Utility Rate Design for Solar PV Customers

Solar Power PV Conference & Expo
Boston MA

Presented by Richard Sedano

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Introducing RAP and Rich

• 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.

  – Richard Sedano directs RAP’s US Program. He was commissioner of the Vermont Department of Public Service from 1991-2001 and is an engineer.
Focus of this panel and this presentation

• What the customer pays for electricity and can avoid with on site resources
• What revenue the customer generating kWhs can get for on site production
Objectives decision-makers may have

- Encourage wise use of energy
- Encourage wise investment in energy capital
- Reduce cost-intensive peak use
- Properly allocate costs
- Strategically deploy grid resources
- Address climate change
- Provide customers with choices
- Enable new grid resources
- Ensure fairness, social justice
- Reasonably ensure utility revenue adequacy
- Project an aura of progress in a state
Objectives decision-makers may have

- Cost and Resource Management
- Success with other Social Objectives

• 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
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.
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?
  – Do time and place matter?
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)
Flat Rates

• Flat delivery rates communicate little useful to customers
  — Even though usage at particular times drives capital investment (and upward pressure)
  — Even though price differentiation can drive important customer/system operations resources like demand response, customer generation, and storage as well as energy efficiency
Rate Design Options

- Time of Use (with critical peak)
- Demand charge
- **Net metering**
- Minimum bills
- High Customer Charges
- Cost driven Customer Charge, DG & large houses
- Subscription demand charges
- Bidirectional rates
- Value of solar
- Fees imposed on DG users
- Feed-in-tariffs
Nearly Every State Authorizing Net Metering

- Solar service industry growing
  - Making use of declining material cost
  - Making use of favorable federal fiscal policy
    - Some states supplement the deal
  - "Soft costs" declining
  - Lease business model removes first cost barrier
Net metering growth

Number of net metered customers in the U.S.
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
Rate Design Options

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Value of Solar Studies: Utility Economic Values Only

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

Utility Economic Values Only
# Feed In Tariff

## Gainesville Regional Utilities FIT for Systems Energized in 2013

<table>
<thead>
<tr>
<th>Amount</th>
<th>Terms</th>
<th>Eligible system size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rooftop- or pavement-mounted systems &lt;10 kW</td>
<td>20-year contract</td>
<td>Ground-mounted systems maximum: 1,000 kW</td>
</tr>
<tr>
<td>Ground-mounted systems &lt;10 kW: $0.21/kWh</td>
<td></td>
<td>Building- or pavement-mounted systems: 300 kW</td>
</tr>
<tr>
<td>Rooftop- or pavement-mounted systems &gt;10 kW to 300 kW: $0.18/kWh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ground-mounted systems &gt;10 kW to 25 kW: $0.18/kWh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ground-mounted systems &gt;25 kW to 1,000 kW: $0.15/kWh</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Typical FIT Goals

Utilities

- Price relates to short and long run costs
  - Escalating
- Consistent across PV system size
- Term enables capacity deferral
- Control
- Terms linked to performance

Investors

- Price relates to system cost, return
- Flat price reduces risk
- Recognition of locational value
- Term enables investment recovery
- All output will be compensated
- Enduring FIT policy
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
RAP Resources

• Smart Rate Design for A Smart Future
  – With appendices:
  • Cost allocation
  • Rate Design Primer
  • Retail Competition
  • Monopoly Power
RAP Resources

- **Designing Distributed Generation Tariffs Well**: Fair Compensation in a Time of Transition
RAP Resources

• **Teaching the “Duck” to Fly, Second Edition**
  – Includes a rate design strategy
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
"Duck Curve" Showing Net System Demand on System with High Levels of Solar and Wind Generation

December Peak Day 2020

System

Net of Wind and Solar

Energy solutions for a changing world
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

rsedano@raponline.org
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
## Critical Peak with a Demand Charge

<table>
<thead>
<tr>
<th>Rate Element</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs to Connect to the Grid</td>
<td></td>
</tr>
<tr>
<td>Billing and Collection</td>
<td>$4.00/month</td>
</tr>
<tr>
<td>Transformer Demand Charge</td>
<td>$1.00/kVA/month</td>
</tr>
<tr>
<td>Power Supply and Distribution (both directions)</td>
<td></td>
</tr>
<tr>
<td>Off-Peak</td>
<td>$.07/kWh</td>
</tr>
<tr>
<td>Mid-Peak</td>
<td>$.10/kWh</td>
</tr>
<tr>
<td>On-Peak</td>
<td>$.15/kWh</td>
</tr>
<tr>
<td>Critical Periods</td>
<td>$.75/kWh</td>
</tr>
</tbody>
</table>

*Energy solutions for a changing world*
Vulnerable Customers

• Foundation: base rates are fair
  — Rough justice without bias
  — Explicit subsidies can depart from this
• Complement existing support system
  — LIHEAP, Weatherization
  — Defines target population (manageability)
• Avoid high customer charge
• BGS to assure default supply
Lifeline Rates can maintain a consumption price signal

<table>
<thead>
<tr>
<th></th>
<th>Residential</th>
<th>Low-Income</th>
<th>Discount %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Charge</td>
<td>$3.50</td>
<td>$1.75</td>
<td>50%</td>
</tr>
<tr>
<td>First 300 kWh Summer</td>
<td>$0.046</td>
<td>$0.019</td>
<td>58%</td>
</tr>
<tr>
<td>Over 300 kWh Summer</td>
<td>$0.096</td>
<td>$0.036</td>
<td>63%</td>
</tr>
<tr>
<td>First 480 kWh Winter</td>
<td>$0.046</td>
<td>$0.019</td>
<td>58%</td>
</tr>
<tr>
<td>Over 480 kWh Winter</td>
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Some states use a percentage of income cap, which can promote consumption
Explicit Subsidies Can Address Vulnerable Customers

• Percentage of Income (on delivery)
  — Caps amount a family pays
  — Requires income information
  — Can lead to “free” electricity

• % discount (on delivery)
  — Each unit costs something
  — Build in energy efficiency programs

• Aggregated commodity