Regulatory Structures and Market Transformation

National Conference of State Legislators

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Principal

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The Regulatory Assistance Project (RAP)®
RAP – the Regulatory Assistance Project

RAP is a non-profit organization providing technical and educational assistance to government officials on energy and environmental issues. RAP staff have extensive utility regulatory experience. RAP technical assistance to states is supported by US DOE, US EPA and foundations.
Overview of What’s Hot – The Good and the Bad

• Solar costs down, NEM, tax incentives, VOC
• Rate Design
• Time of Use Rates
• Higher fixed fees, standby fees, demand charges
• Distribution System Planning to Control Costs
Costs Continue to Decline

Average PV System Price

- LBNL "Tracking the Sun IV"
- SEIA/GTM Research

Energy solutions
for a changing world
Distributed Generation is Growing

New U.S. PV Installations

+ 30% per year
Since 2001
Cumulative: 11+ GW

Installed Capacity (MW)

• On site generation
  – Prices to deploy are trending down
  – Electricity users value choice
    • To secure prices, or beat the market
    • To assure zero emissions, to do their part
    • To be cool
    • To cooperate with neighbors

• Automation (comms, smart systems, stds.) keeps it simple while chasing value
Consumer Perspective

• Rates are **Prices**
• Prices represent a **message to consumers**
• Utility Prices **signal system value**

• Consumers have **new choices**,
  – Is there **alignment** between customer value and grid value?
Principles for Modern Rate Design

Universal Service: A customer should be able to connect to the grid for no more than the cost of connecting to the grid.

Time-Varying: Customers should pay for grid services and power supply in proportion to how much they use and when they use it.

Fair Compensation: Customers supplying power to the grid should be compensated fairly for the value of the power they supply.
Resources

- **Smart Rate Design for A Smart Future**
  - With appendices:
    - Cost allocation
    - Rate Design Primer
    - Retail Competition
    - Monopoly Power
Grid **Value** from DER – Differentiate by

- **Time**
  - Peaks and managing predictable solar, CHP patterns
- **Location**
  - High marginal cost places
- **Attribute**
  - Unbundled energy, capacity, ancillary
Cross-Subsidies...

- Subsidies are endemic in utility rates
- Averages smooth out distinctions among customers
- **Rough justice** coupled with some **intentional bias** is the norm
- Explicit, appropriate subsidies are fine
  - No more (hidden or unintentional shifts)
# Rate Design Segment

## Simple Residential Tariff

<table>
<thead>
<tr>
<th>Rate Element</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Charge $/month</td>
<td>$5.00</td>
</tr>
<tr>
<td>Energy Charge $/kWh</td>
<td>$0.10</td>
</tr>
</tbody>
</table>
A Fixed TOU Rate in Use

• **On-Peak**
  Summer: weekdays 10 a.m. - 8 p.m.
  Winter: weekdays 7 a.m. - 11 a.m. and 5 p.m. - 9 p.m.

• **Intermediate-Peak**
  Summer: weekdays 7 a.m. - 10 a.m. and 8 p.m. - 11 p.m.
  Winter: weekdays 11 a.m. - 5 p.m.

• **Off-Peak**
  Summer: weekdays 11 p.m. - 7 a.m., Sat., Sun., holidays
  Winter: weekdays 9 p.m. - 7 a.m., Saturday, Sunday, holidays
Sample Time of Use with Critical Peak:

<table>
<thead>
<tr>
<th>Rate Element</th>
<th>Based On the Cost Of</th>
<th>Illustrative Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Charge</td>
<td>Customer-Specific Costs Only</td>
<td>$7.00/month</td>
</tr>
<tr>
<td>Off-Peak Energy</td>
<td>Baseload Resources + transmission and distribution</td>
<td>$.08/kWh</td>
</tr>
<tr>
<td>Mid-Peak Energy</td>
<td>Baseload + Intermediate Resources + T&amp;D</td>
<td>$.11/kWh</td>
</tr>
<tr>
<td>On-Peak Energy</td>
<td>Baseload, Intermediate, and Peaking Resources + T&amp;D</td>
<td>$.15/kWh</td>
</tr>
<tr>
<td>Critical Peak Energy (or PTR)</td>
<td>Demand Response Resources</td>
<td>$.75/kWh</td>
</tr>
</tbody>
</table>
Peak Load Benefits of Different Residential Rate Designs

Conceptual Representation of the Risk-Reward Tradeoff in Time-Varying Rates

- Potential Reward (Discount from Flat Rate)
- Increasing Reward
- Increasing Risk
- Risk (Variance in Price)

- Flat Rate
- Inclining Block Rate
- Seasonal Rate
- TOU
- Super Peak TOU
- CPP
- VPP
- RTP
Enabling Technology Improves Price Response
Contrasting Direct Demand Response and Dynamic Pricing

• **Dynamic pricing** can result in a steady fairly reliable reduction in peak demand, thereby altering the daily load curve, but it can not impact the need to reduce demand as a result of a specific event.

• **Active Load Control** can be employed to respond to specific emergency events to maintain reliability.
Contrasting Direct Demand Response and Dynamic Pricing

In determining whether to use a dynamic pricing rate design or a direct demand response program, the question is whether you want to lower the peak demand curve and shift load in which case changes are incorporated through the rate design or whether you want to create a product that can be used to reduce demand when system peaks are getting too high.
A Peak Time Rebate in Use

- Delaware Delmarva Power and Light (DPL) has a critical peak rebate program for residential customers.
- Customers receive a $1.25 credit for every kWh they reduce their usage below a baseline during an event.
- Customers get this credit automatically; they do not have to enroll in the program.

## Price Elasticity at Work

<table>
<thead>
<tr>
<th>Customer Charge</th>
<th>$5.00</th>
<th>$20.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Charge</td>
<td>$0.12</td>
<td>$0.09</td>
</tr>
<tr>
<td>Change in Price/kWh</td>
<td></td>
<td>-25%</td>
</tr>
<tr>
<td>Predicted Change in Usage</td>
<td></td>
<td>+5%</td>
</tr>
</tbody>
</table>
Customer Specific Costs Appropriate for the Monthly Customer Charge

- Billing
- Collections
- Share of transformer and service drop
Straight Fixed / Variable:

100% of Distribution System Classified as Customer-related
Net metering growth

Number of net metered customers in the U.S.

- 2003
- 2004
- 2005
- 2006
- 2007
- 2008
- 2009
- 2010
- 2011
Maturing Solar: Changes Ahead for Net Metering?

• Compensation method suited for infant industry
  – Emphasis of Simple compensation and interconnection
  – Rough compensation “close enough” at smaller numbers
  – When higher numbers create a financial effect on the utility, a more rigorous compensation method can be considered
Value of Solar Studies: Market Values Only

- **Maine Short-Run**: $0.090
- **Maine Long-Run**: $0.138
- **Minnesota**: $0.135
- **Austin**: $0.107
- **Average per-kWh Rate**: $0.115

Maine values do not include market price response.
Rate Design Principles for DG Users

• DG users should not experience discrimination
• Time-varying rates are appropriate in both directions
• PV user should be able to connect to the grid for no more than the cost to connect
• PV user should be able to avoid the retail rate for all on-site consumption of on-site power
• PV user should pay for T&D service at non-discriminatory rates for power received from the grid
• Recognize “value of solar” to the grid when establishing fair rates and compensation for DG users
Resources

• Designing Distributed Generation Tariffs Well
Complementary Policies

• **Distribution planning** to establish locational and time values

• **Decoupling** to remove throughput incentives and address revenue adequacy and stability
  – With *minimum bill* if PUC judges it needed

• **Outcome-based regulation** to promote most valuable utility activity

• **Technology** when business case informed by value is compelling

• **Bill simplicity** so customers (or their agent) can understand the value of choices
California and New York

• California PUC has directed its utilities to open up the distribution planning process
  – Use DG and DR as primary resources

• NY PSC in its Reforming the Energy Vision process has set its utilities on a similar path
  – Anticipates avoiding significant grid costs from typical solutions
  – Potential transfer of cost from utility to customers choosing to deploy DG and DR
Trends are Clear

• More automation
• More valuable choices for individuals
  – Potential for more consumer interest for services
  – What happens if storage becomes more accessible to consumers?
• What will utilities and their regulators do?
Boothbay Pilot - Peak Shaving

Radial nature of electric service and local distribution circuits on the Boothbay peninsula defines the electrical region for the Pilot Project – Total Peak load – Approx. 30 MW.

Source: GridSolar
NRRI Presentation
Boothbay Maine NTA Pilot Resource Mix

<table>
<thead>
<tr>
<th>Resource</th>
<th>RFP I</th>
<th>RFP II</th>
<th>Totals</th>
<th>Pct.</th>
<th>Units</th>
<th>3 Year Price</th>
<th>10 Yr. (Levelized) Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficiency</td>
<td>237.00</td>
<td>111.25</td>
<td>348.25</td>
<td>19%</td>
<td>7</td>
<td>$23.51</td>
<td>$10.47</td>
</tr>
<tr>
<td>Solar</td>
<td>168.83</td>
<td>106.77</td>
<td>275.60</td>
<td>15%</td>
<td>14</td>
<td>$46.05</td>
<td>$13.19</td>
</tr>
<tr>
<td>BUG (same)</td>
<td>500.00</td>
<td>500.00</td>
<td>500.00</td>
<td>27%</td>
<td>1</td>
<td>$17.42</td>
<td>$20.63</td>
</tr>
<tr>
<td>Demand Response</td>
<td>0.00</td>
<td>250.00</td>
<td>250.00</td>
<td>13%</td>
<td>1</td>
<td>$110.00</td>
<td>$57.65</td>
</tr>
<tr>
<td>Battery</td>
<td>0.00</td>
<td>500.00</td>
<td>500.00</td>
<td>27%</td>
<td>1</td>
<td>$163.70</td>
<td>$75.99</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>905.83</td>
<td>1468.02</td>
<td>1873.85</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* RFP I excludes Maine Micro Grid project; Efficiency increased to reflect EMT contract option.

Boothbay Maine NTA Pilot
Cost Comparison of NTA v. Transmission

Energy Efficiency Is the Lowest Cost Resource

Source: Lazard, 2015
About RAP

The Regulatory Assistance Project (RAP) is a global, non-profit team of experts that focuses on the long-term economic and environmental sustainability of the power sector. RAP has deep expertise in regulatory and market policies that:

- Promote economic efficiency
- Protect the environment
- Ensure system reliability
- Allocate system benefits fairly among all consumers

Learn more about RAP at www.raponline.org

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