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Tapping the Water–Energy Nexus

130th NARUC Annual Meeting and Education Conference

Staff Subcommittee on Rate Design

DISTRIBUTION RATE DESIGN PROPOSAL

Dan Cleverdon
NARUC
November 11, 2018

DISCLAIMER

This presentation represents the thoughts and opinions of the author and is in no way representative of the opinions, decisions or policy of the District of Columbia Public Service Commission.

DISTRIBUTION RATE DESIGN NEED

- Present distribution rates are inadequate to fairly deal with partial requirement customers such as customer generators and other DERs.

- Technology underlying present volumetric rates is 19th Century technology and early 20th Century maximum demand technology, we now have better technology, i.e. AMI, and need to use it to develop rates

DISTRIBUTION RATE DESIGN GOAL

- Create a single distribution rate that equitably and efficiently:
  - Can handle both full and partial requirement distribution customers
  - Matches rates to cost causation
  - Uses, as appropriate, present AMI technology
  - Reflects both equity and efficiency appropriately

- Reduce or eliminate the need for “decoupling

DISTRIBUTION RATE DESIGN
WORK IN PROGRESS

- More of a framework than a specific design

- Welcome thoughts and suggestions

- While trying to get it right I don’t want pursuit of the perfect to prevent the good from being implemented

DISTRIBUTION RATE DESIGN
Overview of Proposed Rate

Three elements:

- A small customer charge to cover fixed charges that do not vary by customer size
- A monthly fixed charge based on the size of the service drop or interconnection for a given meter (or customer)
- A consumption charge based on monthly PLC for a given account

DISTRIBUTION RATE DESIGN
CUSTOMER CHARGE

- Limited to only those elements which are truly independent of customer size
  - Billing
  - Call center
  - IT Functions
  - Others to be identified

- Need to resist attempts to add general overhead costs into customer charge.

DISTRIBUTION RATE DESIGN MONTHLY FIXED CHARGE

- Based on size of service drop
  - Idea cribbed from RAP.
  - Addresses problem of large intraclass differences among customers

- Size of charge should be enough to truly reflect the differential potential demands made by different customers on the distribution system but not large enough to swamp the consumptive portion of the bill

DISTRIBUTION RATE DESIGN CONSUMPTION CHARGE

- Based on kW PLC contribution for monthly class coincident distribution peak
  - No real empirical proof that PLC is the cost driver for distribution costs
  - Some theoretical basis
  - Other demand based measures can be investigated as well, e.g. billing demand

- Use monthly PLC
  - Picks up monthly differential demand for DERs
  - Allows for behavioral or seasonal changes to be reflected quickly

DISTRIBUTION RATE DESIGN
OTHER ISSUES

○ How to divide the Annual Class Revenue Requirement

- 12 equal segments? (OK)
- Weighted by historic monthly energy use? (Better)
  - Percentage of Class Annual Revenue Requirement based on monthly energy use average of past five years

DISTRIBUTION RATE DESIGN
OTHER ISSUES

Division between Monthly Fixed Charge and Consumption Charge

- Thorny problem, needs to be based on utility specific information
- Could be determined via negotiation

DISTRIBUTION RATE DESIGN
OTHER ISSUES

Rate is determinative, i.e. Utility recovers 100% of revenue requirement.

- Lacks incentive for continuing performance improvement
- Could be addressed by Performance Based Ratemaking (a whole other kettle of fish)

DISTRIBUTION RATE DESIGN
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Staff Subcommittee on Rate Design

November 11, 2018

Smart Non-Residential Rate Design: Aligning Rates with System Value

NARUC Staff Sub-committee on Rate Design Panel

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Rate design should make the choices the customer makes to optimize their own bill

consistent with the choices they would make to minimize system costs.

Problems & Solutions

Problem #1: Most non-residential rates do not align customer rates with system costs

Problem #2: Technological change and the emergence of DERs make improvement necessary

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Solution #1: Non-Coincident Peak Demand Charges should be lower

Solution #2: Time-of-Use Rate Design reflects system costs better than coincident peak demand charges

1 Problem #1: Most Non-Residential (NR) Rates do not Align Customer Rates with System Costs

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 Problem #2: Technical Change and the Emergence of DERs Make Improvement Necessary

Technologies affect what is possible and necessary

Smart grid makes better rate design possible

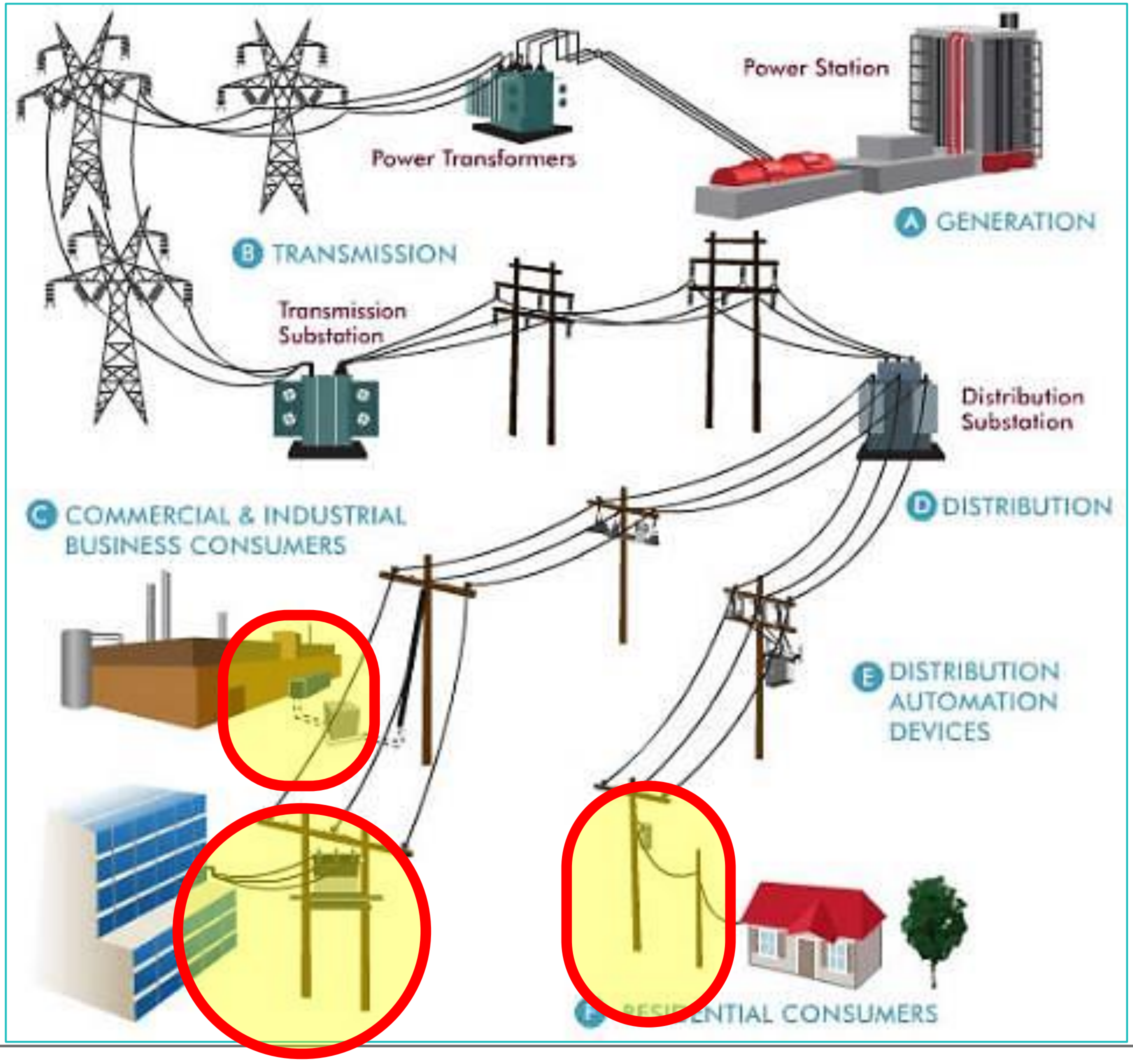
DERs make better rate designs necessary:

- Wind and solar
- Storage technologies
- EVs

3

Solution #1: NCP Demand Charges should be Lower

Costs that vary with customer NCP: Final line transformer and service drop



Load diversity between school and church

Hours	TOU Period	Church	School	Combined
Weekday 4-8 PM	On-Peak	5	15	20
Weekday 9-4	Mid-Peak	5	45	50
Nights	Off-Peak	5	5	10
Weekend Day	Off-Peak	45	5	50

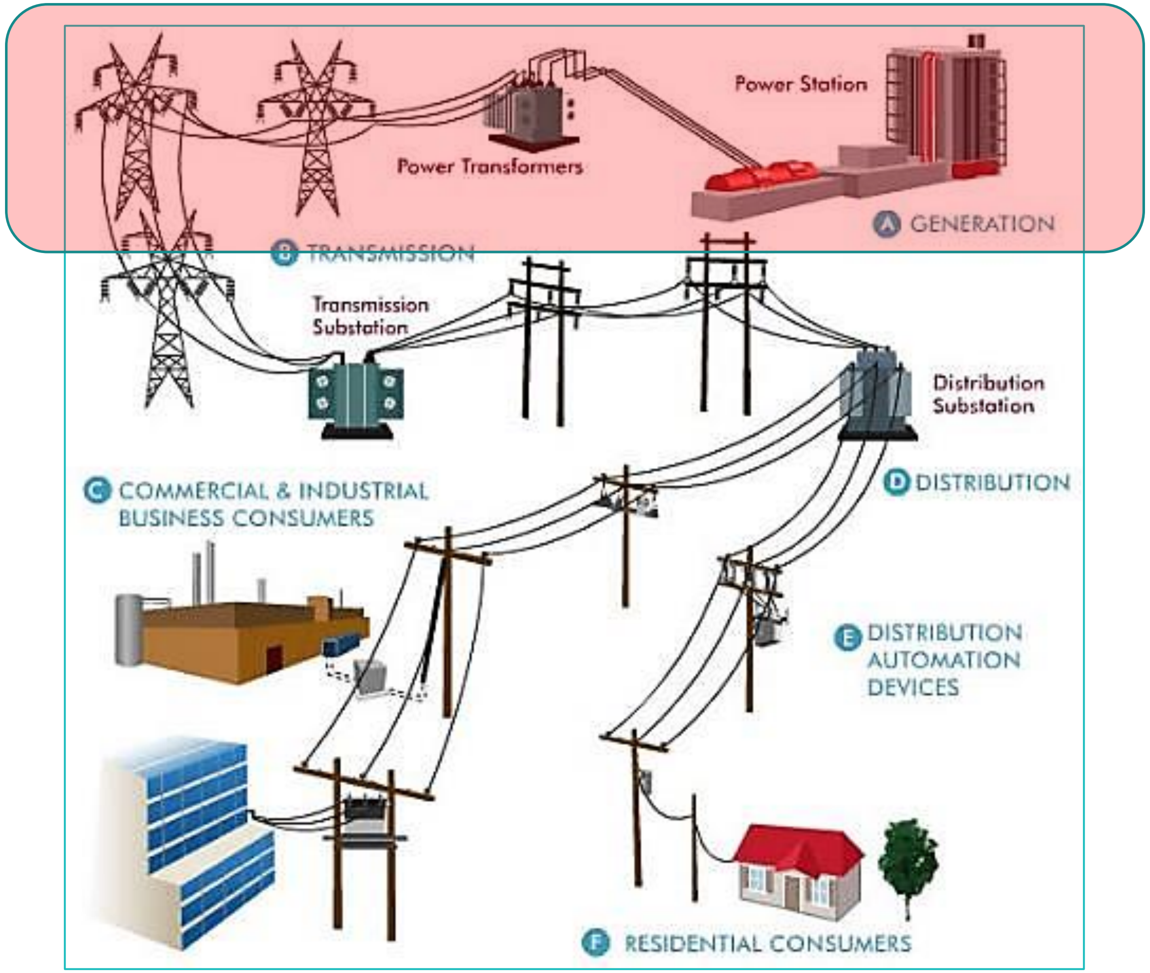
Church and School Demands Are Low During System Peak

NCP demand charges fail to reward load diversity

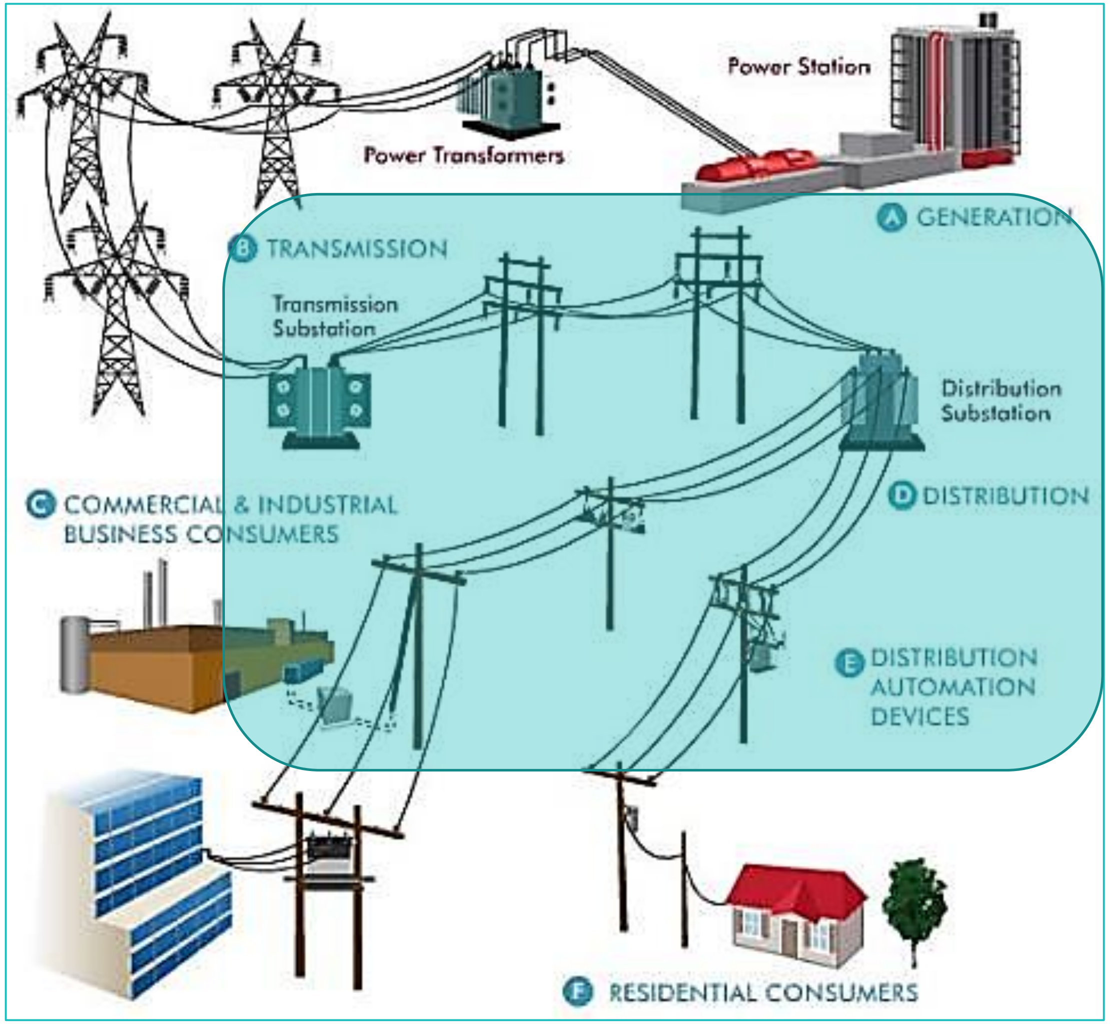
- Limit NCP Peak demand charges to site infrastructure
- All <u>shared</u> generation and transmission capacity costs should be reflected in system-wide time-varying rates so that diversity benefits are equitably rewarded

4 **Solution #2:** Time-of-Use Rate Design Reflects System Costs Better Than Coincident Peak Demand Charges

Costs that vary with system TOU loads: Generation and bulk transmission



Costs that vary with nodal TOU loads: Network transmission and distribution



TOU rates with a CPP encourage beneficial DER operation

- Recognizes the system benefit of sharing infrastructure capacity
- Sends price signals for all hours, with a strong signal deterring use in highest stress hours
- Encourages electric vehicle charging during off-peak and shoulder hours
- Encourages use of air conditioning controls, ice storage and batteries to flex use away from stress periods toward surplus periods

5 Illustrative Rate Designs that Promote Alignment

Antiquated Example Rate #1

(a real utility in the U.S.)

Customer Charge	**$/Month**	**$ 209.00**
Demand Charge	**$/kW**	**$ 21.35**
Energy Charge	**$/kWh**	**$ 0.050**

- Demand charge is based on NCP demand
- Energy charge is not time-differentiated

Better: Example Rate #2
Georgia Power TOU-GS-10

Customer Charge	$/Month	$ 209.00
Demand Charge		
On-Peak	$/kW	$ 15.66
Maximum Peak	$/kW	$ 5.23
Energy Charge		
On-Peak	$/kWh	$ 0.122
Shoulder Peak	$/kWh	$ 0.063
Off-Peak	$/kWh	$ 0.024

- Higher coincident-peak demand charge
- 5 hour window
- Steep TOU energy rate

Sacramento Rate Design
NR Best of Class

Customer Charge	$108/month	
Site Infrastructure Charge	$3.80/kW/month	
Super Peak Demand Charge	$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

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

	Restructured State	Distribution		Unit
Metering, Billing		$100.00		Month
Site Infrastructure Charge		$2/kW		kW
Summer On-Peak		$0.040		kWh
Summer/Winter Mid-Peak		$0.035		kWh
Summer/Winter Off-Peak		$0.020		kWh
Super Off-Peak		$0.010		kWh
Critical Peak	Maximum 50 hours per year			kWh

Optional Dynamic/Real-Time Pricing

- An 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

Takeaways

Rate design should make the choices the customer makes to optimize their own bill consistent with the choices they would make to minimize system costs.

Problems & Solutions

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Problem #2: Technological change and the emergence of DERs make improvement necessary

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Solution #1: Non-Coincident Peak Demand Charges should be lower

Solution #2: Time-of-Use Rate Design reflects system costs better than coincident peak demand charges

Resources from RAP

- Smart Non-Residential Rate Design: Aligning Rates with System Value, Linvill and Lazar, Electricity Journal, available from EJ
- Smart Rate Design for a Smart Future
- Designing Distributed Generation Tariffs Well
- Rate Design Where Advanced Metering Infrastructure Has Not Been Fully Deployed
- Time-Varying and Dynamic Rate Design
- Use Great Caution in the Design of Residential Demand Charges

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

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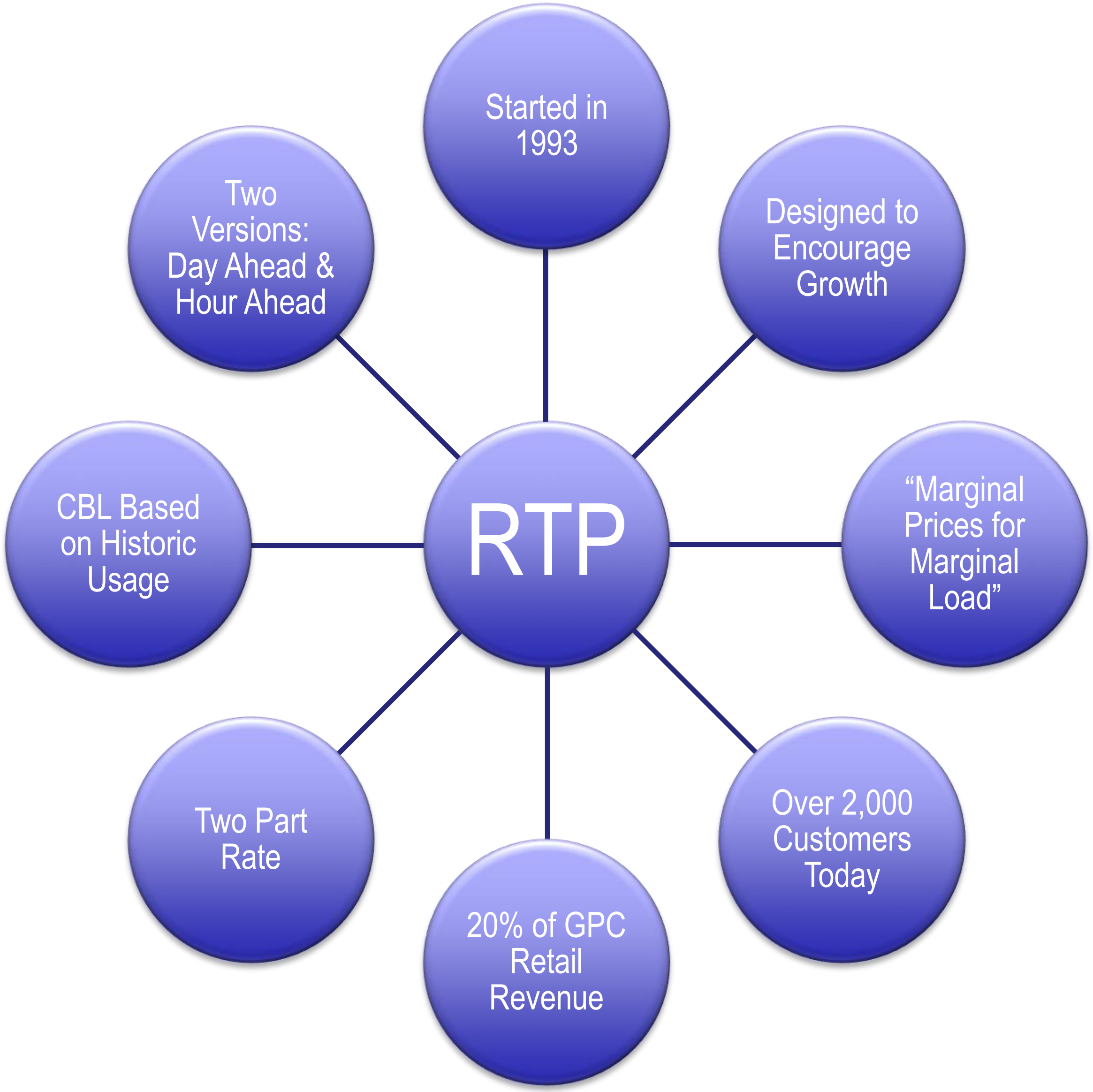
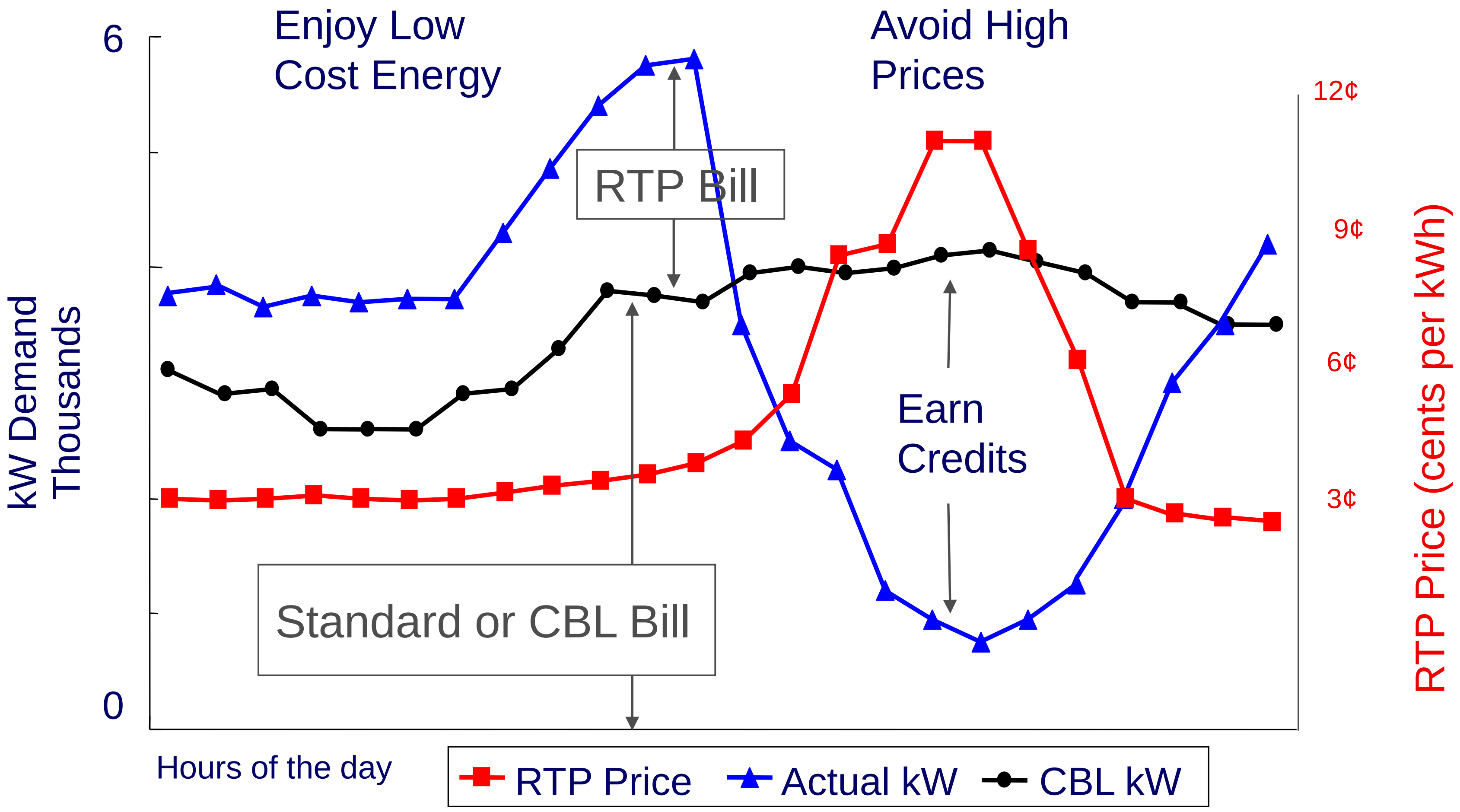
Georgia Power's Real Time Pricing (RTP) Program

Glenn Dyke
Customer Pricing Manager
Georgia Power Company

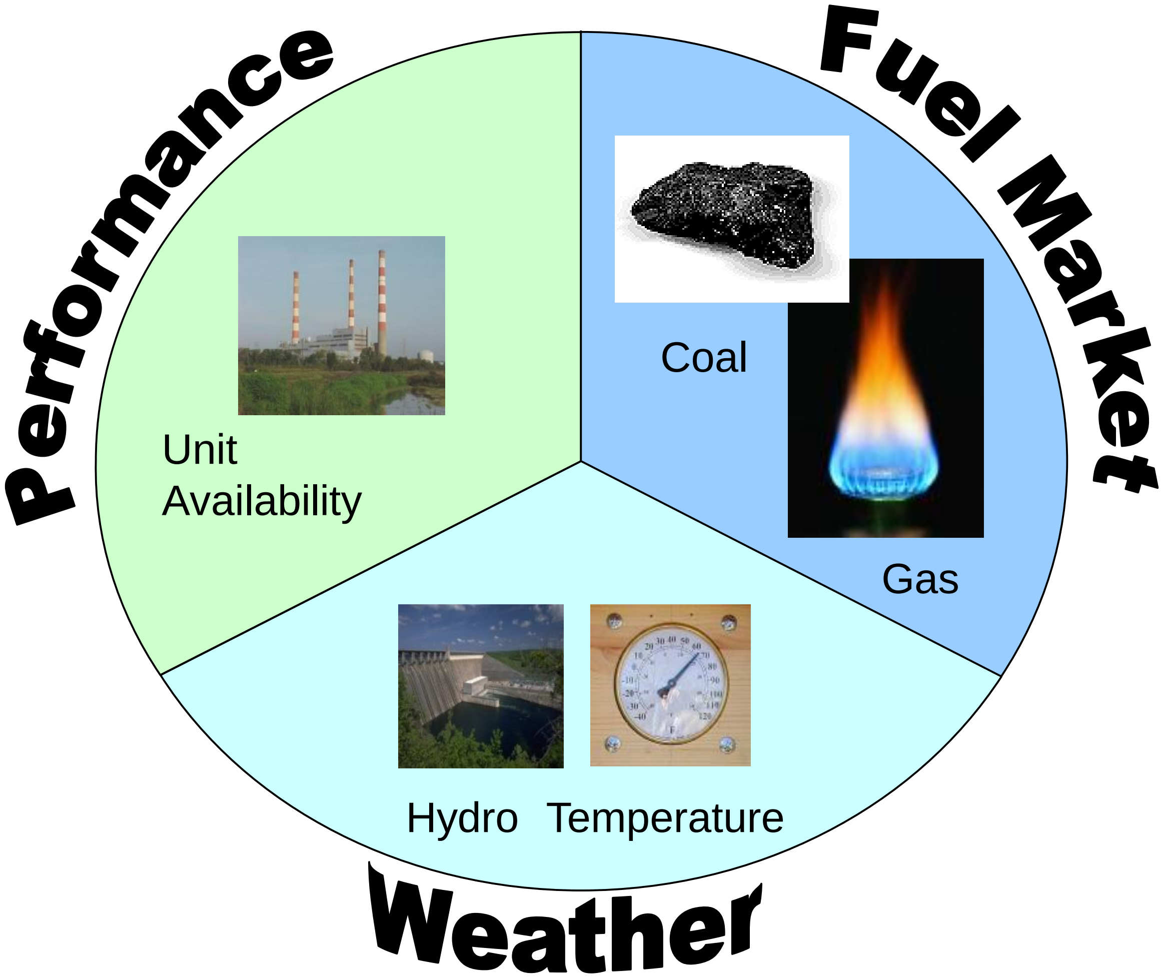
Georgia Power's RTP Program



Example: One Day on RTP



What Affects Prices?



Georgia Power

Staff Subcommittee on Rate Design

Smart Non-Residential Rate Design

Designing for the Future

NARUC Annual Meeting

Orlando

November 11, 2018

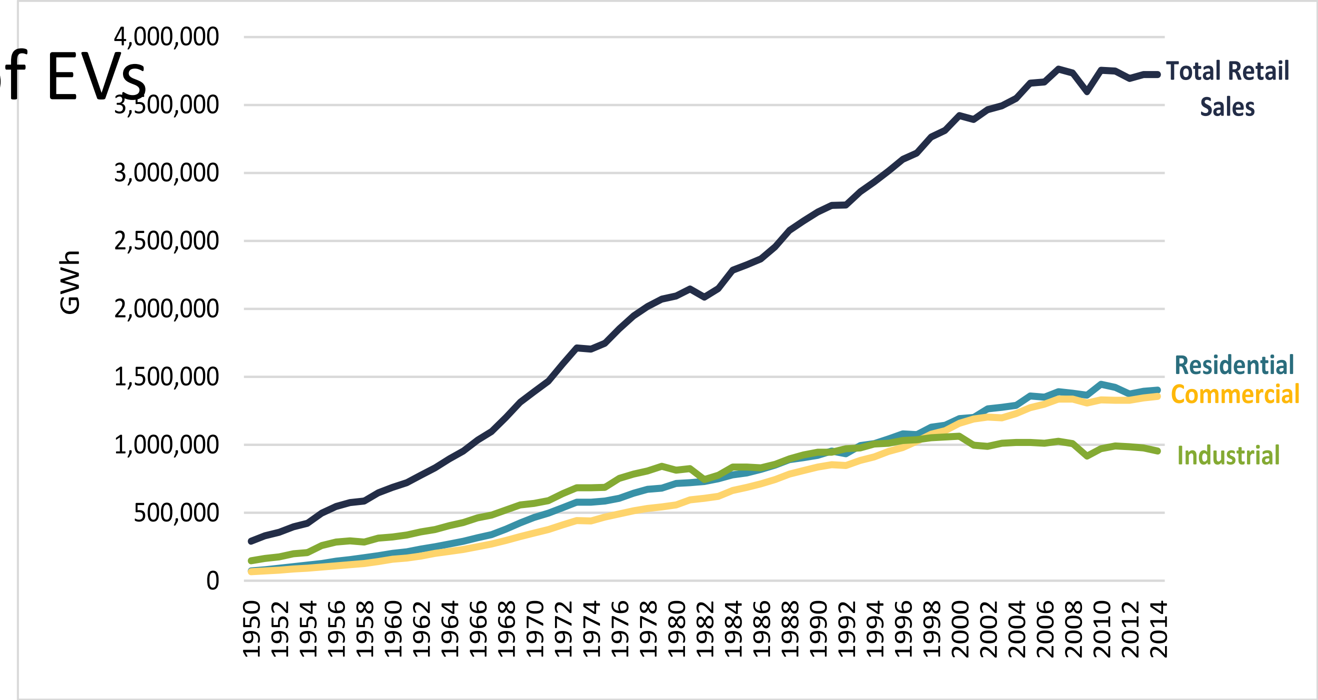
Melissa Whited

Synapse Energy Economics

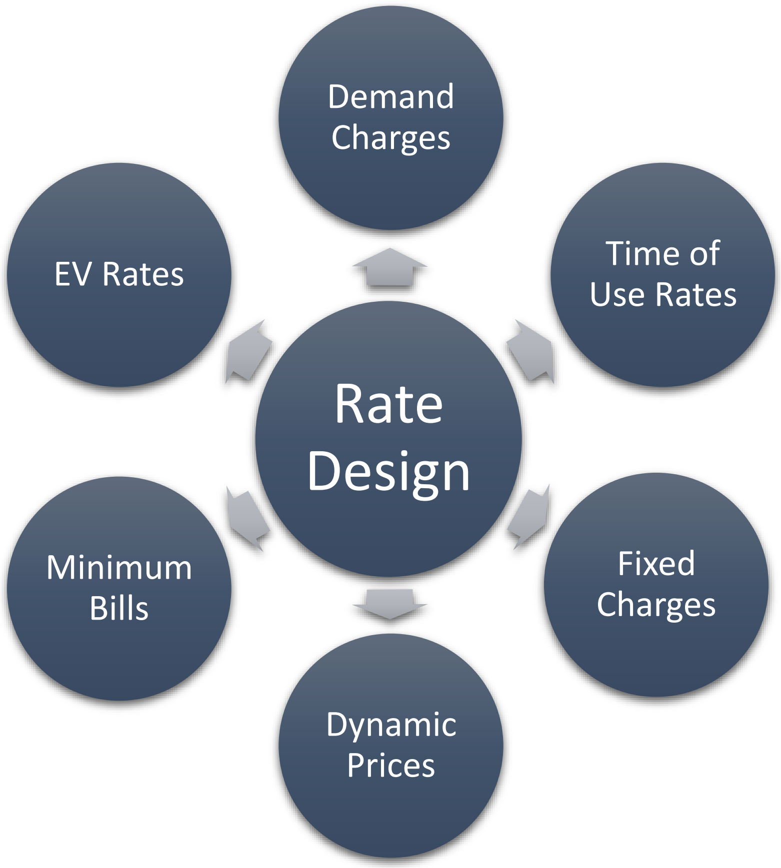
Challenges

- Environmental goals
- Declining sales
- Integration of distributed generation
- Integration of EVs

Image: Glennia, Flickr

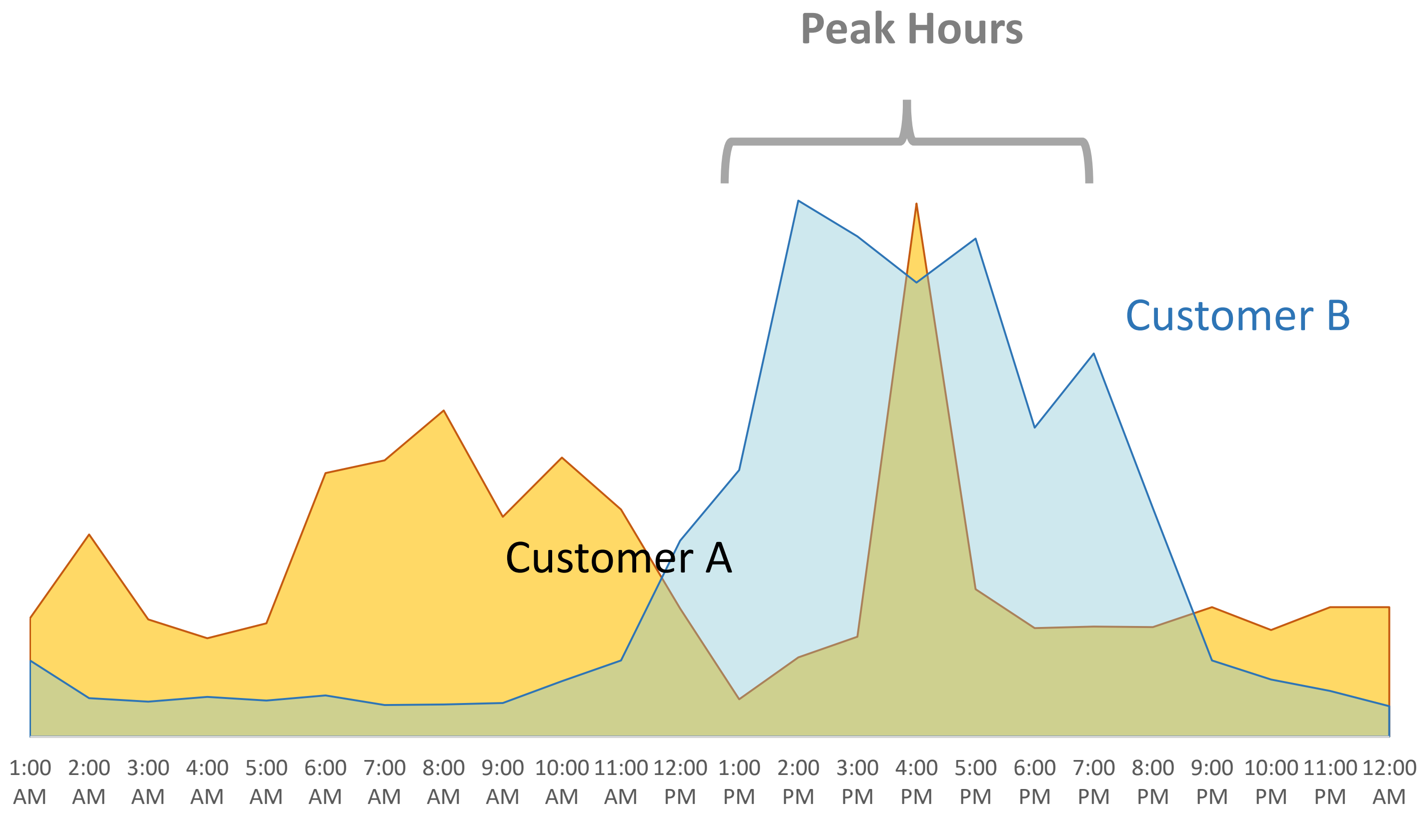


Options


Demand Charges
Time of Use Rates
Fixed Charges
Dynamic Prices
Minimum Bills
EV Rates
Rate Design

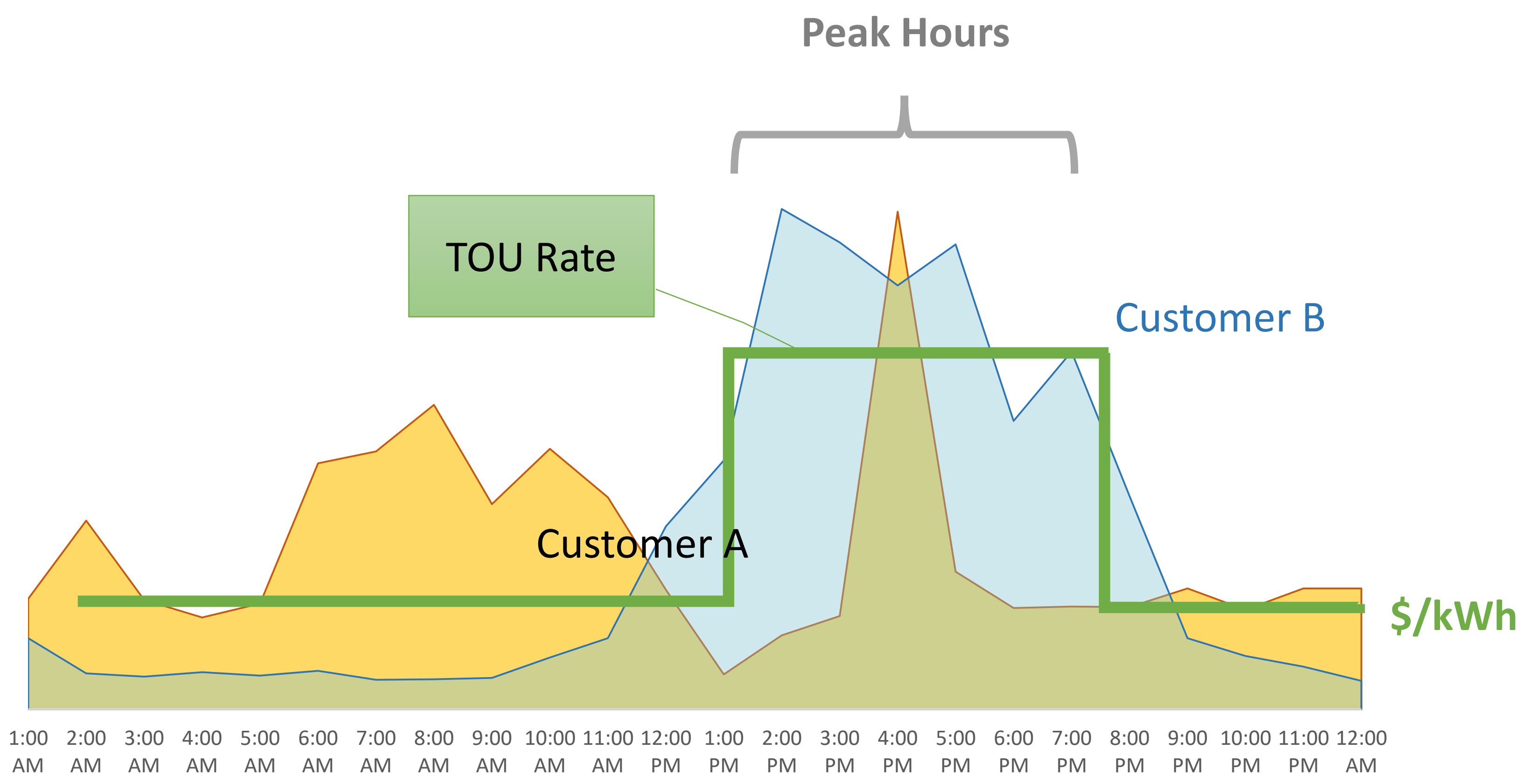
Demand Charges

- Customer A and Customer B pay the same bill under a demand charge
- Even with demand charges that apply only during peak hours, the signal is only concentrated in one hour.



Modifications to demand charges

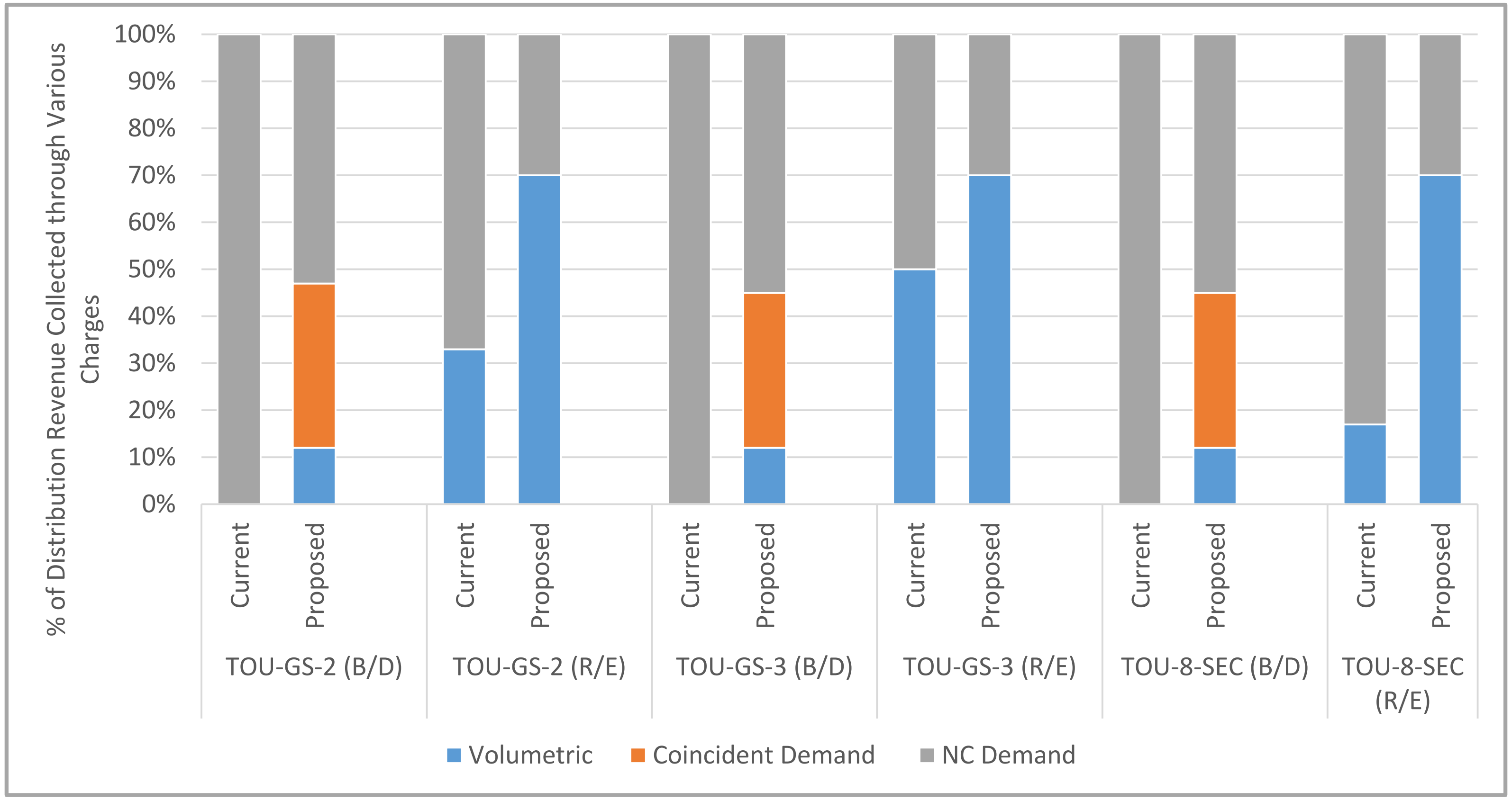
- TOU rates can provide a more accurate reflection of cost- causation



Differentiating distribution costs

- "…non-coincident demand charges do not reflect cost causation for primary distribution, transmission, or generation capacity costs"
- "…non-coincident demand charges also promote inefficient use of energy" and do not promote socially beneficial energy usage

- CPUC D.18-08-013



Demand Charges & EVs

- Workplace C

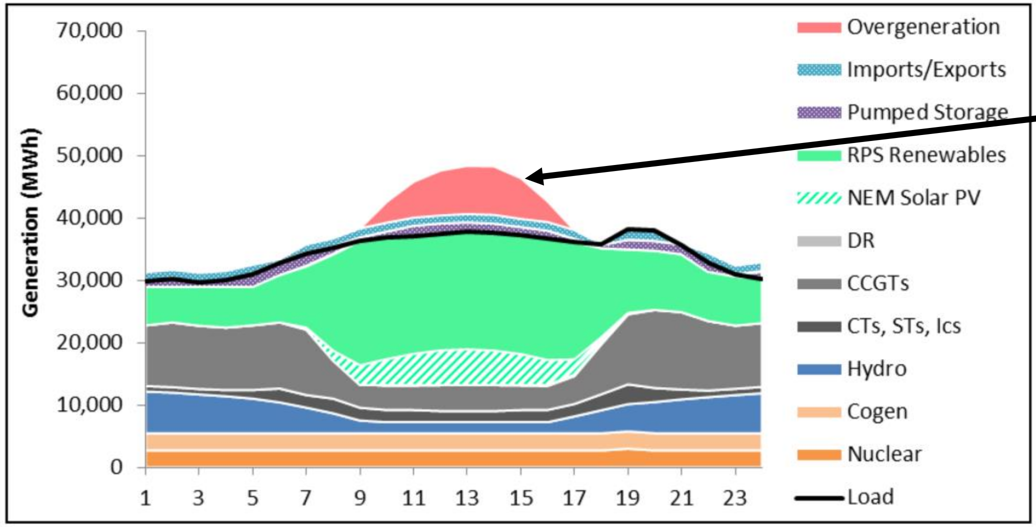


Figure 5. Example of an analysis of the impact of high VG on net load shape and resulting overgeneration

Source: E3 2014

EVs could help offset solar overgeneration

- But most C&I customers have a demand charge
  - = Strong disincentive to charge multiple vehicles

EV Rate Innovation

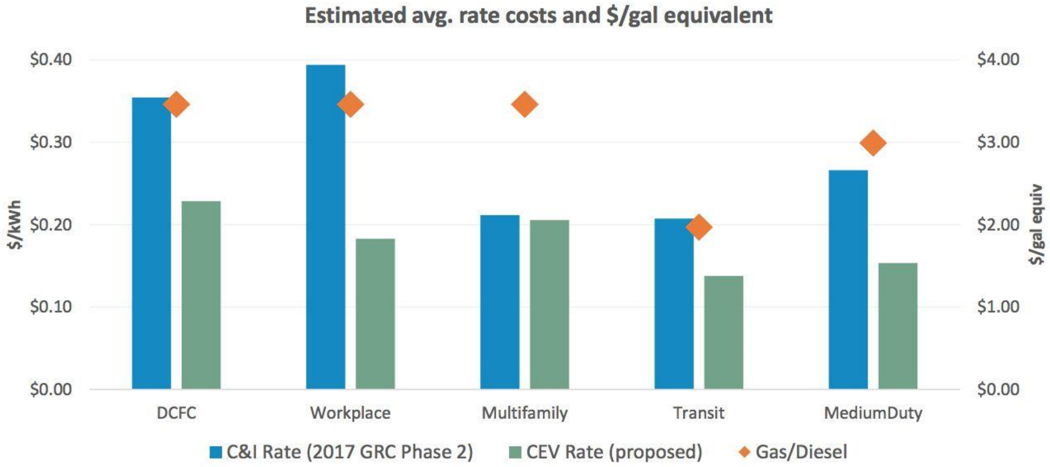
Many utilities offer C&I EV TOU rates, which enable workplaces to avoid crippling demand charges

PG&E's proposed subscription alternative

Estimated bill savings for sample site types

For modeled customer sites, new EV rates can enable significant savings compared to existing commercial rate plans

Actual bill impacts will vary for each customer depending on charging usage patterns



ate and billing estimates are preliminary and only reflect the sample site modeled. Actual costs will ary based on approved rate values, as well as individual site energy usage.

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About Synapse Energy Economics

- Synapse Energy Economics is a research and consulting firm specializing in energy, economic, and environmental topics. Since its inception in 1996, Synapse has grown to become a leader in providing rigorous analysis of the electric power sector for public interest and governmental clients.
- Staff of 30+ experts
- Located in Cambridge, Massachusetts

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