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

NARUC Staff Sub-committee on Rate Design Panel

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The Regulatory Assistance Project (RAP)®
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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

**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
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
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
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

<table>
<thead>
<tr>
<th>Hours</th>
<th>TOU Period</th>
<th>Church</th>
<th>School</th>
<th>Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekday 4-8 PM</td>
<td>On-Peak</td>
<td>5</td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>Weekday 9-4</td>
<td>Mid-Peak</td>
<td>5</td>
<td>45</td>
<td>50</td>
</tr>
<tr>
<td>Nights</td>
<td>Off-Peak</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Weekend Day</td>
<td>Off-Peak</td>
<td>45</td>
<td>5</td>
<td>50</td>
</tr>
</tbody>
</table>

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 shared 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
Illustrative Rate Designs that Promote Alignment
Antiquated Example Rate #1
(a real utility in the U.S.)

<table>
<thead>
<tr>
<th>Customer Charge</th>
<th>$/Month</th>
<th>$ 209.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand Charge</td>
<td>$/kW</td>
<td>$ 21.35</td>
</tr>
<tr>
<td>Energy Charge</td>
<td>$/kWh</td>
<td>$ 0.050</td>
</tr>
</tbody>
</table>

- Demand charge is based on NCP demand
- Energy charge is not time-differentiated
Better: Example Rate #2
Georgia Power TOU-GS-10

<table>
<thead>
<tr>
<th></th>
<th>$/Month</th>
<th>$ 209.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Charge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demand Charge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>On-Peak</td>
<td>$/kW</td>
<td>$ 15.66</td>
</tr>
<tr>
<td>Maximum Peak</td>
<td>$/kW</td>
<td>$ 5.23</td>
</tr>
<tr>
<td>Energy Charge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>On-Peak</td>
<td>$/kWh</td>
<td>$ 0.122</td>
</tr>
<tr>
<td>Shoulder Peak</td>
<td>$/kWh</td>
<td>$ 0.063</td>
</tr>
<tr>
<td>Off-Peak</td>
<td>$/kWh</td>
<td>$ 0.024</td>
</tr>
</tbody>
</table>

- Higher coincident-peak demand charge
- 5 hour window
- Steep TOU energy rate
Sacramento Rate Design
NR Best of Class

<table>
<thead>
<tr>
<th></th>
<th>Customer Charge</th>
<th>Site Infrastructure Charge</th>
<th>Super Peak Demand Charge</th>
<th>Energy Charge</th>
<th>Super Peak</th>
<th>On-Peak</th>
<th>Off-Peak</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$108/month</td>
<td>$3.80/kW/month</td>
<td>$7.65/kW</td>
<td>Summer</td>
<td>$0.20</td>
<td>$0.137</td>
<td>$0.109</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Winter</td>
<td>N/A</td>
<td>$0.104</td>
<td>$0.083</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Description</th>
<th>Distribution</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metering, Billing</td>
<td>$100.00</td>
<td>Month</td>
</tr>
<tr>
<td>Site Infrastructure Charge</td>
<td>$2/kW</td>
<td>kW</td>
</tr>
<tr>
<td>Summer On-Peak</td>
<td>$0.040</td>
<td>kWh</td>
</tr>
<tr>
<td>Summer/Winter Mid-Peak</td>
<td>$0.035</td>
<td>kWh</td>
</tr>
<tr>
<td>Summer/Winter Off-Peak</td>
<td>$0.020</td>
<td>kWh</td>
</tr>
<tr>
<td>Super Off-Peak</td>
<td>$0.010</td>
<td>kWh</td>
</tr>
<tr>
<td>Critical Peak</td>
<td>Maximum 50 hours per year</td>
<td>kWh</td>
</tr>
</tbody>
</table>

### Restructured State
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

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

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
Staff Subcommittee on Rate Design
Georgia Power’s Real Time Pricing (RTP) Program

Glenn Dyke
Customer Pricing Manager
Georgia Power Company
Georgia Power’s RTP Program

- Started in 1993
- Designed to Encourage Growth
- Over 2,000 Customers Today
- 20% of GPC Retail Revenue
- Two Versions: Day Ahead & Hour Ahead
- “Marginal Prices for Marginal Load”
- Two Part Rate
- CBL Based on Historic Usage

Two Part Rate

Two Versions: Day Ahead & Hour Ahead

CBL Based on Historic Usage

“Marginal Prices for Marginal Load”

Over 2,000 Customers Today

20% of GPC Retail Revenue

Started in 1993

Designed to Encourage Growth
Example: One Day on RTP

- **Enjoy Low Cost Energy**
- **Avoid High Prices**
- **Earn Credits**

**Hours of the day**

- **kW Demand Thousands**
- **RTP Price (cents per kWh)**

**Graph Key**

- **RTP Price**
- **Actual kW**
- **CBL kW**

**Table:**

<table>
<thead>
<tr>
<th>Actual kW</th>
<th>CBL kW</th>
<th>RTP Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>6¢</td>
<td>3¢</td>
<td>9¢</td>
</tr>
<tr>
<td>12¢</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
What Affects Prices?

- **Performance**: Unit Availability
- **Fuel Market**: Coal
- **Weather**: Hydro, Temperature, Gas

What affects prices can be broken down into performance (unit availability), fuel market (coal), and weather (hydro, temperature, gas).
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

www.synapse-energy.com - Melissa Whited
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

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

EVs could help offset solar overgeneration
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.

Estimated avg. rate costs and $/gal equivalent

chart showing cost comparisons for different site types:
- DCFC: C&I Rate (2017 GRC Phase 2), CEV Rate (proposed), Gas/Diesel
- Workplace: C&I Rate (2017 GRC Phase 2), CEV Rate (proposed), Gas/Diesel
- Multifamily: C&I Rate (2017 GRC Phase 2), CEV Rate (proposed), Gas/Diesel
- Transit: C&I Rate (2017 GRC Phase 2), CEV Rate (proposed), Gas/Diesel
- Medium Duty: C&I Rate (2017 GRC Phase 2), CEV Rate (proposed), Gas/Diesel

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

www.synapse-energy.com - Melissa Whited
Slide 56
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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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