Smart Non-Residential Rate Design

Missouri Public Service Commission

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Carl Linvill, PhD, Principal
The Regulatory Assistance Project (RAP)®

+1 802 498 0723
clinvill@raponline.org
raponline.org

Agenda

1. Traditional Non-Residential (NR) Rate Design
2. Why NR Rate Design Needs to Change
3. Match Fixed and Non-Coincident (NC) Demand Charges Specifically to Cost Causation
4. Reward Load Diversity
5. Address Peak Demand
6. Establish Price Signals that Convey System Cost
7. Additional Considerations for a Model Tariff
8. Takeaways

1 Traditional Non-Residential (NR) Rate Design

A Traditional Rate for Large Commercial Customers

Customer Charge: **$100/month**

Demand Charge: **$10/kW**

Energy Charge: **$0.10/kWh**

Typical Bills for Two Large Residential Customers

Supermarket (83% LF)	
Customer Charge:	$ 100
300 kW Demand:	$ 3,000
180,000 kWh:	$18,000
Total:	$21,100
Average:	**$.117/kWh**

Office Tower (35% LF)	
Customer Charge:	$ 100
300 kW Demand:	$ 3,000
75,000 kWh:	$ 7,500
Total:	$10,600
Average:	**$.141/kWh**

BUT: for both customers, at ANY hour except their highest use (non-coincident peak) hour, the incremental price for electricity is $0.10/kWh.

What's The Problem?

Customer Charge: $100/month

Demand Charge: $10/kW

Not Linked To System Peak

Energy Charge: $0.10/kWh

Not Time-Differentiated

2 Why NR Rate Design Needs to Change

Bonbright Principles Still Useful

1. Fair
2. Simple
3. Unambiguous
4. Revenue adequacy
5. Proxy for what competition would provide

Technologies Affect What is Possible

Some technologies are here…

- **Advanced metering**
- **Solar**
- **Wind**

Some technologies are ascending…

- **Battery storage**
- **Electric Vehicles**

Some are still emerging…

- **Ice air conditioning**

… and Desirable

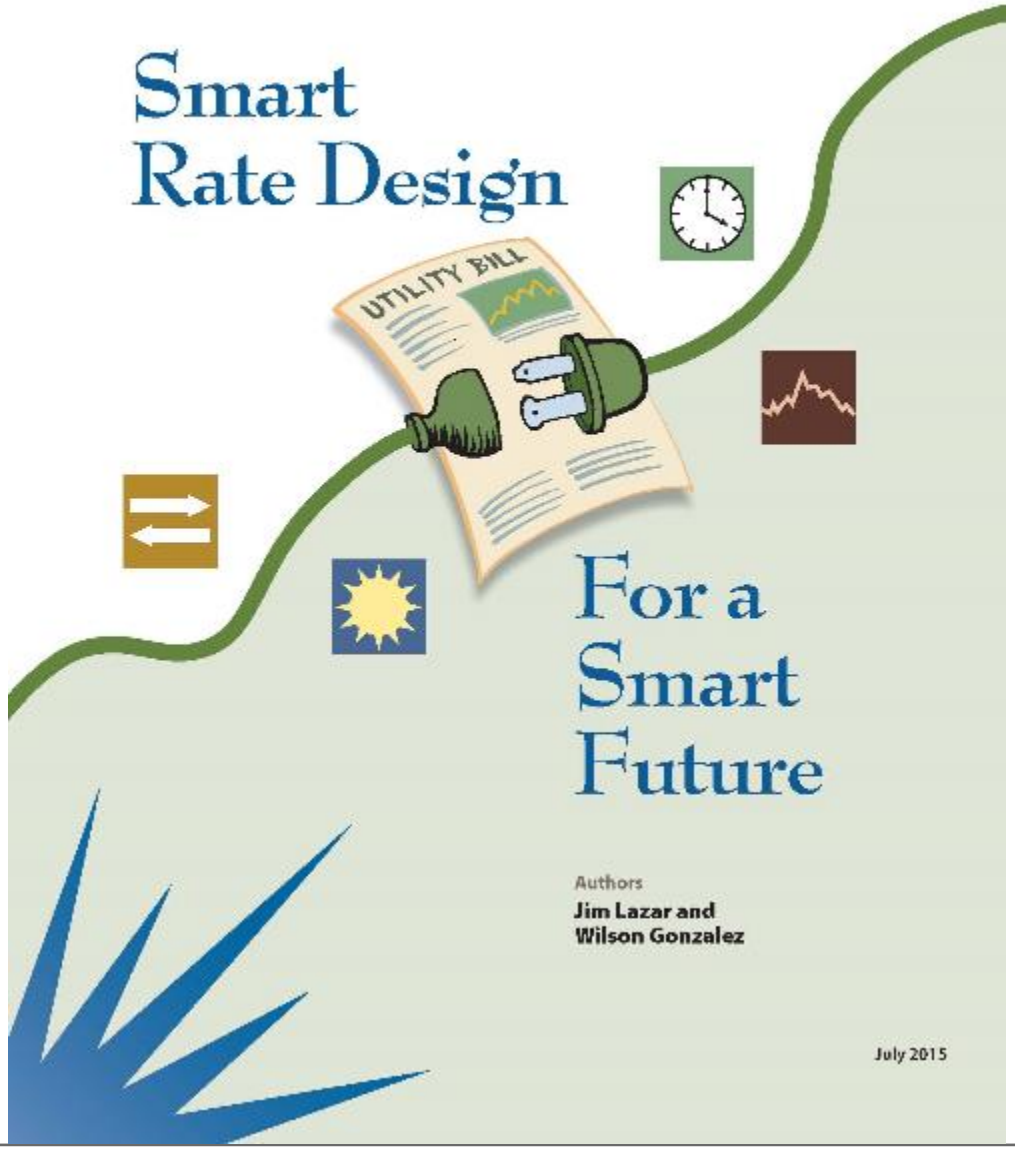
Technology delivers choices that customers want -

- **Buildings sector**
- **Transportation sector**
- **Power sector**

Key Terms: Coincident and Non-Coincident Demand

- **Coincident** Demand: A customer's usage at the time of the system maximum usage.

- **Non-Coincident (NC)** Demand: A customer's highest usage during the month.


RAP
Energy solutions
for a changing world
Smart
Rate Design
UTILITY BILL
For a
Smart
Future
Authors
Jim Lazar and
Wilson Gonzalez
July 2015

Illustrative Future Non-Residential Rate Design

Table ES-1. Proposed Illustrative Rate Design for Non-Residential Consumers

	Production	Transmission	Distribution	Total	Unit
Metering, Billing			$100.00	$100.00	Month
Site Infrastructure Charge			$2/kW	$2/kW	kW
Summer On-Peak	$0.140	$0.020	$0.040	$0.20	kWh
Summer/Winter Mid-Peak	$0.100	$0.015	$0.035	$0.15	kWh
Summer/Winter Off-Peak	$0.070	$0.010	$0.020	$0.10	kWh
Super Off-Peak	$0.030	$0.010	$0.010	$0.05	kWh
Critical Peak	Maximum 50 hours per year			$0.75	kWh

Optional Real-Time Pricing

- A wholesale energy cost component, charged on a per kWh basis, that fluctuates hourly
  - Based on locational marginal prices
- Transmission, distribution costs, and residual generation costs in time-varying rates

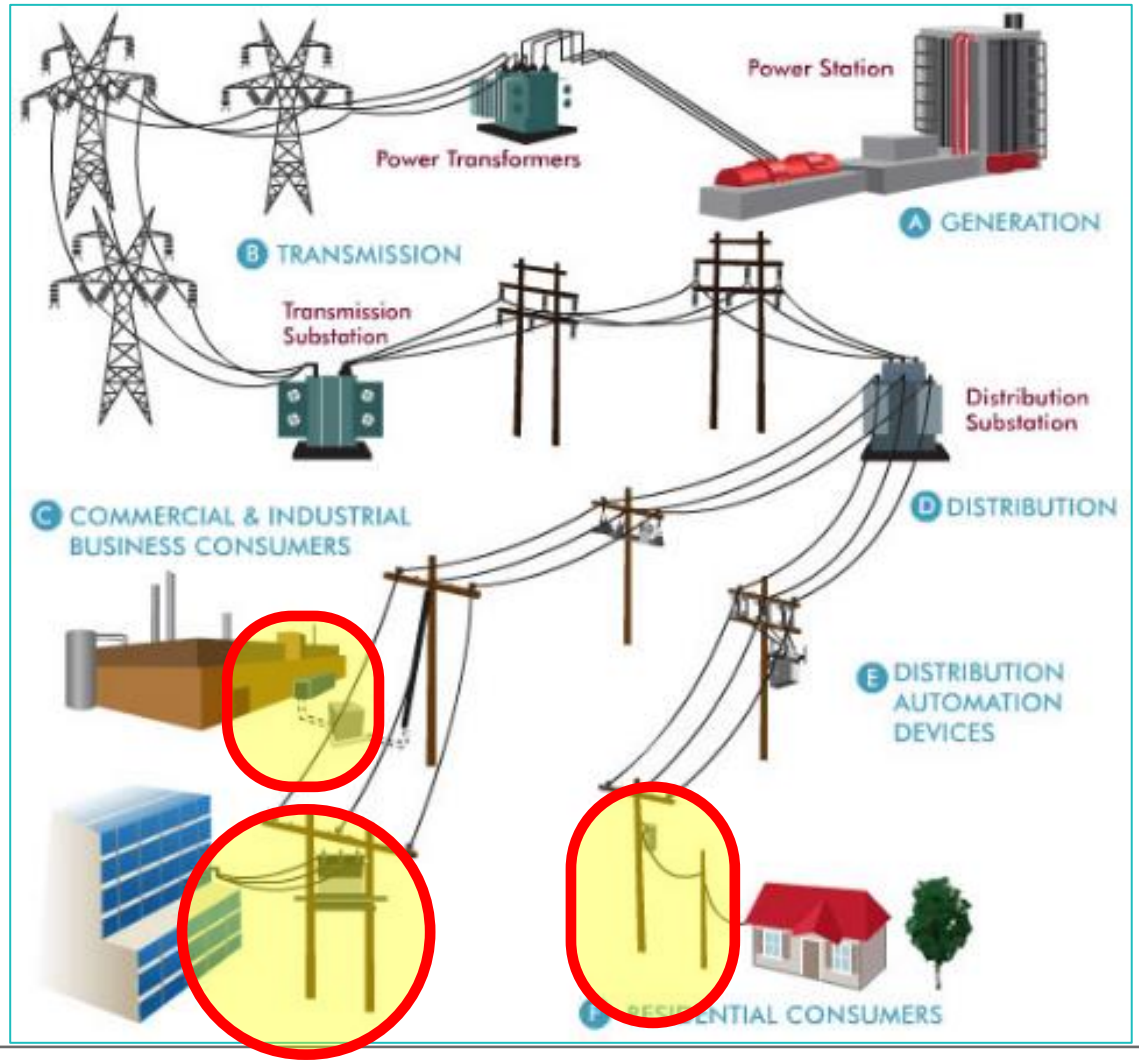
3 Match Fixed & NC Demand Charges Specifically to Cost Causation

Non-Residential (NR) Principle #1

- Service drop, metering, and billing costs should be recovered in a customer fixed charge

- Final transformer is a customer-specific cost.
  - Note: this is different from residential class

Costs that Vary with Customer NCP: Final Line Transformer and Service Drop



Large Non-Residential Customers Typically on Demand Charge Tariffs

Site Infrastructure Charge

Customer Type	NCP Demand	$/kW	Site Infrastructure Charge
Small Retail or Office	20 kW	$2	$40/month
Supermarket	300 kW	$2	$600/month
Office Tower	600 kW	$2	$1,200/month
Suburban Shopping Mall	2,000 kW	$2	$4,000/month

4 Reward Load Diversity

NR Principle 2.1

- **De-emphasize NC Peak demand charges except as noted in NR Principle 1**

- **All shared generation and transmission capacity costs should be reflected in system-wide time-varying rates so that diversity benefits are equitably rewarded**

Load Diversity Between School and Church

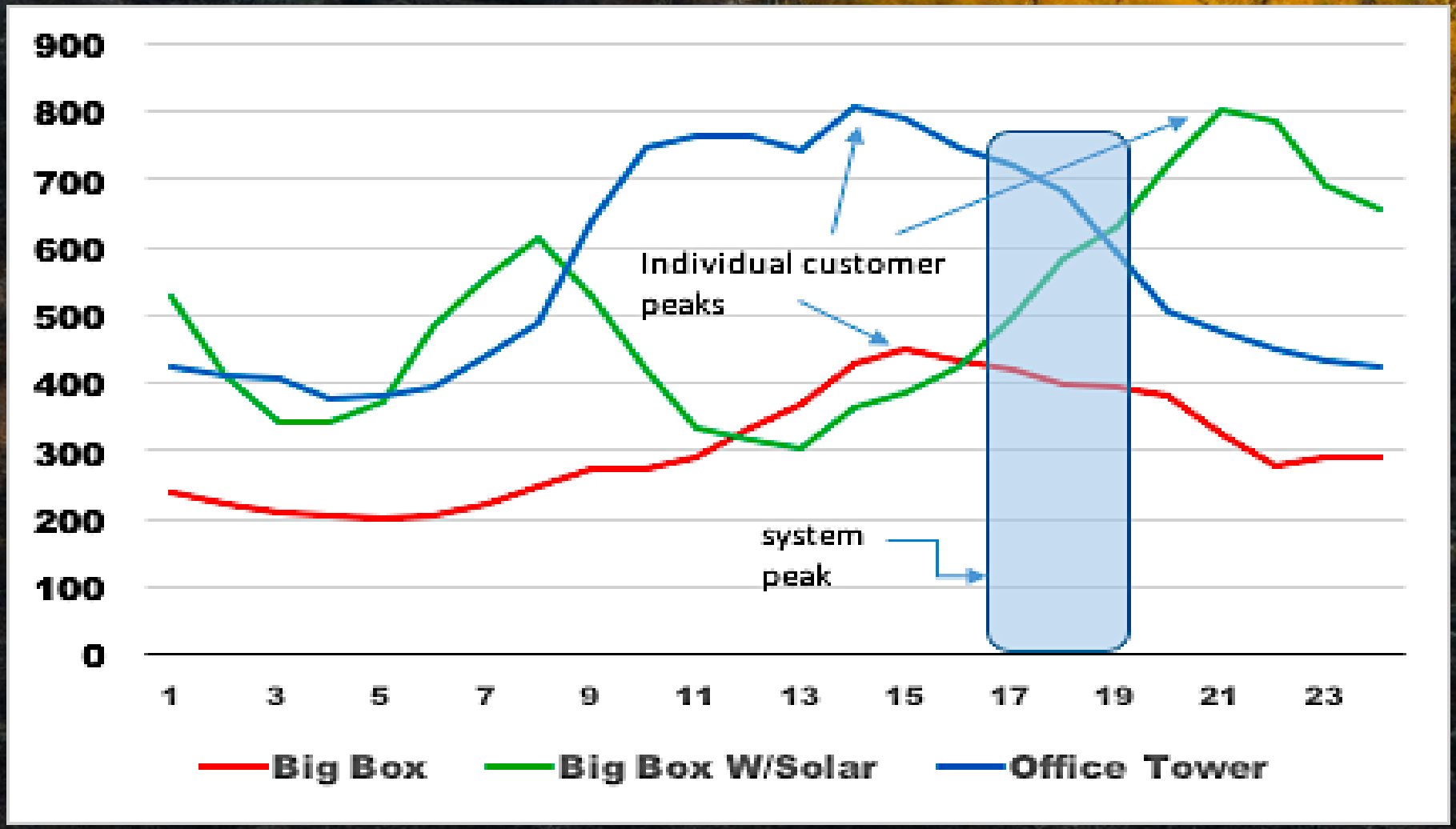
Hours	System Peak	Church	School	Mini-Mart	Total
Weekday 9-4	Mid-Peak	5	45	50	100
Weekday 4-8	On-Peak	5	15	50	70
Nights	Off-Peak	5	5	50	60
Weekend	Off-Peak	45	5	50	100
NCP		45	45	50	140
%		32%	32%	36%	
CP		5	15	50	70
%		7%	21%	71%	

5 Address Peak Demand

NR Principle 2.2

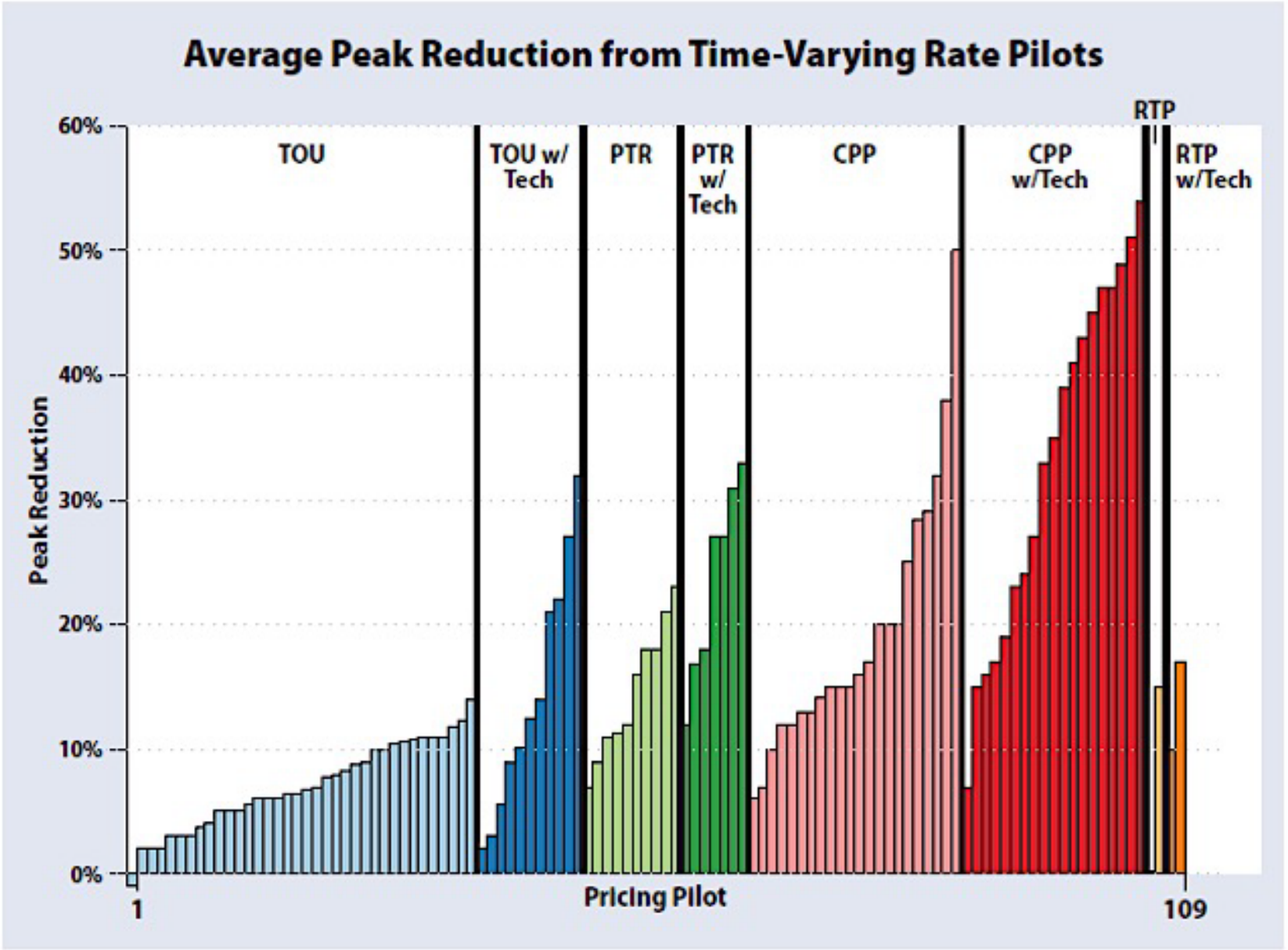
- **Shift shared distribution network revenue requirements into regional or nodal time-varying rates**

Three Actual Large Commercial Customers



Rate Designs That Address Peak Demand

- A Critical Peak Price
- Well-designed Time of Use Prices
- Transparent Real Time Prices
- Peak Time Rebates
- Coincident Peak Demand Charges

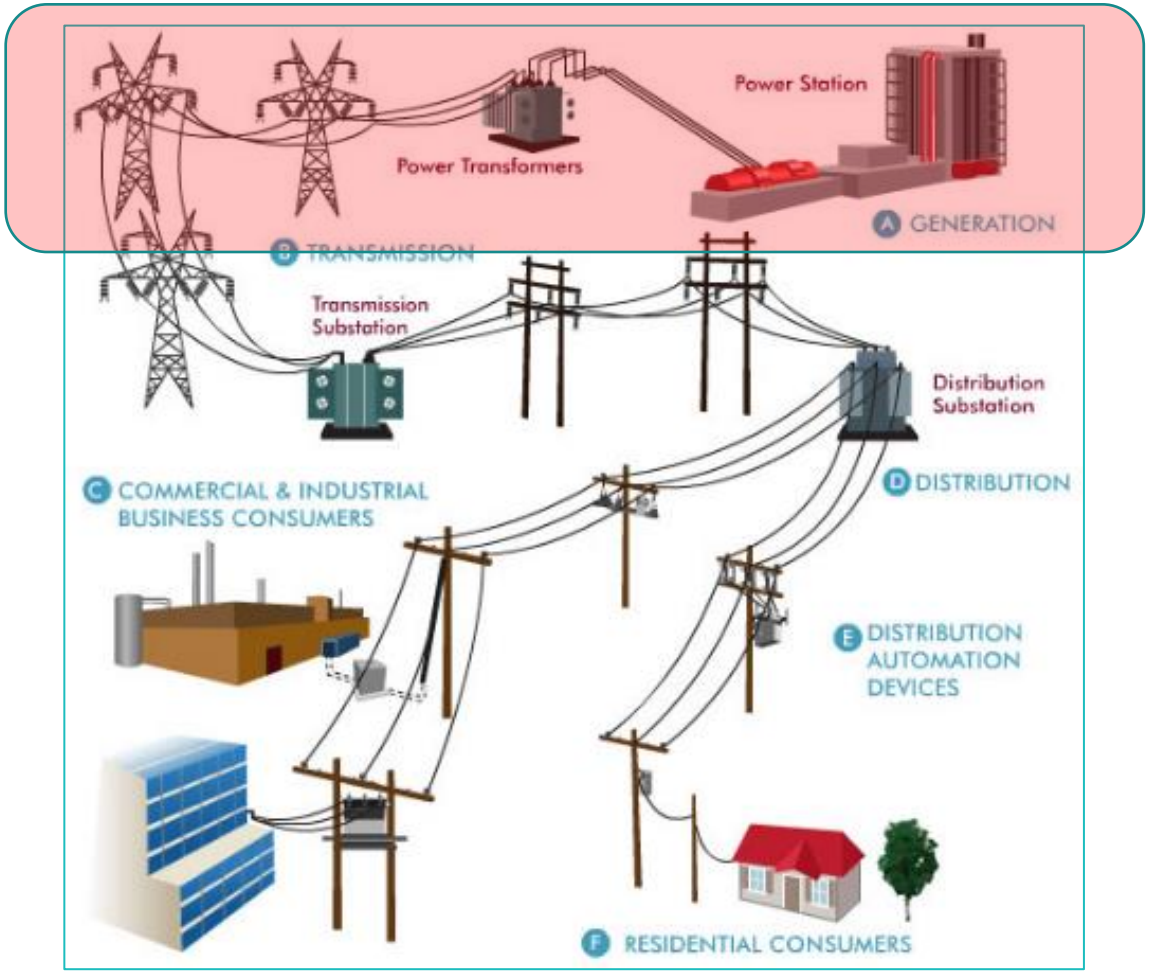

Average Peak Reduction from Time-Varying Rate Pilots
60%
50%
40%
30%
20%
10%
0%
Peak Reduction
TOU
TOU w/ Tech
PTR
PTR w/ Tech
CPP
CPP w/Tech
RTP
RTP w/Tech
1
Pricing Pilot
109

6 Establish Price Signals that Convey System Cost

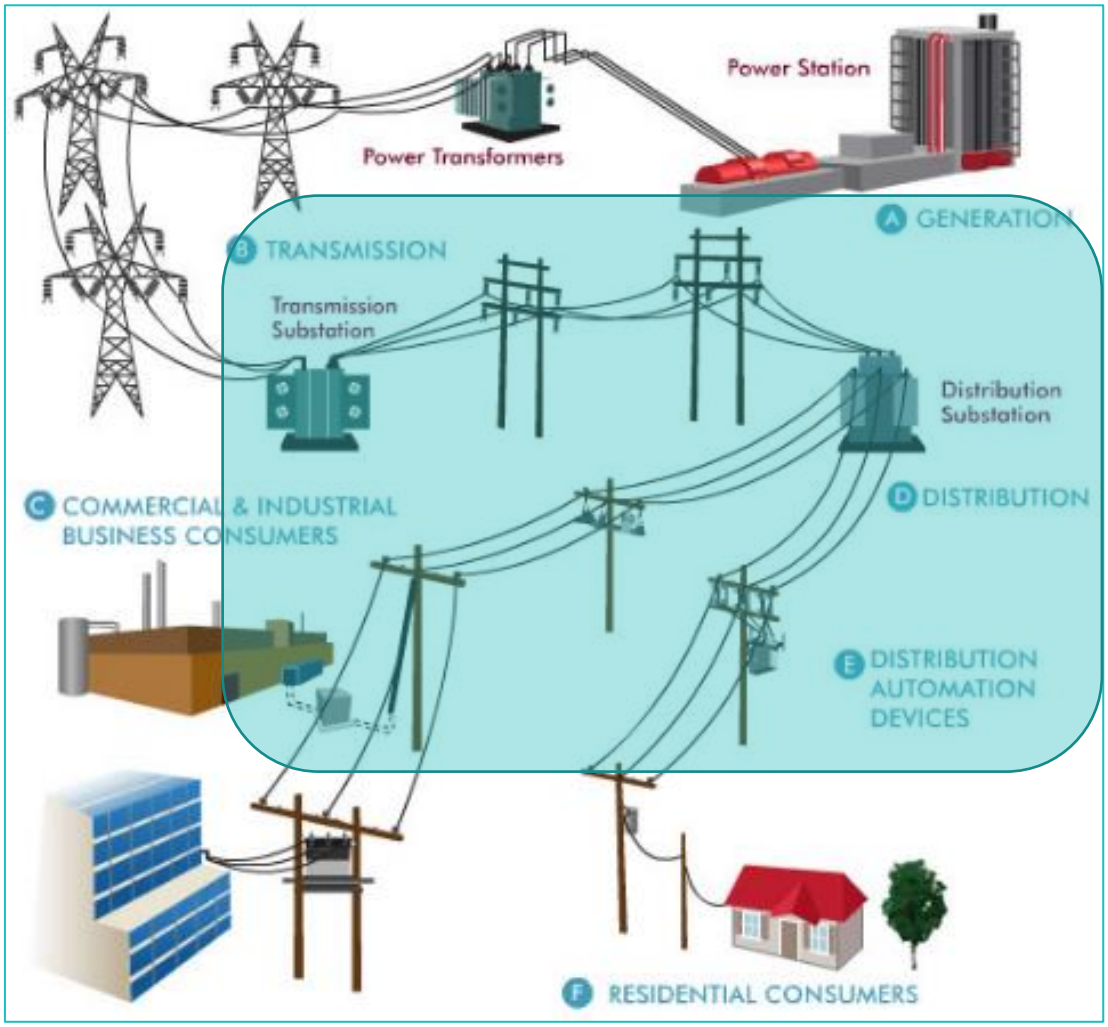
NR Principle 2.2

- **Shift shared distribution network revenue requirements into regional or nodal time-varying rates**

Costs that Vary with System TOU Loads: Generation and Bulk Transmission



Costs that Vary with Nodal TOU Loads: Network Transmission and Distribution



NR Principles 2.3 & 2.4

- **NR Principle 2.3: Consider short-run marginal cost pricing signals and long-run marginal cost pricing signals**
- **NR Principle 2.4: Time-varying rates should align incentives for controllable load, customer generation, and storage dispatch with electric system needs**

Reasons to Consider TOU Rates

- More equitable cost recovery
- Reduce peak demand
- Provide price signal for electric vehicle charging during off-peak and shoulder hours
- Provide price signal for air conditioning controls or ice storage
- Provide price signal for beneficial use of on-site storage

7 Additional Considerations for a Model Tariff

NR Principle 2.5

- **Simple default tariff**
- **Optional tariffs with more granular elements**

What Utility Tariff Best Exemplifies Our Principles?

- We looked at about 20 utilities from around the country and a couple of international examples
- We looked at:
  - Customer charges
  - Demand charges (Distribution and Generation)
  - Volumetric rates
  - Time of use rates
  - Seasonal rates

Sacramento Rate Design
NR Best of Class

Customer Charge	$108/month	
Site Infrastructure Charge	$3.80/kW/month	
Super Peak Demand Charge Summer weekdays 2-7 PM	$7.65/kW	
Energy Charge	Summer	Winter
Super Peak	$0.20	N/A
On-Peak	$0.137	$0.104
Off-Peak	$0.109	$0.083

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Super Peak Demand Charge	$7.65/kW	
Energy Charge	Summer	Winter
Super Peak	$0.20	N/A
On-Peak	$0.137	$0.104
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We made two changes:

1) Convert the super-peak demand charge to a critical peak energy charge, applied to specific hours of system stress;
2) Add a super-off-peak rate, to encourage consumption when energy is unusually abundant and market prices are near zero.

Illustrative Future Non-Residential Rate Design

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Critical Peak	Maximum 50 hours per year			$0.75	kWh

Optional Real-Time Pricing

- A wholesale energy cost component, charged on a per kWh basis, that fluctuates hourly
- Tied to locational marginal prices
- Transmission, distribution, and residual generation costs would be collected in TOU rates

NR Principle 2.6

- **Optimal non-residential rate design will evolve as technology and system operations mature**

- **Opportunities to revisit rate design should occur regularly**

7a Illustrative Electric Vehicle Charging Cost With Three Rate Designs

Comparison of Traditional Rate, CP Demand Charge, and Smart Rate

	Traditional Rate	Coincident Peak Demand Charge	Smart Rate
Demand	$10/kW	$10/kW	$2/kW
Demand Measurement	NCP	4 PM - 8 PM	Site Infrastructure
Energy	$.10/kWh	$.10/kWh	$.05 - $.75/kWh
Energy Measurement	No TOU	No TOU	TOU

EV Charging Cost

	Traditional Rate	Coincident Peak Demand Charge	Smart Rate
Demand	$10/kW	$10/kW	$2/kW
Demand Measurement	NCP	4 PM - 8 PM	Site Infrastructure
Energy	$.10/kWh	$.10/kWh	$.05 - $.75/kWh
Energy Measurement	No TOU	No TOU	TOU

Electric Vehicle Charging Cost Per Month		6.6 kW	250 kWh/month
NCP Demand	$ 66.00	$ -	$ 13.20
CP Demand		$ -	
Energy	$ 25.00	$ 25.00	$ 15.00
Total	$ 91.00	$ 25.00	$ 28.20
$/kWh	**$ 0.36**	**$ 0.10**	**$ 0.11**

7b When Will Dynamic Pricing Be Sufficient?

Dynamic Prices can be Sufficient if:

1. Locational Marginal Prices (LMP) and Congestion Revenue Rights (CRR) exist down to the feeder
2. Free entry and exit on the distribution system
3. Utility serving as the platform has the opportunity to be revenue adequate
4. Political tolerance for scarcity pricing exists

Barriers to Dynamic Pricing being Sufficient Today

1. Distribution system over-built (analog tech) so price signals will be muted
2. Structural change massive (digital tech)
3. Barriers to entry on the distribution system
4. Embedded cost recovery poses transition challenges
5. Political tolerance for scarcity pricing is low

8 Takeaways

1. **Match Fixed & NC Demand Charges Specifically to Cost Causation: customer specific costs.**
2. **Reward Load Diversity**
3. **Address Peak Demand**
4. **Establish Price Signals that Convey System Cost at all hours of the year**
5. **Include an Optional Real Time Pricing Tariff that begins the process of establishing granular locational and temporal pricing on the distribution system**

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

Carl Linvill, PhD
Principal
The Regulatory Assistance Project (RAP)®

Davis, California
United States

+1 802 498 0723
clinvill@raponline.org
raponline.org