Rate Analysis Utilizing Meter Data

Presented by James Pucula
Agenda

1. Role of a Utility
2. Rate Design
3. Meter Reading
4. Rate Analysis
Introduction

James Pucula
Energy Market Analyst

Background
• Bachelor of Engineering – Energy

Professional
• Energy Engineer-in-Training
• Software Developer
Role of a Utility

Part 1 of 4
The Role of a Utility and Rates

- Distribution Utility service regional areas with a safe and reliable supply of electricity
- Electricity reform in the 90s caused vertically integrated utilities to break into three separate companies
- Shift in Pricing Structures

Image credit: EIA
North American Energy Markets

• 3,195 electric utilities in the United States
• This system allows for electricity demand to be met, but also includes a multitude of price influencers
• Regional effects

Image credit: U.S. Energy Information Administration
Quote: electricity.ca/learn/electricity-today/north-American-power-grid/
North American Energy Markets

Balancing Supply with Demand

<table>
<thead>
<tr>
<th>Fuel Type</th>
<th>Power Output (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuclear</td>
<td>8,538</td>
</tr>
<tr>
<td>Wind</td>
<td>3,988</td>
</tr>
<tr>
<td>Hydro</td>
<td>4,340</td>
</tr>
<tr>
<td>Solar</td>
<td>11</td>
</tr>
<tr>
<td>Gas</td>
<td>649</td>
</tr>
<tr>
<td>Biofuel</td>
<td>0</td>
</tr>
</tbody>
</table>

Hourly Ontario Energy Price at 5:00 p.m. EST
- $27.34 / MWh

Global Adjustment 1st Estimate (March)
- $81.05 / MWh

Distributed Energy Resources

- **Generation**: Small scale generation such as solar, wind, hydro, bioenergy and combined heat and power are connected to the distribution grid.
- **SMART HOMES**: Consumers can better control their energy use at home with smart lighting and appliances. On-site generation and energy storage can help shift energy use at home or sell to the grid. Several homes can even be aggregated to provide electricity services back into the grid.
- **Storage**: Storage technologies such as batteries can withdraw electricity from the grid when prices are low, store it, and release the energy back into the grid.
- **Customers with Generation and Controllable Equipment**: Businesses use a combination of energy efficiency, demand response techniques, as well as on-site generation to manage their energy use and costs. Equipment such as heating and cooling pumps can be controlled to ramp up or down depending on electricity prices. They can also generate and/or store their own electricity to use or sell to the grid.
Utility Costs

• Utilities are responsible for:
  • Infrastructure – meters, powerlines, generators etc.
  • Operating Cost – personnel, customer service, monitoring etc.
  • Regulatory Costs – transmission, government initiatives, etc.

• Revenue Requirement
  • The revenue that a utility must earn to provide adequate service to its customers, and a fair return to stakeholders

• Inputs Include:
  • Rate Base
  • Utility Income (Operating Revenue – Expenses)
  • Taxes
  • Capitalization/Cost of Capital
Utility Revenues

- **Distribution Revenue**
  - Transmission Rates
  - Network Rates
  - Wholesale/Distribution Market
  - Distribution Rates

- **Regulatory Revenue**
  - Rural or Remote etc.

- Fixed ($ vs Volumetric ($/kWh, $/kW)

- **Commodity Revenue**
  - Cost of Electricity from Power Generators
  - Regulated Price Plans vs Spot Market

[Diagram showing Ontario Electricity Time-of-use Price Periods]
Utility Money Flow

Vertically Integrated Utility
- Generation
- Transmission
- Distribution

Power Generation Firms, Curtailment Service Providers

Regional Transmission Organization

Electric Distribution Utilities

Wholesale Electricity, Transmission Service

Transmission Fees

Wholesale Electricity

Market Prices, Transmission Fees

Market Prices

Regulated retail prices

Retail Electricity

Figure 1.4: Flows of money (green arrows) and electricity services (blue arrows) in the electricity sector prior to reforms in the 1990s (left hand side) and after those reforms were put in place (right hand side).

Diagram credit: www.e-education.psu.edu/ebf483/node/641
Effectiveness of Utilities

1. Customer Focus
2. Operational Effectiveness
3. Public Policy Responsiveness
4. Financial Performance
Rate Design

Part 2 of 4
Bill

- Generation
- Transmission
- Distribution
- Regulatory
- Tax
- Rebates

November Monthly Bill Statement

<table>
<thead>
<tr>
<th>Time of use - Winter</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>448 kWh Off-peak (lowest price) @ 10.1 ¢/kWh</td>
<td>0.00</td>
</tr>
<tr>
<td>126 kWh Mid-peak (mid price) @ 14.4 ¢/kWh</td>
<td>0.00</td>
</tr>
<tr>
<td>126 kWh On-peak (highest price) @ 20.8 ¢/kWh</td>
<td>0.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time of use - Summer</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>455 kWh Off-peak (lowest price) @ 6.5 ¢/kWh</td>
<td>0.00</td>
</tr>
<tr>
<td>119 kWh Mid-peak (mid price) @ 9.4 ¢/kWh</td>
<td>0.00</td>
</tr>
<tr>
<td>126 kWh On-peak (highest price) @ 13.4 ¢/kWh</td>
<td>0.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Delivery</th>
<th>0.00</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Regulatory Charges</th>
<th>0.00</th>
</tr>
</thead>
</table>

Your Total Electricity Charges | 0.00 |

H.S.T. | 0.00 |

8% Provincial Rebate | (0.00) |
Ontario Electricity Rebate | (0.00) |

Total Amount | $0.00 |

### MONTHLY RATES AND CHARGES - Delivery Component

<table>
<thead>
<tr>
<th>Charge</th>
<th>Rate ($)</th>
<th>Amount ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Charge</td>
<td></td>
<td>11,426.80</td>
</tr>
<tr>
<td>Distribution Volumetric Rate - $/kW</td>
<td></td>
<td>1.1889</td>
</tr>
<tr>
<td>Low Voltage Service Rate - $/kW</td>
<td></td>
<td>0.1579</td>
</tr>
<tr>
<td>Retail Transmission Rate - Network Service Rate - $/kW</td>
<td></td>
<td>3.0822</td>
</tr>
<tr>
<td>Retail Transmission Rate - Line and Transformation Connection Service Rate - $/kW</td>
<td>2.1440</td>
<td></td>
</tr>
</tbody>
</table>

### MONTHLY RATES AND CHARGES - Regulatory Component

<table>
<thead>
<tr>
<th>Charge</th>
<th>Rate ($)</th>
<th>Amount ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wholesale Market Service Rate (WMS) - not including CBR - $/kWh</td>
<td></td>
<td>0.0032</td>
</tr>
<tr>
<td>Capacity Based Recovery (CBR) - Applicable for Class B Customers - $/kWh</td>
<td></td>
<td>0.0004</td>
</tr>
<tr>
<td>Rural or Remote Electricity Rate Protection Charge (RRRP) - $/kWh</td>
<td></td>
<td>0.0003</td>
</tr>
<tr>
<td>Standard Supply Service - Administrative Charge (if applicable) - $</td>
<td></td>
<td>0.25</td>
</tr>
</tbody>
</table>
Rate Design

Revenue Requirement → Rate Base → Residential
- Fixed $
- $/kWh
Commercial
- Fixed $
- $/kWh
- $/kW
Industrial
- Fixed $
- $/kWh
- $/kW
- $/kVA
Rate Design

- Residential
  - Fixed $/kWh
  - Fixed $/kW
  - On-Peak
  - Mid-Peak
  - Off-Peak

- Commercial
  - $/kWh
  - $/kW

- Industrial
  - $/kWh
  - $/kW
  - $/kVA
Simplistic Rate Design

1. Determine revenue requirement
2. Gather usage for each class
3. Split revenue between classes
4. Create rate structure

- Residential: 60% of $1M, $600k, $10/month, 0.14 $/kWh
- Commercial: 20% of $1M, $200k, $20/month, 0.10 $/kWh, 40 $/kW
- Industrial: 20% of $1M, $200k, 100 $/account/month, 0.06 $/kWh, 20 $/kW, 20 $/kW co-incident peak
Effectiveness of Rate Design

1. Production Motivation / Capital Attraction
2. Efficiency Incentive
3. Demand Control / Consumer Rationing
4. Income-Distribution

- Principles of Public Utility Rates: James Bonbright (1961)
Meter Reading

Part 3 of 4
Meter Readings

- Metering Evolution
  - Manual
  - Walk/Drive By (Radio Frequency, but short Distance)
  - Smart Metering (Radio frequency both short/long distance, cellular etc.)

- AMR – Automatic Meter Reading
- AMI – Advanced Metering Infrastructure
Operational Data Storage to Utility Data Hub

- An **operational data store (ODS)** is a type of database that collects data from multiple sources for processing, after which it sends the data to operational systems and data warehouses.

- A **data hub** is a collection of data from multiple sources organized for distribution, sharing, and often sub-setting. Generally, this data distribution is in the form of a hub and spoke architecture.
Rate Analysis

Part 4 of 4
Analytics Value Curve

How far has your utility advanced in its analytics maturity? How much value is being derived as a result?

Source: Utility Analytics Institute
Business Analytics Software

• Software that allows a utility to combine finance with meter readings
• Able to peruse through large datasets, organize and surface with rich visualizations
• Able to perform Scenario Analyses
• Provide insight to make intelligence decisions
Rate Analysis

Revenue Requirement → Rate Base

- Residential...
- Commercial...
- Industrial...

Effectiveness of Rate Design
Rate Analysis

Revenue Requirement → Rate Base

- Residential
- + Solar
- Commercial
- Industrial

Effectiveness of Rate Design
Total Usage (kWh) 262,855,962

Total Revenue $35,251,005

Revenue by Category

Revenue - Actual versus Adjusted

Revenue by Month
Rate Design and Monitoring Performance

• Business Analytics software enables utilities to view their customer base through a financial lens.

• Enables a utility to understand the financial impacts on their customer base. Also allows for grouping of rate classifications.

• Advanced applications can test multiple scenarios for rate designs, including regulated price plans (i.e., TOU, Tiered, Spot, Peak Demands).

• Continuously monitor financial performance of utility after a rate design has been selected.
Questions?
Thank you!
Utilismart Overview

• Established in 2000
• Serve over 140 utilities across North America
• Hosted, managed services
• Cloud applications
  • Meter data management
  • Customer engagement
  • Utility rate analysis and settlement
  • Network analysis
  • Grid simulation
• Own and operate all infrastructure and applications
• Secure ISO27001

Utilismart Corporation: 1-888-652-0689