



ADVANCED RATE DESIGN FOR DISTRIBUTION SERVICES

CPUC Rate Design Forum

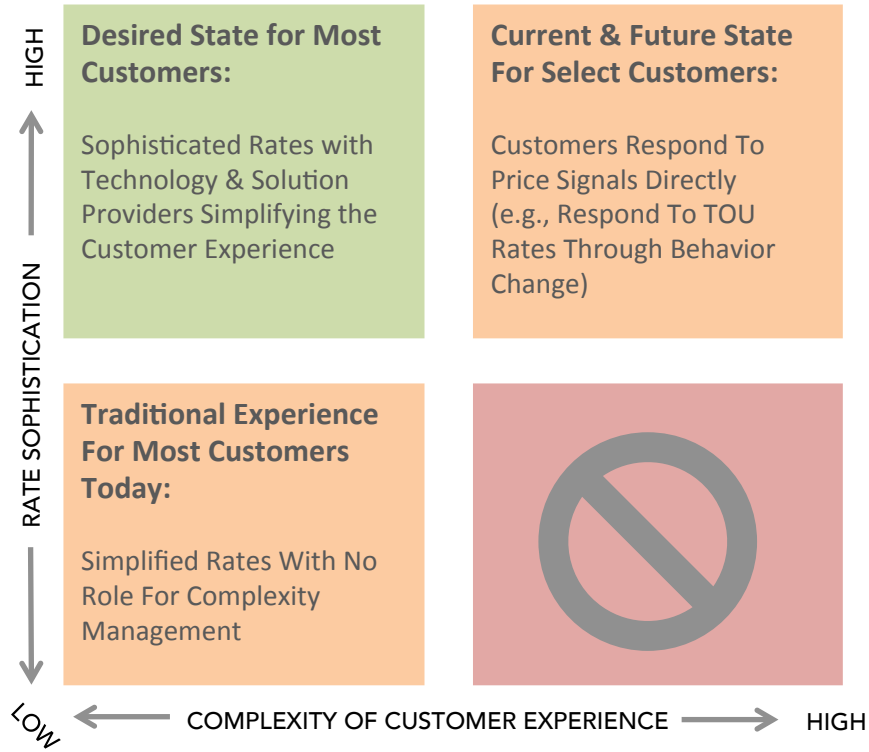
Dan Cross-Call | December 11, 2017



Transforming global energy use to create a clean, prosperous, and secure low-carbon future.

Pricing will be an evolution toward more sophisticated options

Managing Rate Complexity for the Customer



Near- and Long-term Evolutionary Rate Structures

Near-Term Default or Opt-in Possibilities	Longer-Term, More Sophisticated Possibilities
Time-of-Use Pricing	Real-Time Pricing
Energy + Capacity Pricing (e.g., demand charges)	Unbundled Attribute-Based Pricing
Distribution "Hot Spot" Credits	Distribution Locational Marginal Pricing

Nine key dimensions to consider in time-varying rates



PRICING FOUNDATION

1. Cost Components & Allocation



STRUCTURE

1. Peak/Off-Peak Price Ratio
2. Peak Period Duration
3. Peak Period Frequency
4. Number of Pricing Periods
5. Seasonal Differentiation
6. Financial Mechanism



IMPLEMENTATION

1. Enrollment Method
2. Enabling Technology

Structure: Peak/Off-Peak Price Ratio

The POPP ratio is a key determinant of how impactful a rate will be

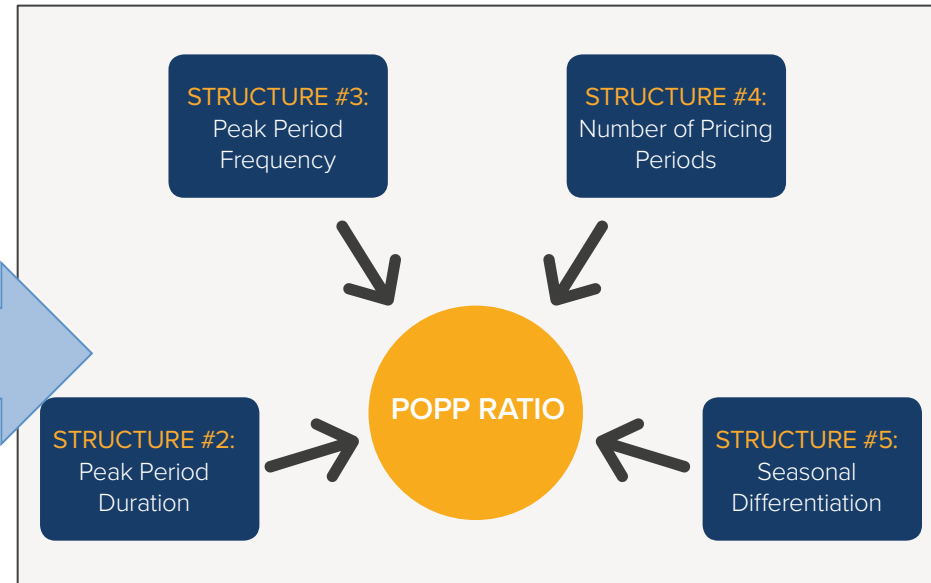
OPTIONS

POPP ratios vary widely in practice, and differ depending on the structure:

- *Basic Time-Based Rates*: 1:1 → 7:1.
- *Modified Time-Based Rates*: 4:1 → 20:1, including CP modifications.

IMPORTANT CONSIDERATIONS

- The POPP ratio is a function of four input dimensions
- To set an appropriate ratio, all dimensions should be considered in balance with each other




A similar set should be considered for demand charges



PRICING FOUNDATION

1. Cost Components & Allocation



STRUCTURE

1. Peak Coincidence
2. Measurement Interval
3. Number of Peaks
4. Seasonal Differentiation
5. Ratchet Mechanism



IMPLEMENTATION

1. Enrollment Method
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\$ Pricing Foundation: Cost Components

Approaches boil down to three options:

1. Narrow Demand Charges

Include only a customer's service drop and share of the line transformer

2. Broad Demand Charges

Also include other capacity-related distribution costs

3. Extensive Demand Charges

Include all costs for system infrastructure built to meet peak demand

COST COMPONENTS	APPROACH		
	NARROW DEMAND CHARGE	BROAD DEMAND CHARGE	EXTENSIVE DEMAND CHARGE
Customer Meter*	X	X	X
Service Drop and Transformer	✓	✓	✓
Other Marginal Distribution- Capacity Costs	X	✓	✓
Marginal Transmission- Capacity Costs	X	X	✓
Marginal Generation- Capacity Costs	X	X	✓

✓ Include X Exclude



Structure: Peak Coincidence

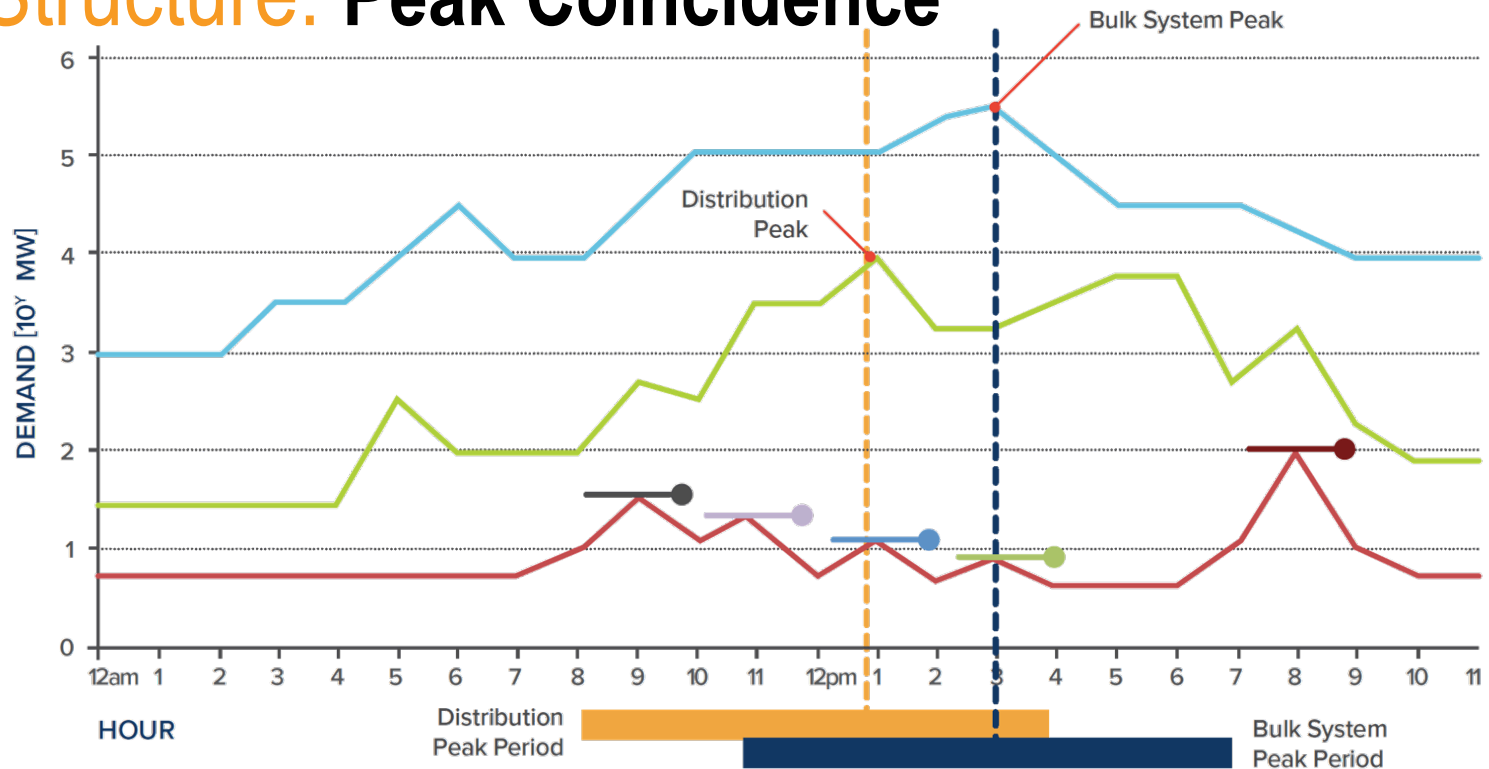
Many existing demand charges are based on the customer's non-coincident peak demand, but alternative options may better reflect cost causation.

OPTIONS

1. **Non-coincident peak**—customer's maximum demand any time in a billing period
2. **Coincident peak**—customer's peak demand at the time of the system peak
 - When is the timing of peak established?*
 - **Ex ante**—predetermined peak period (selected to coincide with system peak)
 - **Ex post**—time when system peak actually occurs
 - What level of the system determines the peak?*
 - **Distribution system**—only the portion of the system local to the customer
 - **Bulk system**—includes loading on the utility's entire power system



Structure: Peak Coincidence



Legend

- Bulk System Load
- Distribution System Load
- Customer Load

Customer's Billed Demand

- Noncoincident peak
- Coincident peak: ex ante, bulk system
- Coincident peak: ex ante, distribution system
- Coincident peak: ex post, distribution system
- Coincident peak: ex post, bulk system



Design for desired outcomes:

How do we encourage *buildings as grid assets*?

RMI's new net-zero energy office in Boulder, CO

- Targeting 26 kBtu/SF/yr
- 596 kW Solar
- Lighting = 0.35 W/SF



Thank You

