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Rate Design and Net Metering

Kit Carson Stakeholder Workshop

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Topics for today

- Key Principles and Background
- Changing Needs and Resource Options
- Cost Allocation
- Rate Design
- Considerations and Options for Reform
1 Key Principles and Background
Purposes of utility regulation

• Protect consumers
  • Prevent price discrimination
• Mimic results of a competitive market
  • Create efficient economy-wide outcomes
• Achieve public policy goals
  • Provide universal access to necessary services
  • Almost anything else!
Simplified rate-making process

1. **Determine revenue requirement**
   - **Net rate base**
     (Plant in service – depreciation reserve)
   - **Rate of return**
   - **Depreciation expense**
     (Plant in service x depreciation rate)
   - **Operating expense**
     (Fuel + purchased power + labor + labor overheads + supplies + services + income taxes)
   - **Other taxes**

   \[ \text{Net rate base} \times \text{Rate of return} \times \text{Depreciation expense} \times \text{Operating expense} + \text{Other taxes} = \$ \text{millions} \]

2. **Allocate costs among customer classes**
   - **Residential**
   - **Commercial**
   - **Industrial**
   - **Street lighting**

3. **Design retail rates**
   - Dollars per month
   - Dollars per kWh peak
   - Dollars per kWh off-peak
   - Cents per kWh peak
   - Cents per kWh off-peak
Principles for rate structure

• Primary goals
  • Revenue sufficiency and stability
  • Fair cost apportionment
  • Efficient levels of usage
  • Feasibility and understandability
  • Public policy goals

• Modern practice
  • Cost allocation: primarily about group equity
  • Rate design: primarily about efficient forward-looking incentives, customer understanding and individual bill impacts
Revenue-sales decoupling

• Sets revenue target every year
  • Under- or over-recovery results in rate adjustment
• Increases creditworthiness of utility
• Reduces downside to utility of energy efficiency and distributed generation
Determining customer classes

Types:
- Residential
  - Single-Family?
  - Multi-Family?
  - Solar?
  - Heating?
- Commercial
- Industrial
- Irrigation
- Street Lighting
Changing Needs and Resource Options
What’s new?

- Wind, solar and storage
- Customer-sited generation
- Energy efficiency
- Demand response
- Smart grid
- Electric vehicles
- Advanced metering
Variable renewable generation is growing quickly

Unpredictability of renewables varies

“Net Load” presents new shape
Variable renewables can be complementary
Flexibility strategies now span many timescales

Load-side resources can “shift” demand to times when surplus power is available.
Load-side resources can “shift” demand
Limited curtailment can “shed” during critical hours

Responsive load can “shimmy” to meet short-term grid needs

Source: PJM
3 Cost Allocation
Electric Cost Allocation for a New Era

A Manual

By Jim Lazar, Paul Chernick and William Marcus

Edited by Mark LeBel
Key principles

• How to define an equitable division of costs?
  • Cost causation – often historical
  • Costs follow benefits – typically present day

• Efficiency implications
  • Data and analysis from cost allocation process often informs rate design
  • Class cost allocations set boundaries that rate design must work within

• Older analytical techniques have trouble accounting for the features of the modern grid
Traditional ECOSS process
Issues with traditional demand & energy allocators

- Demand at what hours?
  - System peak, equipment peak, or class peak?
- Energy-classified costs are usually allocated using annual kWh usage
  - Fails to reflect time-varying costs
- Time-based allocation addresses these issues
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
Best practices for all frameworks

- Whether a cost is fixed or variable in the short term does not demonstrate causation
- Apportion shared assets on measures of usage
- Only customer-specific costs are customer-related
- Ensure broad sharing of administrative and general costs
- Move towards smarter customer classes
4 Rate Design
General goals of rate design

- Efficient forward-looking price signals
- Recovery of revenue requirement
- Equitable intra-class cost allocation
- Customer understanding and acceptance
- Achievement of public policy goals

Within overarching frame of imposing pricing discipline – Equivalent to competitive markets
Principles of smart rate design

1. Customer should be able to connect to grid for no more than the cost of connecting to grid

2. Customers should pay for grid services and power supply in proportion to how much they use these services and how much power they consume

3. Customers who supply power to grid should be fairly compensated for full value of power they supply
We pay for other “grids” in volumetric prices
## Examples of smart rate design

<table>
<thead>
<tr>
<th></th>
<th>Residential</th>
<th>Medium C&amp;I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Charge ($/mo.)</td>
<td>Multifamily: $7</td>
<td>$25</td>
</tr>
<tr>
<td></td>
<td>Small Single-Family: $10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Large Single-Family: $17</td>
<td></td>
</tr>
<tr>
<td>Site Infrastructure ($/kW)</td>
<td>N/A</td>
<td>$2</td>
</tr>
<tr>
<td>Off-peak (cents per kWh)</td>
<td>6 cents</td>
<td>5 cents</td>
</tr>
<tr>
<td>Mid-peak (cents/kWh)</td>
<td>9 cents</td>
<td>8 cents</td>
</tr>
<tr>
<td>On-peak (cents/kWh)</td>
<td>14 cents</td>
<td>13 cents</td>
</tr>
<tr>
<td>Critical peak (cents/kWh)</td>
<td>75 cents</td>
<td>75 cents</td>
</tr>
</tbody>
</table>
Fort Collins: Smart residential rate

<table>
<thead>
<tr>
<th>Customer Charge</th>
<th>$ 6.78</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off-Peak</td>
<td>$ 0.069</td>
</tr>
<tr>
<td>On-Peak</td>
<td>$ 0.241</td>
</tr>
<tr>
<td>Tier Charge (Over 700 kWh)</td>
<td>+ $.0194 / kWh</td>
</tr>
</tbody>
</table>

## Graphical Representation

- **Non-Summer (October–April)**: Weekdays Only
  - Off-Peak Hours (Approx. 2 AM–9 AM)
  - On-Peak Hours (Approx. 9 PM–2 AM)

- **Summer (May–September)**: Weekdays Only
  - Off-Peak Hours (Approx. 7 PM–2 AM)
  - On-Peak Hours (Approx. 2 AM–7 PM)
## Oklahoma Gas & Electric: SmartHours variable peak pricing

<table>
<thead>
<tr>
<th></th>
<th>Summer Variable Peak: 2 pm to 7 pm weekdays</th>
<th>Summer Off-peak: All other hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Charge ($/mo.)</td>
<td>$13</td>
<td></td>
</tr>
<tr>
<td>Low (cents per kWh)</td>
<td>5 cents</td>
<td>N/A</td>
</tr>
<tr>
<td>Standard (cents per kWh)</td>
<td>10 cents</td>
<td></td>
</tr>
<tr>
<td>High (cents/kWh)</td>
<td>22 cents</td>
<td></td>
</tr>
<tr>
<td>Critical peak (cents/kWh)</td>
<td>41 cents</td>
<td></td>
</tr>
<tr>
<td>All other hours</td>
<td>N/A</td>
<td>5 cents</td>
</tr>
</tbody>
</table>
Understandability and transitions

- Customers must be able to understand their rates and manage their bills
  - 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
- 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
5 Considerations and Options for Reform
Net metering puzzle

• Many jurisdictions adopted net metering in 2000s
  • Monthly netting and retail rate credit rollover
• Issues
  • Potential for revenue shifting increases with DG adoption
    • Different perspectives on value (or avoided costs) of clean DG
  • Costs of integrating high levels of variable DG
  • Inefficiencies in baseline rate design
Net metering solutions

- Netting period changes can be linked to time-varying rates
  - Under monthly netting, customer with zero kWh net consumption only pays customer charge
  - Moving to TOU period netting can be significant
- Delink export credit value from import rates
  - Top down in California
  - Flat “value of solar” in Minnesota
  - Bottom up (VDER) in New York
- Bi-directional distribution rate
  - Charge A&G costs to both imports and exports
Hawaiian Electric TOU rate

Interim Time-of-Use Rates*
(For illustrative purposes only)

PRICE (¢ per kWh)

*Illustration reflects September 2019 electric rates with applicable surcharges.
### Illustrative impact of TOU rate design and netting

<table>
<thead>
<tr>
<th>Rate Element</th>
<th>Rate</th>
<th>Unit</th>
<th>Time Period</th>
<th>Load</th>
<th>Generation</th>
<th>Net</th>
<th>Billed Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Charge</td>
<td>11.50</td>
<td>$/Month</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$ 11.50</td>
</tr>
<tr>
<td>Off-Peak</td>
<td>0.136</td>
<td>$/KWh</td>
<td>9 AM to 5 PM</td>
<td>195.3</td>
<td>477</td>
<td>-281.7</td>
<td>$ (38.31)</td>
</tr>
<tr>
<td>Mid-Peak</td>
<td>0.329</td>
<td>$/KWh</td>
<td>Other Times</td>
<td>198.6</td>
<td>42</td>
<td>156.6</td>
<td>$ 51.52</td>
</tr>
<tr>
<td>On-Peak</td>
<td>0.419</td>
<td>$/KWh</td>
<td>5 to 10 PM</td>
<td>140.1</td>
<td>15</td>
<td>125.1</td>
<td>$ 52.42</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td>534</td>
<td>534</td>
<td>0</td>
<td>$ 77.13</td>
</tr>
</tbody>
</table>
Changes to credit structure and value

- CA removed certain elements from retail rate credit value in new TOU structure
- MN created flat “value of solar” credit for some categories of projects
- NY “Value of Distributed Energy Resources” tariff creates time-varying “value stack” for energy, capacity, delivery, and environmental values
NY value of DER tariff

• Energy
  • Export credit linked to wholesale hourly prices

• Generation capacity
  • Per-kWh credit for exports 2 pm-7 pm in summer

• Delivery
  • System-wide per-kWh credit for exports in peak hours
  • Additional locational value in constrained areas

• Environmental
  • Based on greater of REC value or social cost of carbon
Bidirectional distribution rate

- Charged on both imports and exports but can be integrated with TOU netting
- Most appropriate for administrative and general costs but could include other cost categories

<table>
<thead>
<tr>
<th>Rate Element</th>
<th>Load</th>
<th>Generation</th>
<th>Net</th>
<th>Billed Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bidirectional charge</td>
<td></td>
<td></td>
<td></td>
<td>$0.01 per kWh</td>
</tr>
<tr>
<td>Off-Peak</td>
<td>195.3</td>
<td>477</td>
<td>-281.7</td>
<td>$2.82</td>
</tr>
<tr>
<td>Mid-Peak</td>
<td>198.6</td>
<td>42</td>
<td>156.6</td>
<td>$1.57</td>
</tr>
<tr>
<td>On-Peak</td>
<td>140.1</td>
<td>15</td>
<td>125.1</td>
<td>$1.25</td>
</tr>
<tr>
<td>Total</td>
<td>534</td>
<td>534</td>
<td>0</td>
<td>$5.63</td>
</tr>
</tbody>
</table>
Other options

• Buy all, credit all
  • Separation of rate for gross consumption and compensation for gross generation
• “Instantaneous” netting
  • Tracking imports and exports separately
• Higher customer charges
• Demand charges
Closely related issues

- Interconnection fees
- Contributions in aid of construction
- Renewable energy credit policy
- DG operational restrictions
- DG inverter requirements
Designing customer classes

• Considerations
  • Technology-specific customer classes may not have solid cost basis
  • Feedback loops between class definitions and rate design considerations
  • New Mexico has prohibition on certain types of distinctions

• Potential new distinctions
  • “Simple residential” and “Advanced residential”
Grandfathering vs. gradualism

• Grandfathering
  • More fully protects economics for existing net metering customers
  • Difficult administratively if multiple changes are made over time

• Gradualism
  • Less protective of economics for existing net metering customers
  • New rate designs can encourage more efficient behavior
About RAP

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