Traditional Economic Regulation of Electric Utilities

U.S. EPA

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Introductions

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
Outline

• A Very Brief History of Regulation
• Industry Structure
• Ratemaking Basics
• What Else Do Regulators Do?
• A Few Shortcomings of the Traditional Regulatory Approach
But first … why do we care?

- Air quality and energy are inextricably linked
- PUCs evaluate potential future environmental costs and risks
- PUCs oversee and approve the long-term energy plans to serve customers
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.
Series of Later Court Decisions

• Prudent investment rule
• Utility entitled to a return comparable to companies with similar risks
• “Just and reasonable” standard
  • No class of customers shall be unduly discriminated against; Tied to cost of service
• Intervenors have limited rights
2 Industry Structure
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)

- ~10% of US utilities, 65% of customers
- Privately owned, publicly-traded (usually)
- Profit-making enterprises, financed by shareholder equity and bondholder debt
- Economically regulated by state public utility commissions (PUCs)
- Examples: Duke Energy Carolinas, Mississippi Power, Dominion
Electric Membership Cooperatives

- Mostly rural, 14% of customers
- 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, Delta Montrose Electric Association (CO)
Public Power Utilities

• 12% of customers
• Owned by taxpayers, not-for-profit
• Governed by locally elected officials or their designees
• Less (or no) PUC oversight – varies by state
• Examples: Sacramento Municipal Utility District (CA), Orlando (FL) Utilities Commission, Burbank Water and Power (CA)
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
Segments of Electric Service

<table>
<thead>
<tr>
<th>Wholesale</th>
<th>Retail</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Generating Station</strong>&lt;br&gt;Electricity is typically generated by a steam- or hydro-driven turbine at the power plant.</td>
<td><strong>5. Subtransmission Customer</strong>&lt;br&gt;The electricity then passes through a series of switches to distribution lines.</td>
</tr>
<tr>
<td><strong>2. Step-Up Transformer</strong>&lt;br&gt;The power is then ramped up to high voltage for long-distance transmission.</td>
<td><strong>6. Customers</strong>&lt;br&gt;Power is then delivered to customers via local lines.</td>
</tr>
<tr>
<td><strong>3. Transmission</strong>&lt;br&gt;Next, a series of high voltage lines transmit the electricity through the power grid.</td>
<td><strong>4. Step-Down Transformer</strong>&lt;br&gt;Power is then reduced to a lower voltage for use in homes and businesses.</td>
</tr>
</tbody>
</table>

*Source: NY ISO*
Coordinating Supply and Demand

Roles of State Economic Regulators

- Extensions of legislatures, executing powers granted in statutes
- Regulate in “the public interest”
- Pricing: the essential regulatory act
- Transparent and accessible process
- Service quality standards
- Prudence review
“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 Basics
“Allocation of costs is not a matter for the slide rule. It involves a judgment of a myriad of facts. It has no claim to an exact science.”

Justice William O. Douglas
US Supreme Court
Colorado Interstate Gas Co. v. Federal Power Commission
324-US 581,589 (1945)

Source: National Center for Education Statistics, 2016
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
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

- 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
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:
  1. Amount of investment allowed in rate base
  2. Fair rate of return on that investment
  3. Reasonable expenses to serve customers
- Utilities are most concerned with this step
Revenue Requirement =
(Rate Base Investment x 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
  (plant that is no longer “used and useful”)
= 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
Rate of Return: Cost of Capital

- Allowed Return on Equity
  - Return utility must offer to investors to get them to invest in the utility
  - Recently ~9-11%

- Cost of Debt
  - Lower rate of return than equity due to lower risk

- Rate of Return = weighted average of these
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 • $100,000,000
x Rate of Return • x 8%
= Return Requirement • $8,000,000
+ Operating Expenses • $25,000,000
= Revenue Requirement • $33,000,000
Steps in Utility Ratemaking

Revenue Requirement

Functionalization
- Assign cost to appropriate utility function
Functionalization

Divide Revenue Requirement Among Utility Functions

This is an area of limited controversy
Steps in Utility Ratemaking

Revenue Requirement

Functionalization
- Assign cost to appropriate utility function

Classification
- Classify functionalized costs to demand, energy, customer

This is an important step!
Classification: Focus on Customer-Related Costs

- Generation
- Transmission
- Distribution
- Customer

- 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
Classification: Distribution

- Built to deliver energy
- Designed to carry peak demand
- Connects to every customer
Meters

- **Historical**: Used only for billing → customer-related
- **Smart Meters**:  
  - Peak load management  
  - Conservation program support  
  - Reliability services – voltage reduction  
  - Disconnect / reconnect  
  - Demand response
Basic Customer Method:

ONLY customer-specific facilities classified as customer-related
Other methods*: 

Up to 100% of distribution system classified as customer-related

*Showing Straight-Fixed Variable Method
## 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></td>
<td>$/month/customer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poles</td>
<td>$5</td>
<td>$10</td>
<td></td>
</tr>
<tr>
<td>Wires</td>
<td>$10</td>
<td>$20</td>
<td></td>
</tr>
<tr>
<td>Transformers</td>
<td>$5</td>
<td>$10</td>
<td></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

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  • Assign cost to appropriate utility function

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  • Classify functionalized costs to demand, energy, customer

Allocation
  • Assign cost responsibility among customer classes
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Revenue Requirement

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Rate Design
• Develop pricing method for recovering assigned costs
Approximate Components of Electric Rates
Ratemaking Takeaways

- Bias toward capital spending
- Avoid stranded assets
- Ratemaking has many steps
- Pricing (rate design) influences customers behavior – come back this afternoon!
4 What Else Do Regulators Do?
Resource Acquisition

- Portfolio standards
- Integrated Resource Planning
- Construction Authorization
- Prudence Review
- Energy Efficiency
Energy Efficiency

- Ensure full economic benefits of EE are achieved
- Ensure cost-recovery for utilities
- Set parameters for efficiency programs
- Determine who will operate programs
- Determine cost-effectiveness tests
Transportation Electrification

- Evolving area for PUCs
- Oversight of utility’s role and expenditures
  - EV charging infrastructure
  - Other utility incentives
- Concern with preserving competition
- Smart meters and rate design
PUC Processes

Adjudicatory proceedings – rate cases

Rulemaking
  • More interactive
  • May provide guidance for how Commission will view future utility actions

Generic proceedings and stakeholder collaboratives
  • Examine emerging issues
  • Can result in recommendations, or a Commission policy statement

Photo credit: Rocky Mountain Institute
5 Shortcomings of Traditional Cost of Service / Rate of Return Regulation
Shortcomings of Traditional Cost of Service/Rate of Return Regulation and Rate Design

- Cost Allocation is Not an Exact Science
- Capital Bias ("Averch-Johnson Effect")
- Throughput Incentive
- Regulatory Lag
- Regulatory Capture
Shortcomings of Traditional Cost of Service/Rate of Return Regulation and Rate Design

- Cost Allocation is Not an Exact Science
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- Regulatory Capture
Averch-Johnson effect

The tendency to over-invest capital to increase profit

- Results from revenue requirement calculation
- “Gold plating”
Utility Revenue Requirement: “The Capital Bias”

Utility Revenue Requirement (aka Cost-of-Service) = Capital Investments (Cap-ex) + Operating Expenses (Op-ex)

“Rate Base” x Rate-of-Return (Interest on Shareholders’ “Loan”) = $1 x 10% = $1.10

Pass-Through, No Rate-of-Return = $1 = $1
Utility Revenue Requirement: Discourages Distributed Energy Resources

Revenue Requirement (aka Cost-of-Service) = Capital Investments (Cap-ex) + Operating Expenses (Op-ex)

Both reduce kWh sales

Distributed Generation = less need for cap-ex

Energy Efficiency = more op-ex & less need for cap-ex
Throughput incentive

Increased sales lead to increased utility profit

- True when load is served with existing facilities, thus costs are fixed
- Creates incentive to resist measures that reduce sales
# How Changes in Sales Affect Earnings: It’s Significant

<table>
<thead>
<tr>
<th>% Change in Sales</th>
<th>Revenue Change</th>
<th>Impact on Earnings</th>
<th>% Change</th>
<th>Actual ROE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-tax</td>
<td>After-tax</td>
<td>Net Earnings</td>
<td></td>
</tr>
<tr>
<td>5.00%</td>
<td>$9,047,538</td>
<td>$5,880,900</td>
<td>$15,780,900</td>
<td>59.40%</td>
</tr>
<tr>
<td>4.00%</td>
<td>$7,238,031</td>
<td>$4,704,720</td>
<td>$14,604,720</td>
<td>47.52%</td>
</tr>
<tr>
<td>3.00%</td>
<td>$5,428,523</td>
<td>$3,528,540</td>
<td>$13,428,540</td>
<td>35.64%</td>
</tr>
<tr>
<td>2.00%</td>
<td>$3,619,015</td>
<td>$2,352,360</td>
<td>$12,252,360</td>
<td>23.76%</td>
</tr>
<tr>
<td><strong>1.00%</strong></td>
<td><strong>$1,809,508</strong></td>
<td><strong>$1,176,180</strong></td>
<td><strong>$11,076,180</strong></td>
<td><strong>11.88%</strong></td>
</tr>
<tr>
<td>0.00%</td>
<td>0</td>
<td>0</td>
<td>9,900,000</td>
<td>0.00%</td>
</tr>
<tr>
<td><strong>-1.00%</strong></td>
<td><strong>-$1,809,508</strong></td>
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<td><strong>$8,723,820</strong></td>
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<td>$4,019,100</td>
<td><strong>-59.40%</strong></td>
</tr>
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Is Something Wrong with the Throughput Incentive?

• There are many reasons why utility sales might go up or down, but what should the utility motivation be?

• Public interest appears to be in conflict with throughput incentive
  • Energy Efficiency (EE), Distributed Generation (DG), other policies reduce sales
Dealing With Shortcomings

- Decoupling
- Performance-based ratemaking; price-cap regulation
- Incentives for energy efficiency
- Integrated Distribution Planning
- Competitive power supply procurement requirements
- Restructuring
- Securitization

Not covering these today…
Suggested Reading

Discussion
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

Contact Jessica at: jshipley@raponline.org