Traditional Economic Regulation of Electric Utilities

Electric Utility Ratemaking Education and Engagement Workshop

Regulatory Assistance Project
www.raponline.org
The Regulatory Assistance Project (RAP) is a global NGO providing technical and policy assistance to government officials, agency staff, and others on energy and environmental issues.

- Foundation-funded; some contracts
- Non-advocacy; no interventions

Introductions

Jim Lazar
John Shenot
Jessica Shipley
Outline

• 120 minute session
• Genesis of Regulation
• Roles of Utilities and Regulators Today
• Ratemaking Basics:
  • Revenue Requirement
  • Cost Allocation
  • Rate Design Basics
1 A Very Brief History of Regulation
Medieval England Accommodations

- Business “affected with the public interest.”
- Prices regulated due to monopoly stature

New Inn, Gloucester, 1454
US Origins: Munn v. Illinois (1877)

- Grain elevators charging monopoly prices to farmers.
- Supreme Court ruled “affected with the public interest” and subject to price regulation.
Bluefield Water Works (1935)

- Prudent investment rule.
- Utility entitled to a return comparable to companies with similar risks.
Hope Natural Gas (1944)

- “Just and reasonable” standard upheld.
- End result, not the method employed.
- Intervenors have limited rights.
Market Street Railway (1945)

- Company not entitled to recover cost of stranded assets due to technological evolution.
Roaring ’60s and Scary ’70s

- Load Growth
- + Inflation

- Avoided Cost for Independent Power
- Right of Intervention
- PURPA Ratemaking Standards

**Rate Design Standards**
- Cost of Service
- Time of Day
- Seasonal
- Interruptible
- Declining Block
- Lifeline

**Utility Service Standards**
- Master Metering
- Fuel Adjustment Clauses
- Information to Consumers
- Termination of Service
- Advertising
The PURPA Right of Intervention

• Any subject utility: 750 million kWh/year
• Any consumer may intervene
  • Right to present evidence
  • Right to reasonable rules of discovery
  • Right to intervenor compensation if no consumer advocate is funded.
The ’80s: Rate Increases, Cost Overruns, and Abandoned Nukes

- Expensive New Capacity
- High rates resulted in low load growth
- Three Mile Island incident led to 50 nuclear plant abandonments
Electric Utilities and Regulatory Commissions
Roles of Utilities

• Provide service to anyone who requests it
• Adhere to strict safety standards
• Adhere to reliability standards
• Provide adequate service
• Be responsive to customer needs
Investor-Owned Utilities (IOUs)

- Privately owned
- Publicly traded (usually)
- Profit-making enterprises
- Economically regulated by state public utility commissions (PUCs)
- Examples: Duke Energy Carolinas, Mississippi Power, Entergy Arkansas
Electric Membership Cooperatives

• Owned by members
• Not-for-profit
• Governed by Board of Directors elected by the members
• Less (or no) PUC oversight – varies by state
• Examples: Jackson (GA) EMC, Northern Virginia Electric Coop, SW Louisiana EMC
Public Power Utilities

- Owned by taxpayers
- Not-for-profit
- Governed by locally elected officials or their designees
- Less (or no) PUC oversight – varies by state
- Examples: Orlando (FL) Utilities Commission, City of Huntsville (AL), Nashville (TN) Electric Service
Asset Ownership

• Vertically Integrated Utilities
  • Own generation, transmission, distribution
  • Serve retail customers

• Generation & Transmission Utilities (G&Ts)
  • Own generation and transmission
  • Sell power at wholesale to other utilities
  • No (or few) retail customers

• Distribution Utilities
  • Own distribution, sometimes transmission
  • Buy power from other utilities or from markets
  • Serve retail customers
Roles of Economic Regulators

- Extensions of legislatures, executing powers granted in statutes
- Pricing: the essential regulatory act
  - More on this later
- Transparent and accessible process
- Service quality standards
- Prudence review
- Regulate in “the public interest”
“Regulatory Compact*”

- Utility accepts obligation to serve
- Government will approve rates that will compensate the utility fully for prudently incurred costs

*Not a binding agreement
3 Ratemaking and Rate Cases
Basics

- “Cost of Service” approach to determining a fair price for electric service:
  - Total costs for providing service are recovered, plus reasonable return on investment
- Regulators concerned with ‘just and reasonable’ rates
  - Sufficient but no more than necessary to cover costs and return on investment
- Rate design: structure of prices
Alternative Cost of Service Frameworks

- **Embedded Cost of Service**
  - As many methods as analysts

- **Marginal Cost of Service**
  - Short-run marginal cost
  - Long-run marginal cost
  - Incremental cost
  - Total system long-run incremental cost
Steps in Utility Ratemaking

Revenue Requirement

Functionalization
  • Assign cost to appropriate utility function

Classification
  • Classify functionalized costs to demand, energy, customer

Allocation
  • Assign cost responsibility among customer classes

Rate Design
  • Develop pricing method for recovering assigned costs
Steps in Utility Ratemaking

Revenue Requirement
Revenue Requirement

- First step: *revenue requirement*
  - Total amount the utility needs to cover costs and earn a fair rate of return on investment
- Requires determining:
  - Amount of investment allowed in rate base
  - Fair rate of return on that investment
  - Reasonable expenses to serve customers
Test Year Concept

• Definition: A specific time period chosen to assess a utility’s costs of service and revenue requirement.

• A test year can be either historical, which is the most common approach, or projected (often called a “future” or “forecasted” test year).
Revenue Requirement Formula

Revenue Requirement = (Rate Base Investment \times Rate of Return) + Operating Expenses

- Major capital expenditures, like power plants and transmission lines, but also buildings, computers, fleet vehicles, etc.
- Percent return utilities make annually on their investment
- Regular expenses, like labor, power purchases, fuel, insurance and other costs that recur regularly
Plant In Service At Original Cost

- **Generation**
  - $40,000,000

- **Transmission**
  - $10,000,000

- **Distribution**
  - $60,000,000

- **General Plant**
  - $20,000,000

- **Total Plant in Service**
  - $130,000,000
Rate Base Calculation

Plant in Service
- Accumulated Depreciation
= Net Plant in Service
+ Working Capital
+ Regulatory Assets
- Deferred Taxes
= Rate Base

- $130,000,000
- ($30,000,000)
- $100,000,000
- $ 5,000,000
- $ 1,000,000
- ($6,000,000)
- $100,000,000
Traditional Rate of Return Regulation: Cost of Capital

- Rate of Return
  - Cost of Common Equity
  - Equity Capitalization Ratio
- Cost of Debt
- Debt Ratio
- Preferred Stock and Short Term Debt as appropriate
Rate of Return Calculation

Equity Ratio
x Allowed Return on Equity
= Weighted Equity Cost

\[ \text{Equity Ratio} \times \text{Allowed Return on Equity} = \text{Weighted Equity Cost} \]

Debt Ratio
x Cost of Debt
= Weighted Debt Cost

\[ \text{Debt Ratio} \times \text{Cost of Debt} = \text{Weighted Debt Cost} \]

Sum = Rate of Return

\[ \text{Sum} = \text{Rate of Return} \]
Operating Expenses

- Production: $10,000,000
- Transmission: $1,000,000
- Distribution: $5,000,000
- Administrative and General: $2,000,000
- Taxes: $2,000,000
- Depreciation: $5,000,000

Total Expenses: $25,000,000
Traditional Rate of Return
Revenue Requirement

Rate Base
x Rate of Return
= Return Requirement
+ Operating Expenses
= Revenue Requirement

• $100,000,000
• x 8%
• $8,000,000
• $25,000,000
• $33,000,000
Steps in Utility Ratemaking

Revenue Requirement

Functionalization
  • Assign cost to appropriate utility function
Functionalization
Divide Revenue Requirement Among Utility Functions

- **Generation**
  - Fuel
  - Power Plants O&M

- **Transmission**
  - High-Voltage Lines (>30 kV)
  - Substations O&M

- **Distribution**
  - Substations
  - Primary lines
  - Line transformers
  - Secondary lines
  - Poles O&M

- **Customer**
  - Service drops
  - Meters
  - Billing
  - Metering
  - Customer Service

- **Lighting**
  - Fixtures
  - Brackets
  - Dedicated poles
Functionalization: Area of Limited Controversy

- Non-utility activities
- Lobbying
- Administrative and General Costs
  - Administrative & General Salaries
  - Outside Services
  - Employee Pensions and Benefits
  - Insurance / Damages
  - General Plant and Maintenance
Steps in Utility Ratemaking

Revenue Requirement

Functionalization
- Assign cost to appropriate utility function

Classification
- Classify functionalized costs to demand, energy, customer
Classification: General Categories of Cost Drivers

- **Generation**
- **Transmission**
- **Distribution**
- **Customer**

**Energy kWh**
(by time period?)

**Demand kW**
(Various measures)

**Customer-Related**

**Usage**

**System Coincident Peak**

**Peak Loads**

**Equipment Peaks**

**Customer Maximum Demand**

**Number, Size & Type of Customers and Connections**
Classification: Baseload Generation

- Expensive to build
- Cheap to operate
- Lower fuel costs
- Issue: Classify part of capital cost as though it is avoided fuel cost.
Baseload Generation Classification

- Classify 100% to “Demand”, then:
  - 1 coincident peak (1CP)
  - 4CP
  - 12CP
  - Average and Peak
  - Average and Excess
- OR: Classify between “Demand” and “Energy”
  - Peak Credit: ~75% Energy-related
- OR: No Classification: Base-Intermediate-Peak
  - All baseload costs assigned equally to all hours
Peaking Generation Classification

- Classify 100% to “Demand”, then:
  - 1CP
  - 4CP
  - 12CP
  - Average and Peak
  - Average and Excess
- OR: Classify between “Demand” and “Energy”
  - Peak Credit: ~80% Energy-related
  - A portion of costs may be assigned to reserve function
- OR: No Classification: Base-Intermediate-Peak
  - All peaking costs assigned equally to all peak hours
Classification: Transmission

- Older methods: classify as demand-related, allocate on peak.
- Purpose may be to move power, cheaper than moving fuel.
- Issue: Classify a portion of the investment as energy (avoided fuel)?
Transmission to Connect Baseload Power Plants

- Originally built to integrate coal
- Now used for interconnection between utilities
- Is this a “demand-related” investment?

Minnesota Power to idle North Shore coal plant
Pioneer Press July 9, 2015
Classification: Distribution

• Built to deliver energy
• Designed to carry peak demand
• Connects to every customer

• WHY was the system built in the first place?
• HOW MUCH did the customer pay to have the service installed?
Meters

- Historical: Used only for billing
- **Smart Meters:**
  - Conservation program design
  - Peak load management
  - Reliability services
  - Disconnect / reconnect
  - Billing
Classification: Customer-Related Costs

- Generation
- Transmission
- Distribution

- Energy kWh (by time period?)
- Demand kW (Various measures)
- Customer-Related

- Usage
- Peak Loads
- System Coincident Peak
- Equipment Peaks
- Customer Maximum Demand
- Number, Size & Type of Customers and Connections
Basic Customer Method:

ONLY customer-specific facilities classified as customer-related
Minimum System Method:

~50% of distribution system classified as customer-related
Straight Fixed / Variable:

100% of distribution system classified as customer-related
### Comparing Methods

<table>
<thead>
<tr>
<th>Cost Category</th>
<th>Basic Customer</th>
<th>Minimum System Method</th>
<th>Straight Fixed / Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poles</td>
<td>$5</td>
<td>$10</td>
<td>$10</td>
</tr>
<tr>
<td>Wires</td>
<td>$10</td>
<td>$20</td>
<td>$20</td>
</tr>
<tr>
<td>Transformers</td>
<td>$5</td>
<td>$10</td>
<td>$10</td>
</tr>
<tr>
<td>Services</td>
<td>$1</td>
<td>$1</td>
<td>$1</td>
</tr>
<tr>
<td>Meters</td>
<td>$1</td>
<td>$1</td>
<td>$1</td>
</tr>
<tr>
<td>Billing</td>
<td>$2</td>
<td>$2</td>
<td>$2</td>
</tr>
<tr>
<td>Customer Service</td>
<td>$2</td>
<td>$2</td>
<td>$2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$6</strong></td>
<td><strong>$26</strong></td>
<td><strong>$46</strong></td>
</tr>
</tbody>
</table>
Steps in Utility Ratemaking

Revenue Requirement

Functionalization
• Assign cost to appropriate utility function

Classification
• Classify functionalized costs to demand, energy, customer

Allocation
• Assign cost responsibility among customer classes
Customer Classes

- Definition: A collection of customers sharing common usage or interconnection characteristics.
- The utility’s revenue requirement is allocated to different customer classes, typically:
  - Residential
  - Commercial
  - Industrial
Allocation: Revenue Apportionment

- From the cost of service study results to the class allocation of a rate increase (or decrease).
- Mix of arithmetic and policy
- Gradualism
- Perceptions of equity and fairness
Presentation of Results

Rate of Return and Return Index

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>RESIDENTIAL</th>
<th>SMALL GENERAL SVC (0-20 KW)</th>
<th>MEDIUM GENERAL SVC (20-250 KW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allocated Rate Base</td>
<td>$87,878,094</td>
<td>$24,943,243</td>
<td>$8,342,091</td>
<td>$18,488,889</td>
</tr>
<tr>
<td>Return at Current Rates</td>
<td>$6,321,882</td>
<td>$342,980</td>
<td>-$587,203</td>
<td>$2,548,888</td>
</tr>
<tr>
<td>Rate of Return</td>
<td>7.19%</td>
<td>1.38%</td>
<td>-7.04%</td>
<td>13.79%</td>
</tr>
<tr>
<td>Index of Class to Average Rate of Return</td>
<td>19.11%</td>
<td>-97.85%</td>
<td>191.63%</td>
<td></td>
</tr>
</tbody>
</table>

Revenue to Cost Ratio

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>RESIDENTIAL</th>
<th>SMALL GENERAL SVC (0-20 KW)</th>
<th>MEDIUM GENERAL SVC (20-250 KW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Revenue per KWh</td>
<td>$0.1066</td>
<td>$0.1108</td>
<td>$0.1057</td>
<td>$0.1129</td>
</tr>
<tr>
<td>Average Cost of Service per KWh</td>
<td>$0.1066</td>
<td>$0.1138</td>
<td>$0.1200</td>
<td>$0.1072</td>
</tr>
<tr>
<td>Ratio of Revenue to Cost</td>
<td>100.00%</td>
<td>97.37%</td>
<td>88.12%</td>
<td>105.30%</td>
</tr>
</tbody>
</table>
Consider Results of Multiple Studies

<table>
<thead>
<tr>
<th>Class</th>
<th>Revenue to Cost Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Duvall (PP&amp;L)</td>
</tr>
<tr>
<td>Residential</td>
<td>0.91</td>
</tr>
<tr>
<td>General Service</td>
<td>1.13</td>
</tr>
<tr>
<td>Large General Service</td>
<td>1.10</td>
</tr>
<tr>
<td>Large Power Service Secondary</td>
<td>1.02</td>
</tr>
<tr>
<td>Large Power Service Primary</td>
<td>1.14</td>
</tr>
<tr>
<td>Irrigation</td>
<td>1.10</td>
</tr>
<tr>
<td>Street and Area Lighting</td>
<td>1.13</td>
</tr>
<tr>
<td>Other</td>
<td>1.09</td>
</tr>
</tbody>
</table>
Consider Factors Other Than Cost of Service

B. Factors for Consideration in Addition to Cost of Service

Study Results

In directing the filing of cost of service studies with future rate filings, the Commission did not manifest an intent to make rate design and rate spread decisions based solely on the mechanical application of cost of service study results. Instead, the Commission indicated it would analyze the cost studies presented, as well as other relevant evidence. The Commission stated the following:

- Overall public interest
- Economic conditions in the service territory
- Perceptions of equity and fairness
- Gradualism
- Elasticity of Demand (results will change)
Gradualism

- Bonbright principle
- Examples:
  - In an increase, no class gets a decrease
  - In a decrease, no class gets an increase
  - 2:1 gradualism: No class gets more than 2X the % increase of the lowest class increase
  - 3:1 gradualism
  - No increase to overpaying classes
Approximate Components of Electric Rates
Steps in Utility Ratemaking

Revenue Requirement

Functionalization
- Assign cost to appropriate utility function

Classification
- Classify functionalized costs to demand, energy, customer

Allocation
- Assign cost responsibility among customer classes

Rate Design
- Develop pricing method for recovering assigned costs
Basics of Rate/Tariff Design

- Customer Charges (Fixed Charges)
- Energy Charges
- Demand Charges: Non-Coincident Peak (NCP) and Coincident Peak (CP)
  - Common for commercial and industrial customer classes, rare for residential class
- Other Charges, for example:
  - Taxes
  - Riders – more on this later today
Basic Rate Design Terminology

- **Customer Charge**: A monthly charge that applies independent of consumption. Also called a Basic, Standing, Meter, or Fixed Charge.
- **Energy Charge**: A price per kWh; may be in more than one time period, or more than one block. May be seasonal, or time-varying.
- **Demand Charge**: A monthly fee based on the highest instantaneous usage rate (usually highest hour) during the month or year.
Terminology

- **kW: Kilowatt** - Usage at the rate of 1,000 watts of electricity
- **CP: Coincident Peak** - Usage at the time of the system peak demand
- **NCP: Non-Coincident Peak** - Highest usage by the customer at any time during the month
Terminology

- **Load Factor**: Ratio of average usage over a period to peak period usage during that same period

- **Load Shape**: Proportion of total usage that falls within Peak, Intermediate, and Off-peak load periods

- **Demand Ratchet**: Year-round demand charge based on highest usage during the year (or the peak season)
“Demand Costs” and Demand Charges

- Some portion of production, transmission, and distribution costs; at least those that are “peak” related
- Some parts attributable to different measures of “demand”
- Often recovered at least partially in energy charges
Energy Costs and Energy Charges

• Minimum: Fuel and variable portion of purchased power
• Often: Portion of generation, transmission, and distribution plant costs
• Vary by season
• Vary by time of day
• A single fuel charge melds these
“Customer Charge” Elements

• Controversial
  • Distribution circuit costs
  • Transformers

• Historically NOT Controversial
  • Service drop
  • Meters
  • Meter reading
  • Billing and collection
  • Customer service
Example Customer Charges (2014)

<table>
<thead>
<tr>
<th>Customer Charges: Largest U.S. Utilities</th>
<th>State (ST)</th>
<th>Charges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pacific Gas &amp; Electric Co.</td>
<td>CA</td>
<td>None</td>
</tr>
<tr>
<td>So Cal Edison</td>
<td>CA</td>
<td>$0.87</td>
</tr>
<tr>
<td>Public Service E&amp;G</td>
<td>NJ</td>
<td>$2.43</td>
</tr>
<tr>
<td>Detroit Edison Co</td>
<td>MI</td>
<td>$6.00</td>
</tr>
<tr>
<td>Virginia Electric Power</td>
<td>VA</td>
<td>$7.00</td>
</tr>
<tr>
<td>Florida Power &amp; Light Co</td>
<td>FL</td>
<td>$7.24</td>
</tr>
<tr>
<td>Georgia Power Co</td>
<td>GA</td>
<td>$9.00</td>
</tr>
<tr>
<td>Commonwealth Edison Co</td>
<td>IL</td>
<td>$15.06</td>
</tr>
<tr>
<td>Consolidated Edison</td>
<td>NY</td>
<td>$15.76</td>
</tr>
</tbody>
</table>

These utilities serve one in six Americans.
Residential Rate Types: From Simple to Complex

- **Flat Rate**: Uniform rate per kWh for all usage
- **Declining Block**: Lower price for increased usage
- **Inclining Block**: Higher price for increased usage
- **Time of Use (TOU)**: Higher price for on-peak hours
- **Seasonal**: Higher price in peak season
- **TOU with Inclining Block**
- **Critical Peak**: A TOU price that has a much higher price for a limited number of hours [Requires advanced meter]
- **Real-Time Price (RTP)**: A price that changes frequently with market conditions [Requires advanced meter]
### Flat Rate

#### Indiana–Michigan Power (Indiana)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Charge</td>
<td>$7.30/month</td>
</tr>
<tr>
<td>Energy Charge</td>
<td>$0.08634/kWh</td>
</tr>
</tbody>
</table>

**NOTE:** Many rates shown in this presentation have extensive “riders” that add significant costs to the base tariffs. We’ll have more discussion about riders later today.
## Flat Rate/Seasonal

<table>
<thead>
<tr>
<th>Xcel Energy (Minnesota)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Charge</td>
<td>$ 8.00/month</td>
</tr>
<tr>
<td>Summer Energy</td>
<td>$0.0867/kWh</td>
</tr>
<tr>
<td>Winter Energy</td>
<td>$0.0739/kWh</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Newfoundland Power</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer Per kWh</td>
<td>$0.0965/kWh</td>
</tr>
<tr>
<td>Winter Per kWh</td>
<td>$0.1190/kWh</td>
</tr>
</tbody>
</table>
# Residential Declining Block Rate

<table>
<thead>
<tr>
<th>Dayton Power and Light (Ohio)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Charge</td>
<td>$4.25/month</td>
</tr>
<tr>
<td>First 800 kWh</td>
<td>$0.0707/kWh</td>
</tr>
<tr>
<td>Additional kWh</td>
<td>$0.0585/kWh</td>
</tr>
</tbody>
</table>
# Residential Inclining Block Rate

<table>
<thead>
<tr>
<th>City of Palo Alto (California)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Customer Charge</strong></td>
</tr>
<tr>
<td><strong>First 300 kWh</strong></td>
</tr>
<tr>
<td><strong>Next 300 kWh</strong></td>
</tr>
<tr>
<td><strong>Over 600 kWh</strong></td>
</tr>
</tbody>
</table>
## Time of Use (TOU) Rate

<table>
<thead>
<tr>
<th>Georgia Power (Georgia)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Charge</td>
<td>$10.00/month</td>
</tr>
<tr>
<td>On-Peak (2 – 7 PM, Mon-Fri, June – September)</td>
<td>$0.2032/kWh</td>
</tr>
<tr>
<td>Off-Peak</td>
<td>$0.0494/ kWh</td>
</tr>
</tbody>
</table>

Plus $0.04 fuel and other tariff riders.
TOU / Seasonal Rate

<table>
<thead>
<tr>
<th>Tucson Electric (Arizona)</th>
<th>Customer Charge</th>
<th>$11.50/month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer</td>
<td>On-Peak</td>
<td>$0.1175/kWh</td>
</tr>
<tr>
<td>Winter</td>
<td>Off-Peak</td>
<td>$0.0897/kWh</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$0.0785/kWh</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$0.0689/kWh</td>
</tr>
</tbody>
</table>
## Fixed-Period TOU Rates With Inclining Block Design

<table>
<thead>
<tr>
<th>Fixed-Period TOU with Inclining Block</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Charge</td>
<td>$5.00/month</td>
</tr>
<tr>
<td>Off-Peak</td>
<td>$0.10/kWh</td>
</tr>
<tr>
<td>On-Peak</td>
<td>$0.20/kWh</td>
</tr>
<tr>
<td>High Use Surcharge, over 500 kWh</td>
<td>$0.04/kWh</td>
</tr>
</tbody>
</table>
Looking At Costs By Function

- Billing and Collection
- Distribution Peaking
- Distribution Backbone
- Network Transmission
- Baseload Transmission
- Demand Response
- Peaking Production
- Mid-Merit Production
- Baseload Production
Building a Cost-Based TOU Rate

Critical Peak Rate

On-Peak Rate

Mid-Peak Rate

Off-Peak Rate

Distribution Backbone

Transmission Backbone

Baseload Generation

Distribution Augmentation for Mid-Peak

Transmission Augmentation for Mid-Peak

Mid-Merit Generation

Peaking Distribution

Peaking Generation

DR

Hour of Day

$/kWh

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

$0.75

$0.68

$0.14

$0.12

$0.10

$0.08

$0.06

$0.04
## Result: Smart Rates

<table>
<thead>
<tr>
<th><strong>Connect To Grid</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Customer Charge</strong></td>
<td>$/Month</td>
</tr>
<tr>
<td></td>
<td>$4.00</td>
</tr>
<tr>
<td><strong>Site Infrastructure</strong></td>
<td>$/kW</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Usage</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Off-Peak</strong></td>
<td>$/KwH</td>
</tr>
<tr>
<td><strong>Mid-Peak</strong></td>
<td>$/KwH</td>
</tr>
<tr>
<td><strong>On-Peak</strong></td>
<td>$/KwH</td>
</tr>
<tr>
<td><strong>Critical</strong></td>
<td>$/KwH</td>
</tr>
</tbody>
</table>
Choosing Time Periods

• When are different resources operated?
• What is the system load profile?
• What is the class load profile?
• Consideration of Renewable Portfolio Standard (RPS) Obligations
  • Wind may be a night resource, but mandatory.
• Look ahead: is the load shape changing due to solar?
Critical Peak Pricing (CPP)

- Definition: A very high rate that is in effect only a few hours per event, a few times per year.
- Goal: Dramatically reduce peak demand in these events.
- Design: Customer receives day-ahead notice when “critical” days will be in effect. On other days, “normal” prices apply.
Oklahoma Gas and Electric “Variable Peak Price” Option

- Customer Charge: $13.00/month
- Summer Energy Charge tied to day-ahead hourly market.
- Maximum 80 Hours at Highest Price

<table>
<thead>
<tr>
<th>Day-Ahead Hourly Price</th>
<th>Retail Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than $.011/kWh</td>
<td>$.029/kWh</td>
</tr>
<tr>
<td>$.011 - $.031/kWh</td>
<td>$.073/kWh</td>
</tr>
<tr>
<td>$.031 - $.170/kWh</td>
<td>$.175/kWh</td>
</tr>
<tr>
<td>Over $.170/kWh</td>
<td>$.380/kWh</td>
</tr>
</tbody>
</table>
Peak-Time Rewards (PTR): CPP In Reverse

- Standard rate at all normal hours
- Critical events called as needed
- Customers get discount for reduced usage below a calculated baseline
- No surcharge for increased usage
- Requires smart meter data to set baseline
PTR Example:
Baltimore Gas and Electric

- Customer Charge: $7.90/month
- Energy Charge: $.121/kWh
- Credit During Events: ($1.25/kWh)
Comparing CPP and Critical Peak Rebates (CPR or PTR)

Figure 12. Average Percent Demand Reductions for Customers on CPP and CPR with and without PCTs by Treatment Group.
TOU Rates and Low-Income

- Low-income customers are less likely to have major peak-focused loads like central air conditioning
- Smaller dwelling size
- More likely to have electric water heat, which can be controlled.
- Most (NOT ALL) low-income customers will benefit from TOU rates.
Non-Residential (NR) Rate Design
Examples of Large NR Customers

[Images of large retail stores and commercial buildings]
### Antiquated NR Example Rate #1
(a real utility in the U.S.)

<table>
<thead>
<tr>
<th></th>
<th>$/Month</th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Charge</td>
<td></td>
<td>209.00</td>
</tr>
<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
Non-Residential Rate Example: Georgia Power TOU-GS-10

<table>
<thead>
<tr>
<th></th>
<th>$/Month</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Charge</td>
<td></td>
<td>$ 209.00</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>Summer weekdays 2-7 PM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Charge</td>
<td>$108/month</td>
</tr>
<tr>
<td>Site Infrastructure Charge</td>
<td>$3.80/kW/month</td>
</tr>
<tr>
<td>Super Peak Demand Charge</td>
<td>$7.65/kW</td>
</tr>
<tr>
<td>Energy Charge</td>
<td></td>
</tr>
<tr>
<td>Super Peak</td>
<td>$0.20</td>
</tr>
<tr>
<td>On-Peak</td>
<td>$0.137</td>
</tr>
<tr>
<td>Off-Peak</td>
<td>$0.109</td>
</tr>
</tbody>
</table>
Alternative Non-Residential Rate Designs Can Address Peak Demand

- Well-designed Time of Use Prices (TOU)
- Critical Peak Price (CPP)
- Peak Time Rebates (PTR)
- Transparent Real Time Prices (RTP)

- Weak: Coincident Peak Demand Charges
Smart Rate Design

For a Smart Future

Authors
Jim Lazar and Wilson Gonzalez

July 2015
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

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Idaho: Customer Charges ≠ Customer Charges

- **Accepted** “minimum system” method for allocation of distribution costs between residential and commercial customers, on a 50% per-customer (and 50% usage-related) basis
- **Rejected** classification of these costs as “customer-related” for rate design purposes

<table>
<thead>
<tr>
<th></th>
<th>Summer</th>
<th>Non-summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Charge, per month</td>
<td>$5.00</td>
<td>$5.00</td>
</tr>
<tr>
<td>Energy Charge, per kWh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>First 800 kWh</td>
<td>8.6901¢</td>
<td>8.0746¢</td>
</tr>
<tr>
<td>801-2000 kWh</td>
<td>10.4494¢</td>
<td>8.9020¢</td>
</tr>
<tr>
<td>All Additional kWh Over 2000</td>
<td>12.4132¢</td>
<td>9.8588¢</td>
</tr>
</tbody>
</table>
A Typical Rate for Large NR Customers

Customer Charge: $100/month
Demand Charge: $10/kW
Energy Charge: $0.10/kWh
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
Rate Designs That Address Peak Demand

- Well-designed Time of Use Prices (TOU)
- Critical Peak Price (CPP)
- Peak Time Rebates
- Transparent Real Time Prices (RTP)
- Weak: Coincident Peak Demand Charges