOU D-Prime for EV customers, 14.7% for SDG&E EV-TOU, and 9.4-16% for PG&E EV-TOU.
  - Massive multi-channel ME&O campaign statewide to "seed the ground" for reinforced understanding of time variant pricing.



		CARE	Non-CARE	All	CARE	Non-CARE	All	CARE	Non-CARE	All
		PG&E			SCE			SDG&E		
		Territory Wide								
Rate 1	% Impact	2.0%	6.5%	5.2%	3.7%	4.4%	4.2%	3.4%	6.3%	5.8%
	kW Impact	0.02	0.07	0.06	0.04	0.06	0.05	0.02	0.05	0.05
Rate 2	% Impact	1.7%	5.0%	4.1%	4.7%	4.0%	4.2%	4.1%	5.6%	5.4%
	kW Impact	0.02	0.06	0.05	0.05	0.05	0.05	0.03	0.05	0.04
Rate 3	% Impact	3.1%	6.6%	5.6%	3.5%	5.2%	4.8%			
	kW Impact	0.03	0.07	0.06	0.04	0.07	0.06			

Evolution of Pricing Strategies to Support Reliability, Electrification, and Demand Flexibility

Demand Flexibility Rulemaking: Summary of Scope and Goals

General Scope

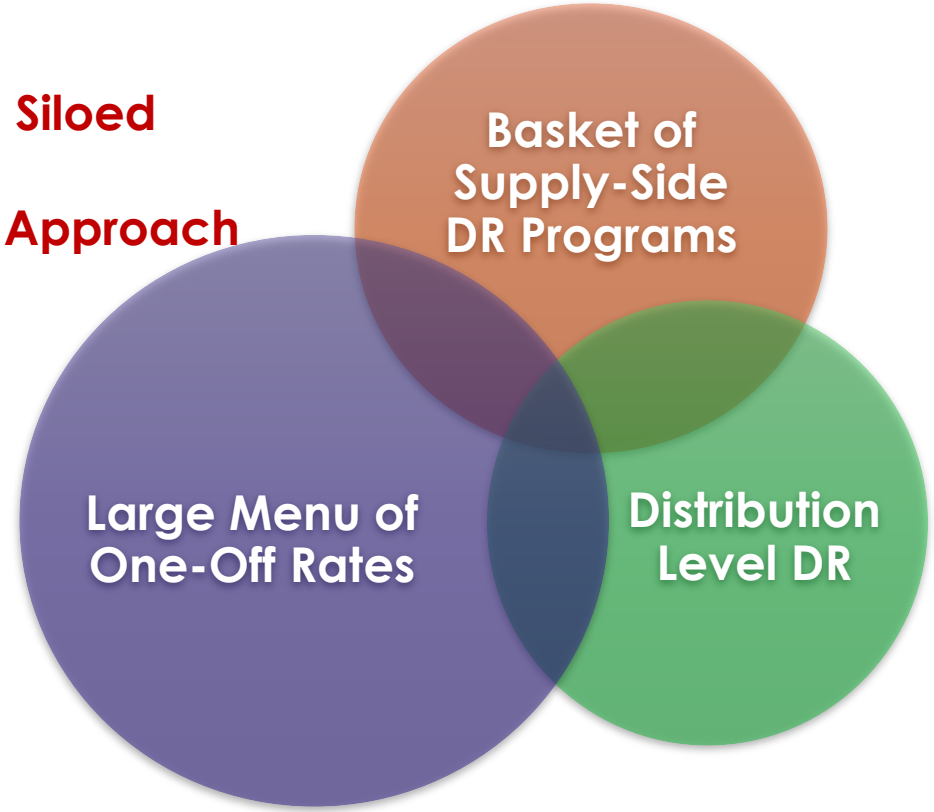
- **Phase 1, Track A: Income Graduated Fixed Charges**
  - Timeline: Now – Q4, 2023
- **Phase 1, Track B**: Demand Flexibility Principles, Guidance, and Systems for Large IOUs
  - Two Working Groups that meet weekly
  - Timeline: Q1 2023 – Q1, 2024
- **Phase 2: Demand Flexibility Implementation**
  - Timeline: Q2 2024 – TBD

High Level Goals

1. Develop policies to achieve widespread customer adoption of automated demand flexibility solutions throughout the state.
2. Ensure IOUs comply with CEC's adopted **Load Management Standards** for hourly, cost-based rates.
3. Implement a streamlined set of advanced TOU designs as base rates (eliminate tiered rates) plus opt-out RTP systemwide.

Why CalFUSE over the Status Quo?

Status Quo: Siloed and Piecemeal Approach



Innovation: Integration, Automation, TOU, RTP and Equitable DER Compensation

California Flexible Unified Signal for Energy (CalFUSE)

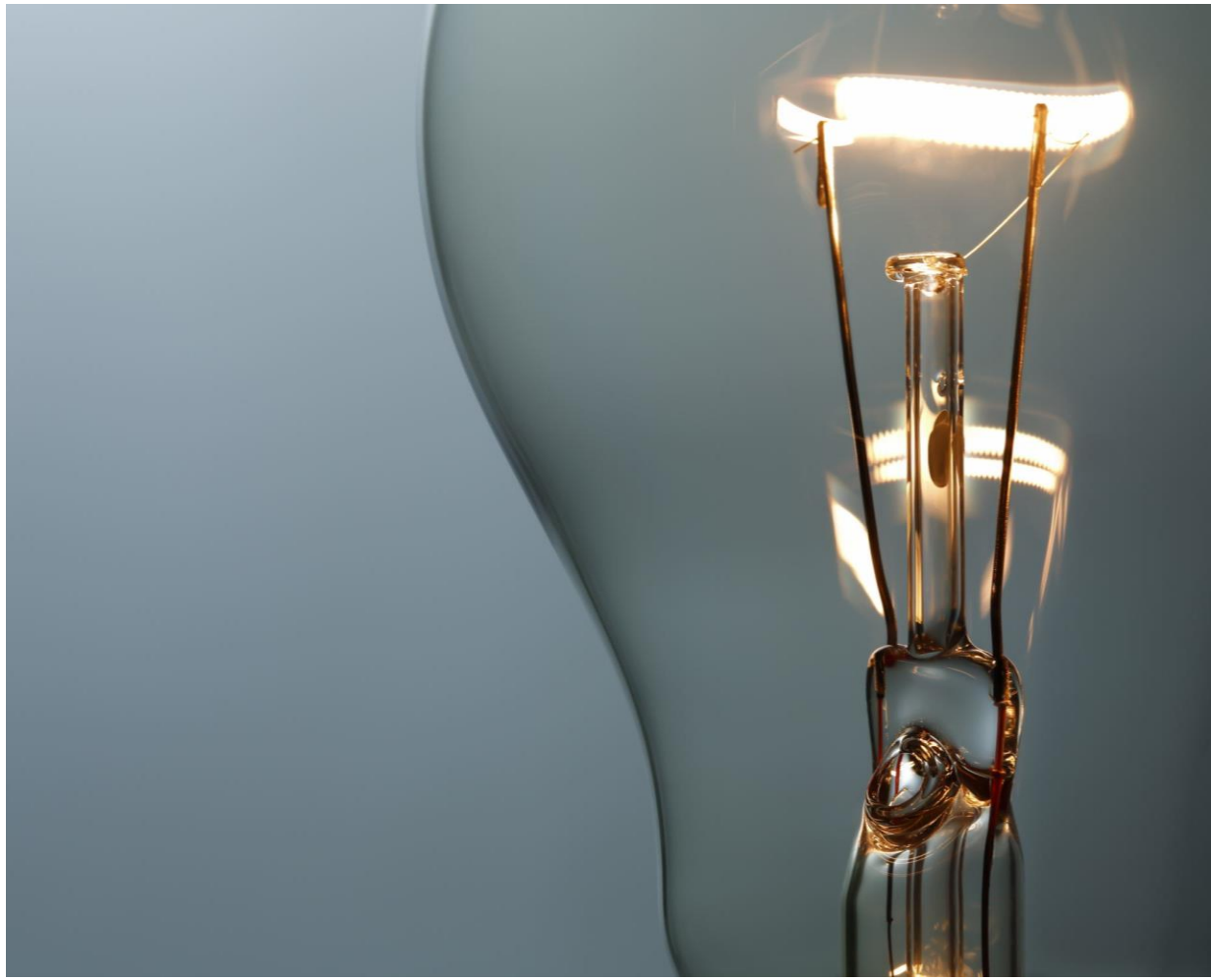
- ➔ Complex, inefficient, expensive, somewhat confusing
- ➔ Difficult to scale, limited adoption, obsolescence
- ➔ High cost of controls and automation
- ➔ Experimental one-off tariff and program designs

- ➔ Reduced complexity, single point focus
- ➔ Highly scalable, widespread adoption
- ➔ Reduced cost of controls, automation, tech growth
- ➔ Consolidation of TOU to RTP, pricing optimization

Current Siloed and Piecemeal Rate Design Strategies Are Insufficient to Meet Future Grid Challenges

- **Consolidation of Multiplicity of Time-Variant Rates**
  - Increasing number of special purpose IOU rates: TOU, CPP, EV, SGIP GHG signals
  - Increasing number of CCAs and rate designs, retail landscape complexity
  - Lengthy and administratively complex ratemaking process, black box settlements (with predictable outcomes for a handful of stakeholders).

- **Widespread Hourly RTP Will Improve Capacity Utilization and Lower Costs**
  - Ongoing auditing of efficiencies and load factors
  - Granular evaluation of avoided distribution and transmission marginal versus average costs
  - Customers from large commercial to residential are leaving prosumer surplus on the table due to inefficiently designed rates.
  - Narrowing the gap between retail & wholesale rates.



Is RTP in Fact Superior to TOU in Realizing Greater Demand Flexibility and Cost Savings?

Domestic Example: ComEd / Ameren (Illinois) RTP Case:

- ComEd customers on the utility's default, flat-rate supply price as a whole paid, on average, over 13 percent more than they would have on real-time pricing.
- 97 percent of smart meter customers would have saved money if they were participating in the Hourly Pricing program, regardless of income groups.

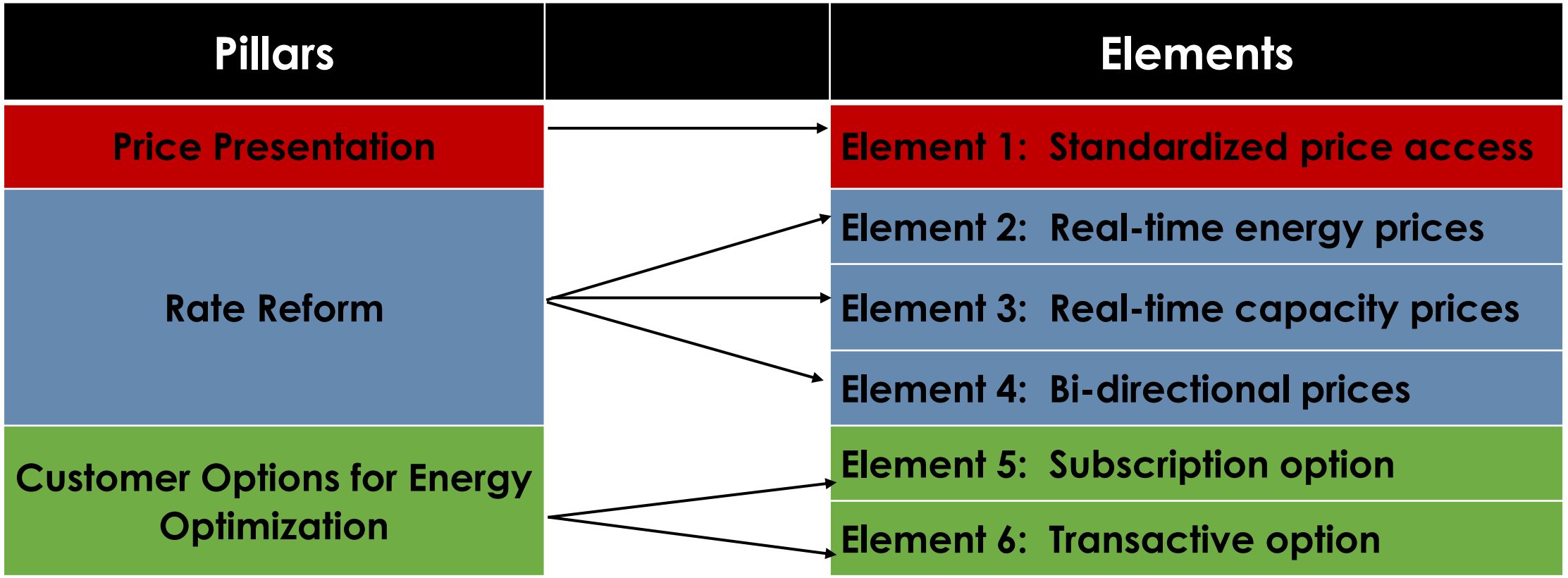
Key Caveats:

1. **Load shapes and demand elasticities matter:** peakier residential customers won't perform as well without behavioral change.
2. **Geography matters:** rural, less dense areas need further testing.
3. **If we build it, will they come**? Cost-based optional rates that are cost-based and aren't "promotional" in nature (e.g., elimination of demand charges) can be slower in uptake and lacking equity in participation.

➢ Overall, RTP studies and simulations across jurisdictions (including Georgia, Oklahoma, and internationally) are clear that hourly pricing is superior to TOU pricing – by a large magnitude, in some cases.

The Road Ahead:
A CalFUSE Conceptual Framework

Broad Conceptual Elements of the CalFUSE Framework



Income Graduated Fixed Charges and Assembly Bill 205 Provisions

- Removes the prior cap of $10/month on fixed charges in default residential rates
- Allows CPUC to authorize fixed charges in residential rates such that:
  - Fixed charges are income-graduated with a minimum of three income thresholds
  - Resulting bills for low-income ratepayers in each baseline territory must be lower without any changes in usage
- CPUC must authorize an income-graduated fixed charge (IGFC) for default residential rates by July 2024 (IOUs to submit applications for default rates that include an IGFC by that date).
  - Allows recovery of public purpose program non-bypassable charges through fixed charge.
  - Adjusts definition of CARE effective discount such that CARE-exempt charges are incremental to the discount.

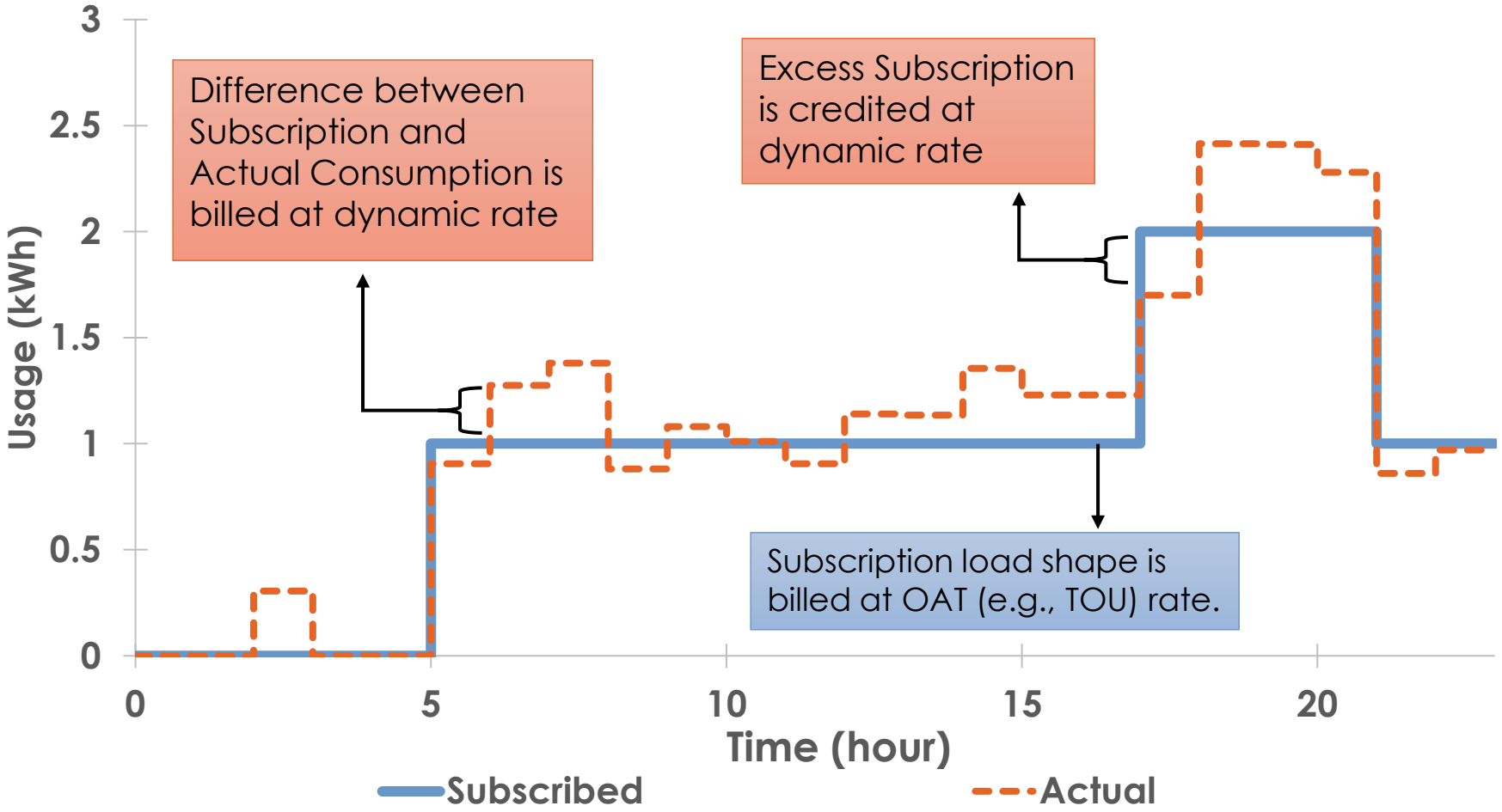
Benefits: Equity and alleviation of volumetric rate pressure and cost shift issues (NEM) on lower income customers.

Challenges:

- Income verification methods are limited and a more sophisticated system that doesn't involve IOU verification will take time. Political issues loom in the near term as well.
- Significantly large fixed charge is needed to make a sizeable reduction in volumetric rates, which may be challenging given that CA IOU rates currently do not feature any fixed charges.
- IGFCs that are too large could partially compromise the capacity utilization and cost savings purpose of RTP.

Another Customer Protection: Baseline Subscription as a Hedge

Historic Load Shape & Energy Quantity at OAT Price



- Stabilizing Element (Hedge) for Customers and Utilities.
- Ongoing shadow bill with the ability to improve "billing position" over previous tariff.
- A form of "paying for your load shape" in advance.
- Georgia Power has long used customer baseline subscriptions w/optional RTP.
- Options for subscriptions shape include:
  - Customer-specific,
  - class-averaged,
  - climate-zone weighted.

CalFUSE Framework and the Transactive Platform Layer

Transactive System

Statewide Web-based Price Portal

https://MyElectricityPrice.com

John Doe
Address
Account #

← P_{1PM} P_{2PM} P_{3PM} P_{4PM} ….
- **Hourly, [15 min„ 5 min]**
- **Next day, 24 x hourly**
- Week-ahead, 7x24 x hourly
- Additional forward prices…

1. Import / Export @ Current Price
2. Fixed Price Subscriptions
3. **Forward Buy/Sell Contracts**

Price Machine
Σ

Third Party Energy Mgmt Service Providers (EMSPs)

LOGIN

Real-time Grid Conditions
x = Circuit Aggregate Load
y = LSE Aggregate Load
z = LSE Net Load Ramp

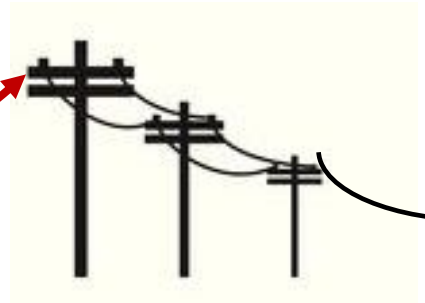
UDC
$P_{Distribution}$ = f(x)

LSE
$P_{RA\ Capacity}$ = g(y)

LSE
$P_{Flex\ RA}$ = h(z)

California ISO

LMP



For More Information:

- Staff Proposal on CalFUSE Framework
- Demand Flexibility Rulemaking

Contact: paul.phillips@cpuc.ca.gov

Utility Perspective

Utility

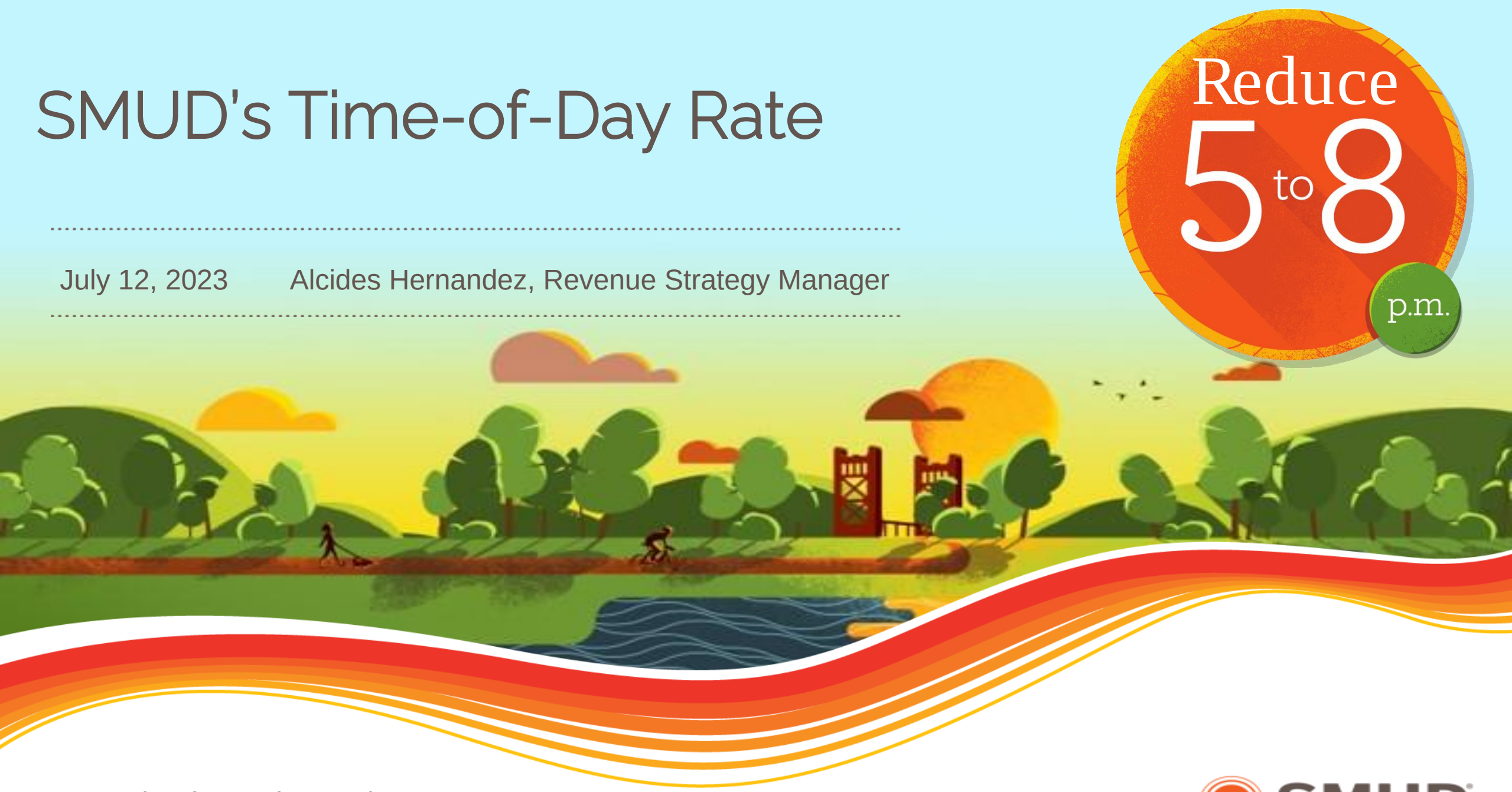
Alcides Hernandez

Revenue Strategy Manager

Sacramento Municipal Utility District (SMUD)

SMUD's Time-of-Day Rate

July 12, 2023 Alcides Hernandez, Revenue Strategy Manager



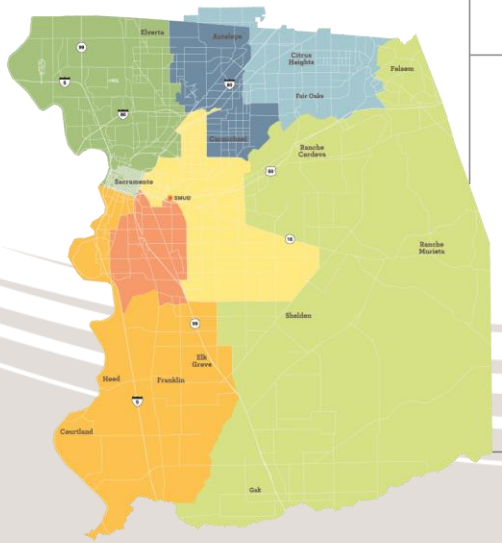
Powering forward. Together.

SMUD

About SMUD

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

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



75+ Years
Est. 1946

Power mix that's on average about **50%** **carbon-free**

100%
Zero carbon by 2030

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

~645,000 Customers

~2,300 Employees

7 member
Elected Board of Directors

Rates among the lowest in CA. On average **47%** lower than PG&E

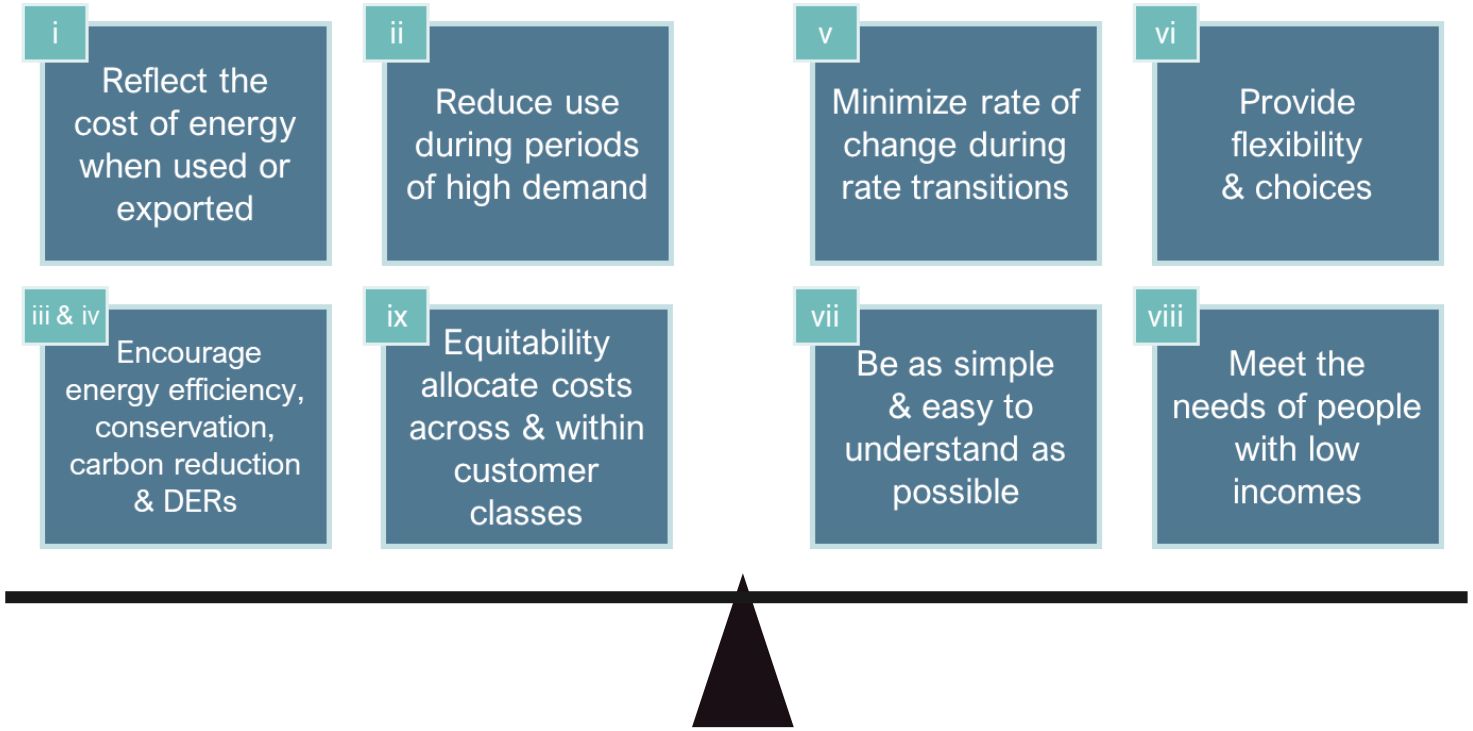
CleanPowerCity.org

* In 2020, SMUD's power supply was more than 60% carbon free. SMUD has a goal to reach zero carbon in its electricity production by 2030.

SMUD®

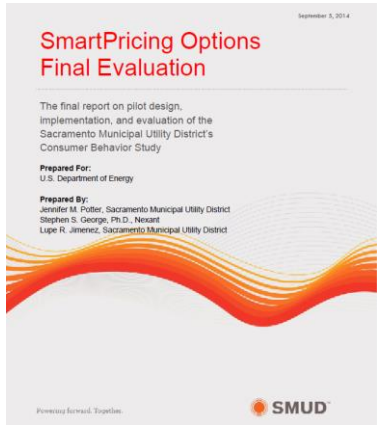
SMUD SD-2 Rates Principles

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



https://www.smud.org/-/media/Documents/Corporate/About-Us/Directives/Strategic-Direction/SD-2.ashx

10 Year Transition to Standard TOD Rate



SMUD's SmartPricing Options Final Evaluation

2009–2012 Smart meter deployment

2011 SIFC* restructure

2012 SmartPricing Options (pilot)

2013 Residential tier convergence begins

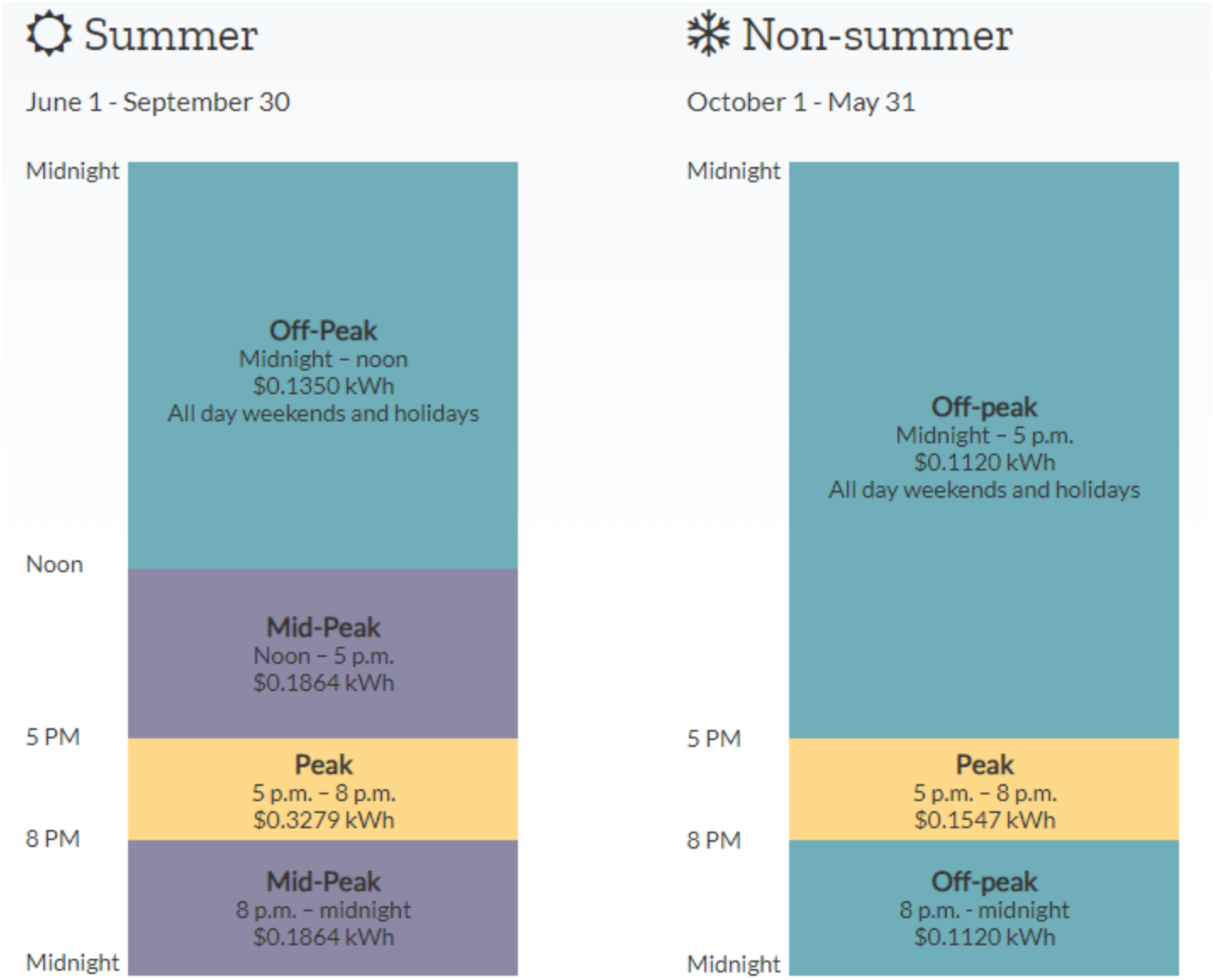
2016 New optional TOD rate

2018–2019 Transition to standard residential TOD rate

2022 Critical Peak Pricing

* System Infrastructure Fixed Charge (SIFC)

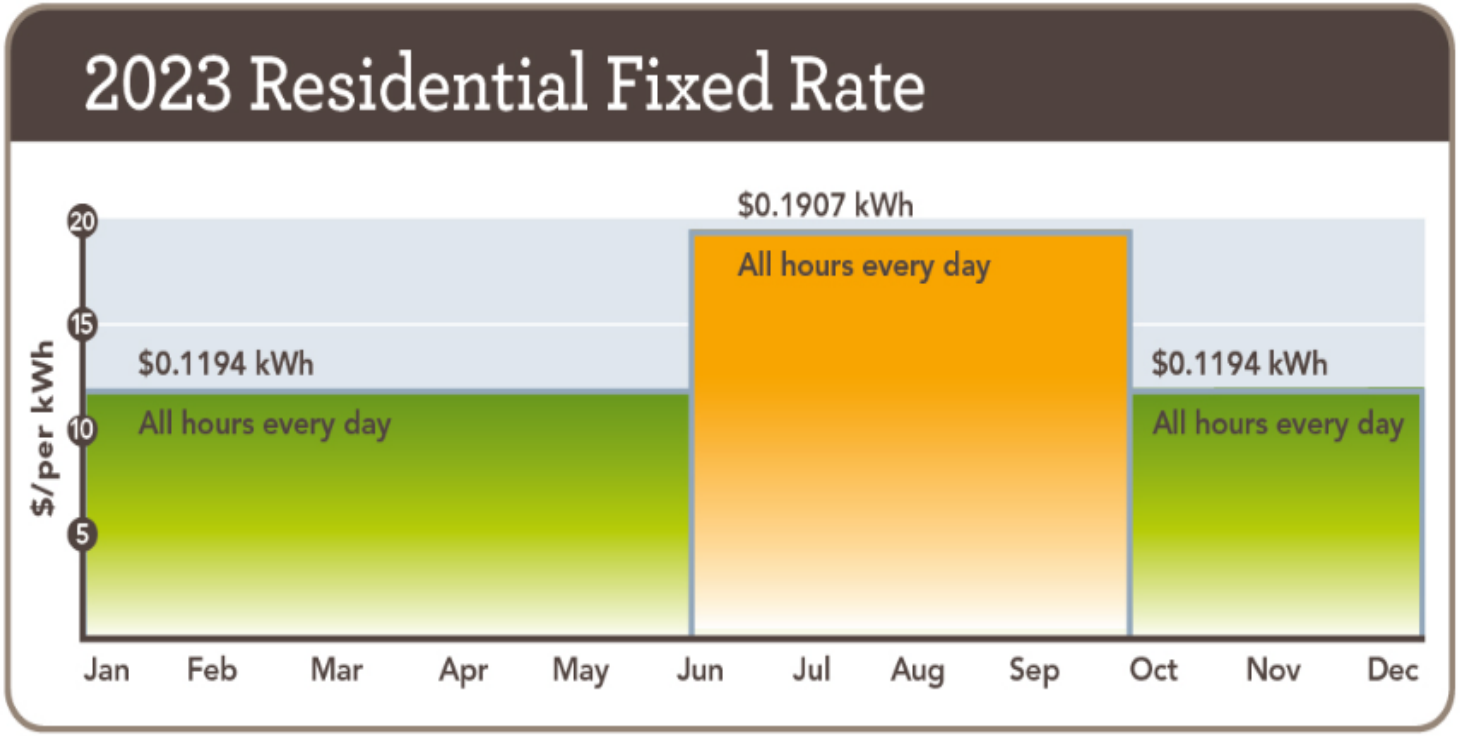
Residential Time-of-Day (5-8 p.m.) Rate



- Simple rate design
  - Weekends off-peak
  - Peak period 5-8 pm
  - Mid-peak in summer only
- Summer - Jun-Sept (4 months)
- Non-Summer Oct-May (8 months)

TOD rate offers ¢1.5/kWh discount from midnight to 6:00 am to promote EV charging

Alternative Fixed Rate



- Customer's choice
- Very simple rate
- Two prices
  - Summer (Jun-Sep)
  - Non-summer (Oct-May)
- Approx. 3% of customers are on this rate

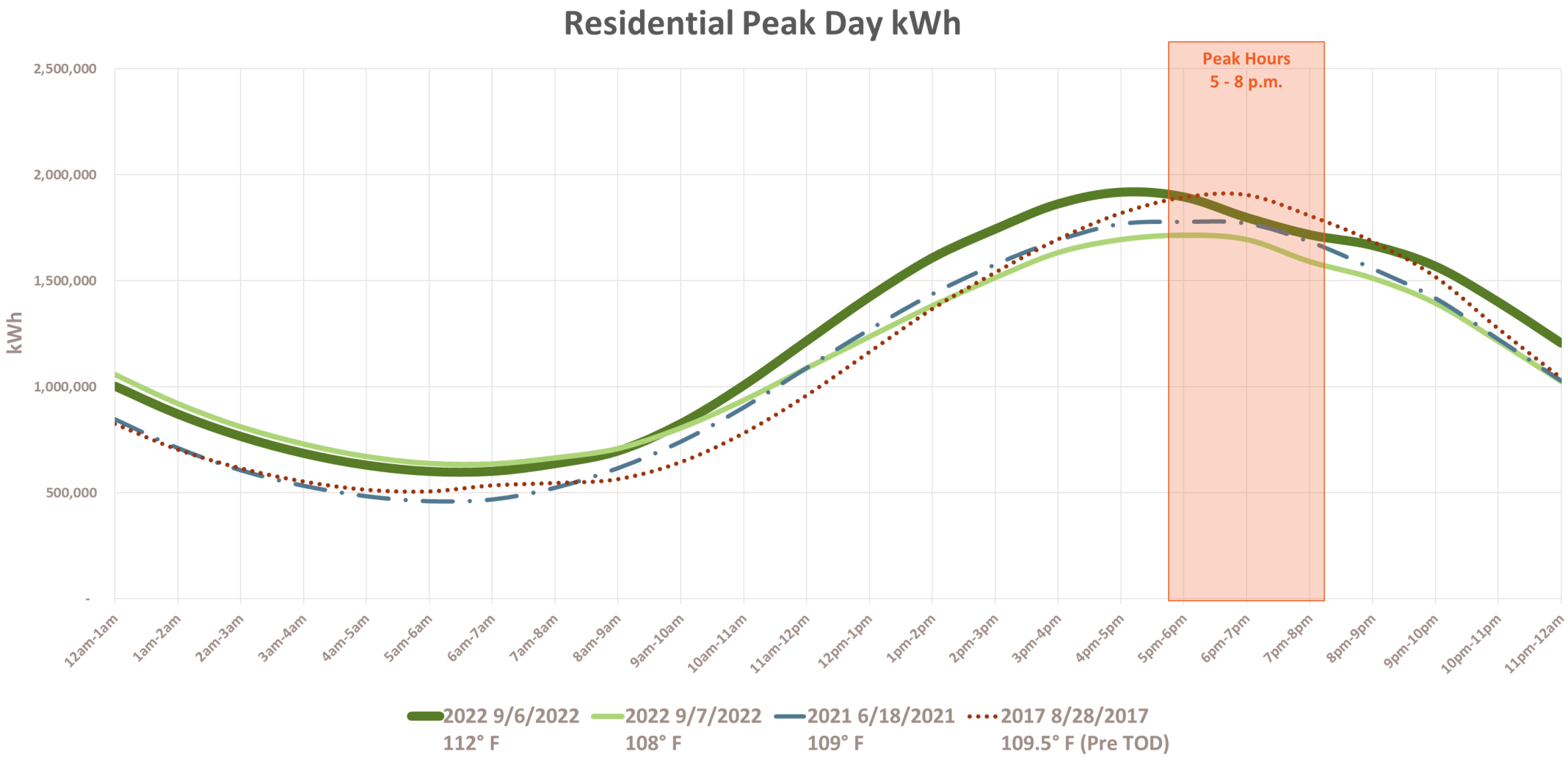
SMUD

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%

SMUD

TOD Rates Continue to Reduce Residential Peak



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

SMUD

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.

SMUD

What's Next

- Continue assessing residential TOD benefits
- Evaluation of optional residential critical peak pricing, EV pilot and commercial rate restructure
- Load Management Standard (LMS) regulation
  - Recently adopted by California Energy Commission (CEC)*
  - Encourages load flexibility with **hourly marginal cost-based rates**
  - POUs have the **flexibility to comply through rates or programs**
  - Creates a rates **database** to support **automated response to TOU**

* https://www.energy.ca.gov/proceeding/load-management-rulemaking

SMUD

Coffee Break

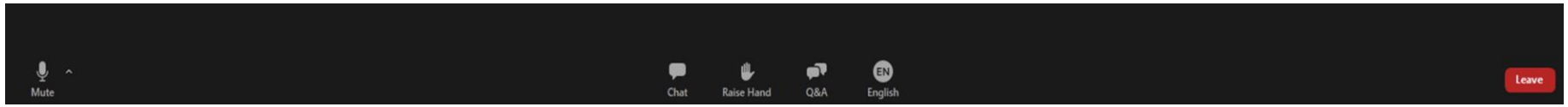
Facilitated Discussion with Q&A from Participants

Facilitated Panel Discussion
Q&A with participants

Use the Q&A window to submit questions

Having technical issues during the meeting?

Send a message using the chat.



thank you!