RETAIL COSTING AND PRICING FOR ELECTRICITY

CAMP 2014
EAST LANSING, MI
INSTITUTE OF PUBLIC UTILITIES

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MICHIGAN STATE UNIVERSITY
Objectives

- Why costs vary by type of customer
- What information does a cost of service study provide
- How is a cost of service study used in designing customer rates
- How Rate Design’s are changing to reflect our current industry
- What are the Strength's and weaknesses of different rate design
Objectives

- Information provided by a cost of service study
- Types of rate structures to achieve specific goals
  - Promotion of energy conservation or renewables
  - Rates designs that maintain stable revenues for Utility
  - Rates designs that more accurately reflect utility costs
- Strength's and weaknesses of each rate design
Definitions

- **Customer (Facilities) Charges** – Fixed monthly charge to recover specific costs to provide service to customers
- **Energy Charge** – Based on number of kWh’s
- **Demand Charge** – Peak usage for customer during month expressed as kW or kVa
- **Minimum Charge** – The minimum charge a customer will be billed each month
Rate Structure - Definitions

- **Load Factor** – Ratio between a customers average usage and peak usage
- **Short Run Marginal Costs** – The cost to purchase or produce the next kWh of electricity
- **Long Run Marginal Costs** – The cost to install and operate the next generating unit
- **Coincident Demand Rates** – Customers billed in same manner as power supply (Used primary for customers that purchase power supply under a contract)
# Residential Rate Design Structures

<table>
<thead>
<tr>
<th>Rate Structure</th>
<th>Monthly Customer Charge</th>
<th>First 500 kWh's</th>
<th>Over 500 kWh's</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inclining Block Rate Structure</td>
<td>10.00</td>
<td>0.070</td>
<td>0.090</td>
</tr>
<tr>
<td>Declining Block Rate Structure</td>
<td>10.00</td>
<td>0.090</td>
<td>0.070</td>
</tr>
<tr>
<td>Flat</td>
<td>10.00</td>
<td>0.080</td>
<td>0.080</td>
</tr>
</tbody>
</table>
Information Provided by Cost of Service Studies
Why Cost of Service is Important to Utilities

- Provides a document to defend and justify rates charged to customer
- Provides information needed to develop new rate forms such as time of use, stand by generation, net metering, economic development, and geothermal
- Answers the question, “Are rate classes adequate? Or should they be expanded or contracted?”
Cost of Service Summary

- Compares revenues with costs to provide service to each customer class.
- Used to determine the potential change in rates for each customer class.
- Identifies power supply costs for each class of customers.
- Identifies distribution costs for each class of customers.
## Cost of Service Summary

<table>
<thead>
<tr>
<th>Customer Class</th>
<th>Cost of Service</th>
<th>Projected Revenues</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>$23,790,065</td>
<td>$21,807,619</td>
<td>9%</td>
</tr>
<tr>
<td>Small General Service</td>
<td>8,940,904</td>
<td>8,259,968</td>
<td>8%</td>
</tr>
<tr>
<td>City Street Lighting</td>
<td>626,336</td>
<td>597,064</td>
<td>5%</td>
</tr>
<tr>
<td>Medium General Service</td>
<td>15,231,978</td>
<td>15,078,877</td>
<td>1%</td>
</tr>
<tr>
<td>MGS - Time-of-Use</td>
<td>943,934</td>
<td>952,012</td>
<td>-1%</td>
</tr>
<tr>
<td>Large General Service</td>
<td>5,239,965</td>
<td>5,334,919</td>
<td>-2%</td>
</tr>
<tr>
<td>Large Industrial Service</td>
<td>11,318,819</td>
<td>10,377,772</td>
<td>9%</td>
</tr>
<tr>
<td>Interruptible Service</td>
<td>2,738,172</td>
<td>2,341,797</td>
<td>17%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$68,830,173</strong></td>
<td><strong>$64,750,028</strong></td>
<td>6.3%</td>
</tr>
</tbody>
</table>
## Power Supply Costs

<table>
<thead>
<tr>
<th>Customer Class</th>
<th>Summer</th>
<th>Winter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Demand</td>
<td>Energy</td>
</tr>
<tr>
<td>Residential</td>
<td>$0.034</td>
<td>$0.044</td>
</tr>
<tr>
<td>Small General Service</td>
<td>0.037</td>
<td>0.044</td>
</tr>
<tr>
<td>City Street Lighting</td>
<td>0.020</td>
<td>0.044</td>
</tr>
<tr>
<td>Traffic Signals</td>
<td>0.029</td>
<td>0.044</td>
</tr>
<tr>
<td>Security Lighting</td>
<td>0.020</td>
<td>0.044</td>
</tr>
<tr>
<td>Medium General Service</td>
<td>12.11</td>
<td>0.044</td>
</tr>
<tr>
<td>MGS - Time-of-Use</td>
<td>9.91</td>
<td>0.043</td>
</tr>
<tr>
<td>Large General Service</td>
<td>13.13</td>
<td>0.043</td>
</tr>
<tr>
<td>Large Industrial Service</td>
<td>14.58</td>
<td>0.043</td>
</tr>
<tr>
<td>Interruptible Service</td>
<td>10.05</td>
<td>0.043</td>
</tr>
</tbody>
</table>
## Distribution Costs

<table>
<thead>
<tr>
<th>Customer Class</th>
<th>Monthly Customer Charge</th>
<th>Distribution Rate</th>
<th>Billing Basis</th>
<th>Public Benefits Programs</th>
<th>Billing Basis</th>
<th>General Fund Equity Transfers</th>
<th>Billing Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>$15.55</td>
<td>$0.029</td>
<td>kWh</td>
<td>$0.0032</td>
<td>kWh</td>
<td>$0.0133</td>
<td>kWh</td>
</tr>
<tr>
<td>Small Commercial</td>
<td>37.50</td>
<td>0.026</td>
<td>kWh</td>
<td>0.0032</td>
<td>kWh</td>
<td>0.0139</td>
<td>kWh</td>
</tr>
<tr>
<td>Municipal</td>
<td>59.89</td>
<td>0.024</td>
<td>kWh</td>
<td>0.0032</td>
<td>kWh</td>
<td>0.0107</td>
<td>kWh</td>
</tr>
<tr>
<td>Medium Commercial</td>
<td>304.03</td>
<td>10.57</td>
<td>kW</td>
<td>0.0032</td>
<td>kWh</td>
<td>0.0124</td>
<td>kWh</td>
</tr>
<tr>
<td>Large Commercial</td>
<td>549.55</td>
<td>10.95</td>
<td>kW</td>
<td>0.0032</td>
<td>kWh</td>
<td>0.0109</td>
<td>kWh</td>
</tr>
</tbody>
</table>
Why Costs Vary by Customer Class
Why Costs Vary by Customer Class

- Delivery of electricity consists of four components:
  - Power Supply
  - Transmission
  - Local Distribution System
  - Customer Specific Costs
Why Rates Vary by Customer Class

- Costs vary because customers use electricity differently:
  - Some customers use more energy during On-peak hours causing power supply costs to be greater
  - Some customers contribute a greater amount to the peak demands of the system.
  - Causing power supply capacity additions and greater transmission costs
Relationship of Coincident to Non-Coincident Peak Demands

- **A = System Coincident Peak**
- **B = Gen. Serv. Class Non coincident Peak**
- **C = Gen. Serv. Class Contribution to System Peak**
- **C/B = Gen. Serv. Class Coincidence Factor**
Distribution Costs

- Customers are served at different voltage levels:
  - Secondary Voltage – Uses all the infrastructure of the distribution system
  - Primary Voltage – Customer owns transformer and service drop
  - Sub transmission – Customer avoids all the distribution system infrastructure
Customer Specific Costs

- Time taken to read a customer’s meters
- Installation costs of the meter
- Time involved to issue a customer’s bill
- Cost of service drop to customer’s facility
- Not all customers have demand recording meters
Rate Designs
Cost of Service is one consideration in design of electric rates along with objectives of the Public Service Commission or Governing Body.
Utility’s Rate Design Objectives

- Environmental Objectives
  - Promote and fund energy efficiency programs
  - Promotion of customer installed renewable generation
  - Rates incentives that promote conservation of electricity
- Economic Development
- Fairness to customers
- Revenue Stability for Utility
- Promote growth of system
Considerations

- Social Concerns
  - Impacts on low use customers
  - Impacts on low Income customers
  - Impacts to year-round customers
  - Promotion of low income rates
- Rate Impacts on each customer classes as a result of rate design
- Rate Impacts on customers within each class
- Legal issues if moving rates away from cost of service
All Rate Designs have Positives and Negatives

1. Identify and develop objectives
2. Identify rates to achieve the objectives
3. Understand the positives and negatives of each rate form
4. Model the rate to identify impacts on customers
Rate Design Trends

- Distribution cost recovery is moving toward recovery based on (kW) demand
- Power supply demand cost have been decreasing
  - (Projected to change)
- Utilities are moving to implementation of power cost adjustments
- Residential inverted block rate designs are causing revenue stability concerns
- Distributed Generation - Customer installed solar installations in some states is moving utilities toward more accurate rate structures to recover distribution costs
- Time of use rates are becoming more widespread
Rates to Promote Conservation & Renewables

- **Inclining Block** – Electric rates increase with increased usage
- **Net Metering** – Customer installs distributed generation and Utility required to net the power received by customer from power provided to utility
- **Long Run Marginal cost credit for photovoltaic generation**
- **Standby Rates** – Customers that install distributed generation but remain connected to Utility
- **Community Solar Installation**
Rates that Create Revenue Stability for Utility

- Declining Block Rates – Rate decreases with increased usage
- *Decoupling Distribution Charges* – Automatic adjustment to customers to recovery distribution costs
- *Power Cost Adjustments* – Automatic adjustment to customers to recover power supply costs
- *Monthly Customer (Facilities) Charges* – Fixed charge to customer
Rates to More Accurately Reflect Utility Costs

- **Time of Use Rates** – Rates that vary with the time of day to reflect utilities cost of power supply
- Seasonal Rates – Rates that vary by season to reflect the seasonal variations in power supply costs
- **Interruptible Rates** – Rates that provide incentives for customers to be interrupted during high costs or peak times
- Coincident Demand Rates – Rates that directly coincide with how a Utility purchases power supply
- **Residential Demand Charges** – Charging residential customer’s using monthly peak demand
Other Rate Designs

- Car Charging Station Rates
  - Residential
  - Commercial Garages
- **Economic Development Rates**
- Contribution in Aid of Construction
Inclining Block Residential Rates

- Significant variations need to occur between rate blocks for customers to respond to price signal
- Shifts fixed cost recovery to outer blocks creating potential revenue recovery concerns for utility
  - Utility may consider decoupling in combination with Inclining Block Rates
- May adversely impact low income customers – Need to check demographics of community
- Currently, short-run marginal costs to purchase power supply often does not support inclining block charges
Inclining Block Residential Rates

- May create proper incentives to conserve energy, insulate homes and purchase energy efficient appliances
- Tries to recognize future costs of generation is more expensive than today’s costs
- May reduce costly peak demands on system
Distribution Cost Recovery
Customer (Facilities) Charges

- Many utilities customer charges reflect only billing and meter reading costs
- Adjusting charges to reflect a certain amount of infrastructure costs
  - Traditional theory uses minimum system analysis to determine the portion of the distribution system to include in the charge
Cost of Service Customer Charges includes the following Components

- Distribution costs that do not vary with usage
  - Meter operation, maintenance and replacement costs
  - Meter reading costs or AMR installation costs
  - Billing Costs
  - Customer Service Department
  - Service into customers facilities
  - Portion of Distribution System
Customer (Facilities) Charges

- For Residential customers approximately 35% - 50% of *distribution charges* recovered in customer charge
- Approximately 2% - 10% of distribution charges recovered in customer charges for large users
Customer (Facilities) Charges

- Increasing customer charges helps stabilize revenues
- Reduces subsidy between year-round customers and seasonal customers
- Will impact low use customers
- Low income compared with low use

At most utilities, low income customers tend to be higher than average users. A higher customer charge may benefit low income
Typical Residential Cost Based Customer Charge

- Density of the service territory affects the monthly customer charges
- Typical cost based residential customer charges:
  - Rural Utilities - $20 - $30/Month
  - Densely Populated Areas - $12 - $21/Month
Distribution Usage Charges

- Most **inaccurate** method of distribution cost recovery is through a kWh charge
- Distribution system is constructed to handle a customers peak demand or a classes peak demands and are not constructed to handle kWh’s
Distribution Recovery to Reflect Utilities Costs (Billing Methods)

- Customer’s monthly peak kW (Demand)
- Peak of current month or previous 11 months peak of customer
- kVa of installed transformer capacity
## Method of Distribution Recovery

<table>
<thead>
<tr>
<th></th>
<th>20.0%</th>
<th>30.0%</th>
<th>40.0%</th>
<th>50.0%</th>
<th>60.0%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand Rate</td>
<td>5,899</td>
<td>5,899</td>
<td>5,899</td>
<td>5,899</td>
<td>5,899</td>
</tr>
<tr>
<td>kWh Charge</td>
<td>0.0223</td>
<td>0.0223</td>
<td>0.0223</td>
<td>0.0223</td>
<td>0.0223</td>
</tr>
<tr>
<td>Load Factor</td>
<td>20.0%</td>
<td>30.0%</td>
<td>40.0%</td>
<td>50.0%</td>
<td>60.0%</td>
</tr>
<tr>
<td>Peak Demand</td>
<td>1,000</td>
<td>1,000</td>
<td>1,000</td>
<td>1,000</td>
<td>1,000</td>
</tr>
<tr>
<td>kWh’s Used by Customer</td>
<td>146,000</td>
<td>219,000</td>
<td>292,000</td>
<td>365,000</td>
<td>438,000</td>
</tr>
<tr>
<td>Energy Rate</td>
<td>3,259</td>
<td>4,888</td>
<td>6,517</td>
<td>8,147</td>
<td>9,776</td>
</tr>
<tr>
<td>Difference</td>
<td>(2,640)</td>
<td>(1,011)</td>
<td>619</td>
<td>2,248</td>
<td>3,877</td>
</tr>
</tbody>
</table>

- For this utility recovery on kWh and kW would produce the same cost recovery
- The example customers all create the same demand on the distribution infrastructure located near the customer
- The kWh method produced a subsidy between low load factor and high load factor customers
Residential Demand Charge

- Many utilities are moving toward or considering demand charges for distribution cost recovery for Residential customers:
  - Send better price signals to customers
  - Promote electric vehicles
  - Reduce distribution subsidies for customers with solar or wind installations
Comparison of Fixed and Variable

Comparison with utility that purchases power supply

- PV unit installation – 5kW
- Midwest PV Unit – 2013 data
- Customers Usage – 798 kWh
- PV production – 725 kWh
- Customers Peak Distribution Demand – Before PV – 5.16 kW; after PV 3.59 kW
- Customer Peak to System Demands – Before PV 2.11 kW; 0.61 kW

Typical Residential Summer Customer
(Average monthly consumption = 798 kWh's)

<table>
<thead>
<tr>
<th>Cost of Service</th>
<th>Revenue Received</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed, $33.90</td>
<td>Fixed, $14.90</td>
</tr>
<tr>
<td>Variable, $70.91</td>
<td>Variable, $91.57</td>
</tr>
</tbody>
</table>
Comparison of Fixed and Variable

Typical Residential Summer Customer

Installation of 5kW PV

- Variable, $8.34
- Fixed, $14.90
- Variable, $14.55
- Fixed, $30.63

Revenue
Cost of Service
Cost-Based Residential Rate Structure

- Once cost based rates are identified, practical rate designs can be developed

<table>
<thead>
<tr>
<th>Cost Based Rate Design</th>
<th>Customer Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Supply Customers Demand Coincident with System Peak</td>
<td>12.72</td>
</tr>
<tr>
<td>Distribution Recovery Based on Customers Maximum Demand</td>
<td>2.19</td>
</tr>
<tr>
<td>Energy Charge</td>
<td>0.0442</td>
</tr>
<tr>
<td>Customer Charge</td>
<td>21.44</td>
</tr>
<tr>
<td>PILOT</td>
<td>9.28%</td>
</tr>
</tbody>
</table>
Economic Development Rates

- State may want to attract jobs and rates can be developed to attract customer’s and help keep electric rates lower for existing customers

_Economic development rates should never be structured to charge new customers below the marginal costs of providing electricity_
How Can an Economic Development Rate Benefit Existing Customers?

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues from new customer at discounted rates</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>Variable Power Supply Costs</td>
<td>700,000</td>
</tr>
<tr>
<td>Amortization of Line Extension</td>
<td>50,000</td>
</tr>
<tr>
<td>Marginal Costs of Decision</td>
<td>750,000</td>
</tr>
<tr>
<td>Contribution Margin</td>
<td>$250,000</td>
</tr>
</tbody>
</table>

Contribution Margin is the contribution the new customer will make toward the fixed cost of the utility and will increase net income $250,000.
Economic Development Rates

- With any rate offered by the utility, criteria has to be set for who qualifies for the rate
- Any customer that fits the criteria can elect to be served by the rate
- If two competing customers are in the same area and the rate is offered to one may create an issue with the competing customer
Typical Rates

- Rates should be structured to last for a three or five year time period
- A phase into normal rate schedule is sometimes used
- At some point the discount has to be eliminated for the customer
## Economic Development Rate Example

<table>
<thead>
<tr>
<th>Year</th>
<th>Secondary</th>
<th>Primary</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>34%</td>
<td>25%</td>
</tr>
<tr>
<td>2</td>
<td>27%</td>
<td>20%</td>
</tr>
<tr>
<td>3</td>
<td>20%</td>
<td>15%</td>
</tr>
<tr>
<td>4</td>
<td>14%</td>
<td>10%</td>
</tr>
<tr>
<td>5</td>
<td>7%</td>
<td>5%</td>
</tr>
</tbody>
</table>
Standby Rates

- Used for customers that have generation facilities but request the utility to provide back up generation during maintenance or emergencies
- Customer is charged for back up distribution services, power factor correction, and any electricity provided by the utility
# Sample Standby Rate

<table>
<thead>
<tr>
<th>Service Level</th>
<th>Monthly Fixed Charge per kW of Capacity Reservation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secondary Voltage</td>
<td>$</td>
</tr>
<tr>
<td>Primary Voltage</td>
<td>4.48</td>
</tr>
<tr>
<td>Substation Voltage</td>
<td>3.89</td>
</tr>
<tr>
<td></td>
<td>1.18</td>
</tr>
</tbody>
</table>
Many Investor-Owned Utilities are considering Decoupling Electric Rates

- Breaks the cycle of linking revenue recovery to sales of electricity
- Reduces utility’s disincentive and opposition to energy conservation programs & rates
- Reduces the risk to utilities and helps ensure recovery of distribution costs
- Works like a power cost adjustment mechanism for distribution costs