Designing Time-of-Use Rates

Missouri Energy Initiative – Midwest Energy Policy Series
Topics for Today

- Principles and Background
- Key Design Choices for TOU Rates
- Real-World Examples
1 Principles and Background
Simplified rate-making process

- **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

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

- **Design retail rates**
  - Dollars per month
  - 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
Principles of Smart Rate Design

1. Customers 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
Cost Causation in General

- Nearly every element of the electric system is driven by the shared requirements of many customers
  - Exceptions: basic meters, most service drops, some transformers
- Each function has distinct cost drivers
  - Fuel, spot energy and some contract purchase costs vary by time
  - Coincident peaks drive the amount of generation capacity, while year-round load patterns determines capacity mix and thus costs
  - Coincident peaks matter in T&D sizing, but line losses are another important consideration
- Tradeoffs exist between capital, labor, fuel, and other expenses

Technology and engineering matter!
Key Design Choices for Time-of-Use Rates
TOU Design Parameters

- Goals of TOU rate design
  - Improve cost causation basis of rates and intra-class cost allocation
  - Avoiding adverse impacts to revenue stability and individual customer bills
  - Keep rates understandable and allow customers to manage their bills

- Key design choices
  - Which customers?
  - What time patterns?
  - Which costs?
  - How do you ensure customer understanding and minimize adverse bill impacts?
Determining Customer Classes

Types:
- Residential
  - Low-income
  - Single-family and multi-family
  - Solar? Electric heating?
- Commercial
- Industrial
- Irrigation
- Street Lighting
Designing Peak Periods

• Tradeoffs
  • Too narrow risks missing or shifting peak without reducing it
  • Too broad makes shifting load difficult for customers and penalizes those without movable load

• Options
  • Different peak periods for different rate classes
  • “Feathering” – allowing customers to choose between different 3-hour periods (e.g., 3 pm to 6 pm, 4 pm to 7 pm, 5 pm to 8 pm)
Start With Costs By Function

- Billing and Collection
- Site Infrastructure
- A&G Costs
- Distribution Peaking
- Distribution Mid-Peak
- Distribution Backbone
- Network Transmission
- Transmission Backbone
- Demand Response
- Peaking Generation
- Mid-Merit Generation
- All Hours Generation
Build a Cost-Based TOU Rate for Shared Elements of System

Critical Peak Rate
75 cents per kWh

On-Peak Rate
22 cents per kWh

Mid-Peak Rate
14 cents per kWh

Off-Peak Rate
8 cents per kWh

Distribution Augmentation for Mid-Peak
Network Transmission
Mid-Merit Generation

Distribution Backbone
Transmission Backbone
Baseload Generation

DR
Peaking Distribution
Peaking Generation

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24

Hour of Day
Understandability and Transitions

- Customers must be able to understand their rates and manage their bills
  - Basic explanations and educational materials
  - 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
3 Real-World Examples of TOU Rates
Fort Collins: Smart residential rate

<table>
<thead>
<tr>
<th></th>
<th>Summer</th>
<th>Winter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Charge</td>
<td>$ 6.78</td>
<td></td>
</tr>
<tr>
<td>Off-Peak</td>
<td>$ 0.069</td>
<td>$ 0.067</td>
</tr>
<tr>
<td>On-Peak</td>
<td>$ 0.241</td>
<td>$ 0.216</td>
</tr>
<tr>
<td>Tier Charge (Over 700 kWh)</td>
<td>+ $.0194 / kWh</td>
<td></td>
</tr>
</tbody>
</table>
Hawaiian Electric TOU Rate

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

PRICE (¢ per kWh)

MIDNIGHT

O

HOURS

ON

OFF

PEAK

PEAK

Off-Peak

Mid-Day

On-Peak

32.9 ¢

13.6 ¢

41.9 ¢

*Illustration reflects September 2019 electric rates with applicable surcharges.
# Oklahoma Gas & Electric: Variable Peak Pricing

<table>
<thead>
<tr>
<th>Customer Charge ($/month)</th>
<th>$13.00</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Off-Peak (cents/kWh)</strong></td>
<td>3.27</td>
</tr>
<tr>
<td><strong>On-Peak (cents/kWh)</strong></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>3.27</td>
</tr>
<tr>
<td>Standard</td>
<td>7.70</td>
</tr>
<tr>
<td>High</td>
<td>18.40</td>
</tr>
<tr>
<td>Critical</td>
<td>38.00</td>
</tr>
</tbody>
</table>
4 Takeaways
Takeaways

• TOU rates (and their cousins) are important tools to optimize future system costs
• Key design choices are inter-related and must be considered together
• Decoupling and fuel adjustment clauses can minimize concerns about revenue sufficiency and stability
Resources

- Smart Rate Design for a Smart Future
- Smart Nonresidential Rate Design for a Smart Future

raponline.org
About RAP

The Regulatory Assistance Project (RAP)® is an independent, non-governmental organization dedicated to accelerating the transition to a clean, reliable, and efficient energy future.

Learn more about our work at raponline.org