Defining Customer Classes in the AMI Age
TPPA Annual Meeting
The Electric Utility Market is Changing

The traditional utility business model is becoming obsolete, calling into question historical product and service offerings, supporting rate design and the definition of rate classes.
Why Have Rate Classes?

• Rate classes balance fairness and complexity in the rate setting environment
What is Fair?

• Cornerstone principle of ratemaking
  – Arguments pertaining to fairness and equity are measured against cost of service results
Cost of Service

- TPPA members provide electricity to a majority of customers on a firm all-requirements basis
- To meet this obligation, TPPA members must have sufficient:
  - Capacity (Demand) to ensure reliability
  - Energy for customer use (work)
  - Representatives to interact and serve customers
- Customer demand and energy requirements drive the majority of utility investment
  - The cost of these investments are allocated to customers via a cost of service study and reflected in rates
Rate Classes and Cost of Service

- Customers are grouped into rate classes based on similar usage characteristics and service requirements
  - Size (kilowatts (kW))
  - Load Factor
  - Service Voltage
  - Time-of-Use (TOU)
  - Reliability

Historically, these groupings have been based on available load research data and general perceptions regarding electricity use.
Adherence to Cost of Service Principles Reduces Subsidization

• Grouping customers with similar usage characteristics results in:
  – Improved cost of service results where imbedded subsidies between classes are reduced (Interclass Subsidies)
  – Properly designed rates using class cost of service results, will reduce subsidies between customers within the same class (Intraclass Subsidies)
    • Reduced need for rate riders
Rate Classes and Metering Technology

• Certain rate class definitions and supporting rate structures became embedded with meter investments
  – Non-demand
  – Demand
  – Interval Demand Recorders
Common Rate Classes

- Often, utilities will create customer classes that blend common socio-economic and political characteristics with perception of customer usage characteristics
  - Residential
  - Small Commercial
  - Medium Commercial
  - Large Commercial
  - Industrial
  - Irrigation
  - Schools
  - Churches
  - Government
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Class descriptions do not describe meaningful cost of service differentials
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  - Government

Customer electricity use is changing, calling into question the validity of traditional customer class groupings
What is Driving Change?

• Enabling technologies
  – Demand destruction
    • High-efficiency appliances, motors, etc.
    • Load control
    • Distributed Energy Resources (DERs)
      – Renewables
      – High-efficiency dispatchable generators
      – Batteries
What is Driving Change?

• Enabling technologies (cont.)
  – Electric vehicles (EVs)
  – Information technology
    • Customer knowledge and control of “real time” usage
    • Utilities increase knowledge of customer behavior (advanced metering infrastructure (AMI))
    • Always connected (Information portals, Billing Systems, etc.)

• Customer values
  – Blur of traditional definitions of “at work” versus “at home”
  – Person interest and control of power supply
  – Increased interest and acceptance of “new” business models
Demand Destruction – Electric Load Growth Decouples from Gross Domestic Product (GDP)

Demand Destruction: load growth as we knew it is likely over. Most utilities are experiencing between 0 - 1% annual growth in loads.
Enabling Technologies – Changing Traditional Customer Load Shapes

- Load shapes in today’s power system are changing as a function of DERs
  - For Residential customers, this is primarily due to rooftop photovoltaics (PV)
  - For Commercial and Industrial customers, various DERs (PV, storage) are being deployed to reduce and manage demand charges
  - Load shapes may change independent of PV penetration (e.g. customers on new TOU rates)
- DERs may change the timing, level, and ramping requirements of peak demand differently in various customer classes
- This influences a utility’s coincident peak and can lead to a change in the amount and type of capacity resources required
Enabling Technologies – Load Shape Impacts can be Complicated by EVs

- DER impacts on load shapes is not only a function of PV but also EVs
- Important to assess impacts of PV and EVs both separately and combined
- Variables that impact EV load profiles are:
  - Type of charger
  - Type of vehicle
  - How the vehicle is used
- Assuming standard evening charging profile, customer, and likely system peak, demand will increase
  - EV load diversity will vary significantly at certain levels of technology penetration
- PV plus EV exacerbates the duck curve and evening ramping requirements
Enabling Technologies – Load Shapes can be Managed by Technology

- Energy storage can help manage load shapes
  - If storage absorbs PV “exports” (assuming minimal sizing differential), then load shapes flatten and reduce Peak demand
- While Peak demand is reduced, ramping requirements may still be significant depending on load diversity

Note: this is not looking at economics of a combined PV + storage system – only what can happen to load shapes if these are installed
Enabling Technologies – AMI Metering and Data

• AMI metering technology enables:
  – Data analytics of customer usage characteristics
  – Data driven solutions addressing appropriate:
    • Customer class designations
    • Rate design
  – Flexibility and change
Customer Usage Characteristics – AMI Data Sample

Sample of 100 Residential Customers’ Usage During Peak Summer Day
Average Shown as Red Dashed Line

Hour Ending

NCP – Demand (KW)

12:00 AM 1:00 AM 2:00 AM 3:00 AM 4:00 AM 5:00 AM 6:00 AM 7:00 AM 8:00 AM 9:00 AM 10:00 AM 11:00 AM
12:00 PM 1:00 PM 2:00 PM 3:00 PM 4:00 PM 5:00 PM 6:00 PM 7:00 PM 8:00 PM 9:00 PM 10:00 PM 11:00 PM
Sample of 100 Residential Customers’ Usage During Peak Summer Day
Average Shown as Red Dashed Line

Hour Ending

Demand (kW)
Common Usage Characteristics?
Residential Class Example

Average Residential Monthly Demand (Sorted Low to High)
Common Usage Characteristics?
Customer Load Profiles

Average Weekday Profile (June-September)
0kW to 10kW

Average Weekday Profile (June-September)
10kW to 50kW

Average Weekday Profile (June-September)
50kW to 300kW

Average Weekday Profile (June-September)
300kW to 3,000kW
Changes in Approach

- Define/align classes based on cost of service differentials
  - Obligation to serve and reliability
    - Firm versus Non-Firm
    - All Requirements versus Partial Requirements
  - Service requirements
Changes in Approach – Rate Classes Aligned with Underlying Customer Usage Characteristics

• Example Classes
  – Full Requirements
    • Secondary Service ≤10 kW
    • Secondary Service > 10 kW
    • Primary Service
    • Transmission Service
  – Partial Requirements – Standby Service
    • Dispatchable
    • Non-dispatchable
  – Interruptible Service
Changes in Approach – Rate Design
Philosophy is Important

• Rate design philosophy dictates the number of required classes
  – May result in less rather than more classes
Changes in Approach – Example Case

• Data analytics approach to rate class determination
  – Evaluation of numerous combinations of rate design and customer groups with the objective of minimizing subsidization on a customer by customer basis
Changes in Approach – Example Case

• Data analytics approach to rate class determination
  – Basic inputs
    • Customer AMI load data
    • System cost of service metrics
      – $/kW – Coincident
      – $/kW – Non-Coincident
      – $/kW – at meter
      – $/kWh – by delivery voltage
      – $/customer
## Changes in Approach – Current Rates/Classes (Example Case)

<table>
<thead>
<tr>
<th>Rate Component</th>
<th>Units</th>
<th>Residential</th>
<th>Commercial &lt;100 kW</th>
<th>Commercial &gt;100 kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Charge</td>
<td>Cust-Months</td>
<td>$10.00</td>
<td>$25.00</td>
<td>$1,000.00</td>
</tr>
<tr>
<td>Energy Charge</td>
<td>kWh</td>
<td>$0.096</td>
<td>$0.0500</td>
<td>$0.0400</td>
</tr>
<tr>
<td>Demand Charge</td>
<td>kW</td>
<td>NA</td>
<td>$8.30</td>
<td>$14.50</td>
</tr>
</tbody>
</table>
Changes in Approach – Customer Level Cost of Service Results (Example Case)
Changes in Approach – Difference from Cost of Service Under Current Rates

Average Customer Difference from COS Under Current Rates (%)

- Pay more than 10% over COS
- Within 10% of COS
- Have subsidy greater than 10% of COS

Difference from COS (%)

Monthly Energy Usage (kWh)

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Changes in Approach – Example Case

• Data analytics approach to rate class determination (cont.)
  – Parameters of evaluation
    • Rate structures
      – Two-Part Rate (Customer/Energy)
      – Three-Part Rate (Customer/Demand/Energy)
      – TOU Rate
      – Etc.
Changes in Approach – Example Case

• Data analytics approach to rate class determination (cont.)
  – Parameters of evaluation
    • Customer groups
      – Maximum Demand (Annual, Summer, Monthly)
      – Energy Usage (Annual, Summer, Monthly)
      – Load Factor
      – Delivery Voltage
      – Etc.
Changes in Approach – Difference from Cost of Service Under Data Driven Classes/Rate Structure
Changes in Approach – Proposed Rates/Classes (Example Case)

<table>
<thead>
<tr>
<th>Rate Component</th>
<th>Units</th>
<th>Class 1 – &lt;2,350 kWh/Month</th>
<th>Class 2 – ≥2,350 kWh/Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Charge</td>
<td>Cust-Months</td>
<td>$6.45</td>
<td>$16.40</td>
</tr>
<tr>
<td>Energy Charge</td>
<td>kWh</td>
<td>$0.0904</td>
<td>$0.0701</td>
</tr>
<tr>
<td>Demand Charge</td>
<td>kW</td>
<td>NA</td>
<td>$10.32</td>
</tr>
</tbody>
</table>
Changes in Approach – Data Driven Solution

- Example Data Driven Solution
  - Reduced number of classes
  - Did not introduce more complicated rate structures
  - Intraclass subsidies reduced by more than 50%

- Classes / Rate Structures Resulting from Data Driven Analysis
  - Class 1 – <2,350 kWh/Month
    - Two-part rate (Customer and Energy Charge)
  - Class 2 – ≥2,350 kWh/Month
    - Three-part rate (Customer, Demand, and Energy Charge)
Additional Considerations
Strategy and Philosophy

- Rate Strategy and Philosophy
  - Tolerance and approach to change
  - Customer impacts
  - Competitive concerns
  - Desire to change customer behavior

![Utility Rate Comparison Diagram](image)
Additional Considerations
Desire to Change Behavior

Average Usage (kW) Summer
Month: June 2017

Average Usage (kW) Winter
Month: December 2017

TOU Peak Period

Residential
Residential TOU

Residential
Residential TOU
DISCUSSION