Smart Grid @ RPU

Burns & McDonnell
Issues for Tonight’s Discussion

• Recap Smart Grid overview-RPU status
• Results of analysis
  – Recommendations
• Path forward

Open dialogue approach
Ask questions as we go!
RPU already is on the Smart Grid path.

How far (and how fast) do you go to Full Smart Grid?
RPU has “Areas of Control” in Smart Grid

RPU involved in SG here through SMMPA/MISO initiatives.

RPU controls this space entirely:
- Remote feeder switching
- Remote monitoring of substation equipment
- Feeder power quality
- Fault identification
- Outage monitoring
- System Loading
- Remote connect/disconnect

RPU works with customers for acceptance “beyond the meter”:
- Variable pricing
- Hourly consumption/bill updates
- Load management at appliance level
- Distributed Generation/Micro Grids
“Areas of Control” have different Products and Technologies

**Smart Generation & Transmission**
- Phasor Measure Units
- Control Center
- Energy Management Systems

**Smart Distribution**
- Buy
- Sell

**Smart Customer**
- Billing
- Information

**Products and Technologies are Aimed at Utility industry**
- Advanced Meters and assoc. comm.
- And consumers-
  - Home Area Networks
  - In home displays
  - Appliances
  - Computer Applications

**Products and Technologies are Aimed at Utility industry**
- Computer Relays
- Distribution Automation
- Outage Management Systems
- Asset Management
- Meter Data Management
RPU has a Relatively Advanced System

<table>
<thead>
<tr>
<th>Existing System</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fiber optic communications</td>
<td>4 out of 10 substations connected</td>
</tr>
<tr>
<td>Advanced SCADA system</td>
<td>21 RTUs and 53 PLCs&lt;br&gt;SEL 2030 Gateways at substations</td>
</tr>
<tr>
<td>Capacitor bank controls</td>
<td>8 advanced capacitor banks&lt;br&gt;50% of distribution capacitor banks with controllers</td>
</tr>
<tr>
<td>Transmission relays</td>
<td>100% fault locating end of 2010</td>
</tr>
<tr>
<td>Distribution Relays</td>
<td>100% fault locating end of 2011</td>
</tr>
<tr>
<td>Telvent Outage Management System</td>
<td>Advanced system with many more capabilities and connectivity than RPU is currently using</td>
</tr>
</tbody>
</table>
RPU’s Reliability is Already High...

<table>
<thead>
<tr>
<th>Measurement</th>
<th>RPU</th>
<th>Industry Ave.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ave # of outages</td>
<td>0.49/customer/yr</td>
<td>1.10 /customer/yr</td>
</tr>
<tr>
<td>Duration of outage</td>
<td>33.59 minutes</td>
<td>90 minutes</td>
</tr>
<tr>
<td>Ave Restoration time</td>
<td>69.01 minutes</td>
<td>81.6 minutes</td>
</tr>
</tbody>
</table>
“Areas of Control” have different Products and Technologies

Products and Technologies are Aimed at Utility industry
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New Products & Technologies Blur Smart Grid Utility/Customer Line

Ultimate Smart Grid Customer Level Functionality
1) Real-time Information on Usage and Cost
2) Automated Control of Appliances
3) Customer Empowerment to affect consumption

CUSTOMER

CUSTOMER/UTILITY INTERFACE

UTILITY

Smart Appliances
Home Energy Displays
Smart Meters/AMI
Direct Load Control
Demand Response

Distribution Automation
Enterprise Data Systems (MDMS)
RPU has Installed an Automatic Meter Reading System…

<table>
<thead>
<tr>
<th>Smart Meter Capabilities</th>
<th>Current Meter Capability?</th>
<th>Add on Capability?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Customer Features</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interval reads (hour or less)</td>
<td>Some Locations</td>
<td>Yes</td>
</tr>
<tr>
<td>Remote on-demand reads</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Real-time information to the home (ZigBee)</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>On Line ePortal for customers</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Distribution Features</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power outage notification</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Power quality monitoring</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Remote connect/disconnect</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Smart Meter Capabilities require two way communication system between RPU and meter.
Two Approaches Essentially Same for Customer, not RPU…

- Data shared with 3rd parties
- Internet Security
- More difficult for RPU to get interval usage
- More devices for same functions as Smart Meter
- Customer controlled, can be supported now by RPU
- Communications via internet
- Not as prone to tech obsolescence with “all eggs in one basket”
- No straightforward approach to sharing data across RPU
- FYI, No billing quality information

- Data controlled by customer and RPU
- RPU Security responsibility
- Easy to get interval data
- Use of AMR requires “add ons”
- RPU controlled so customer must coordinate with RPU
- RPU communications
- Meter technology by vendor
- Replacement with Smart Meters could be done over time, targeted points
- Easier approach to sharing data across RPU
- Provides billing data
Variable costs will affect usage…

Add Renewable Generation?

Variable Costs
So, There are a number of options, considerations and approaches to Smart Grid

How do we get any focus on these issues?

**Customer Space**
- Time varying rates
- Real time usage
- Smart Building Controls
- Ancillary services

**RPU Space**
- Remote connect/disc
- Power quality info
- Outage information
- Real time usage
- Ancillary services

Key issue of Smart Grid for RPU is about use of Advanced Meter Infrastructure
Time of use rate issue is major factor in deployment of AMI

This question drives:
1. Whether to deploy technology across full system or for only customers who want TOU.
2. How readily RPU can leverage technology in customer space for Smart Grid Dist Automation objectives.
3. How many rate structures RPU maintains.
4. How to recover costs (ratebase or per adopter).

-Mandatory

One fundamental question:
Does RPU move to Mandatory Time of Use rates for all customers?

-Voluntary

RPU pledges, we deliver
Decisions on TOU and Tech issues

Customer TOU participation?

Mandatory

RPU invests in full system deployment resulting in highest rate increase

RPU

Voluntary

Who will pay?

RPU tech. or Customer tech.?

RPU

Share

RPU & customers share the cost of meter technology resulting in lower participation and additional benefits and requires less energy rate increase

Customer

RPU invests in meter technology resulting in higher participation and additional benefits to RPU but requires energy rate increase

RPU invests in full system deployment resulting in highest rate increase

RPU

Share

Customer
Support in the voluntary approach

- **RPU** promotes and installs meter technology that customers and RPU gain usage information from.

- **Customer** gains usage information from technologies "behind the meter" that customers gain usage information from.

RPU invests in full system deployment resulting in the highest rate increase.

Mandatory

Voluntary

RPU invests in meter technology resulting in higher participation and additional benefits to RPU but requires energy rate increase.

RPU & customers share the cost of meter technology resulting in lower participation and additional benefits and requires less energy rate increase.

RPU promotes and installs meter technology that customers and RPU gain usage information from.

RPU promotes and advises customers in the acquisition of technologies "behind the meter" that customers gain usage information from.

Share RPU tech. or Customer tech.?
Business Case developed using the following premises...

First: Due to advantages it brings, AMI would be deployed.

- RPU space
- Customer space

Mandatory use of AMI removes question of whether to use Internet or customer based approach

Second: RPU will determine approach to mandatory versus voluntary TOU rates.

- Business Plan reviewed both
- Main difference is pace of AMI deployment
Business Case Includes:

- Discussion of Smart Grid
  - Different perspectives of Customer, RPU and Regulators
- GAP analysis of what infrastructure is currently in place and what is needed
- Discussion of mandatory versus voluntary approaches
- Benefit cost analysis
  - Spreadsheet tool that allows RPU to refine assumptions and rerun assessment
- Recommendations and Implementation Plan
RPU Direct Benefits

Cumulative Net Cost/Benefit (Millions)

- VOLUNTARY RATE / MANDATORY TECHNOLOGY APPROACH
- MANDATORY RATE / MANDATORY TECHNOLOGY APPROACH
Total Community Benefits

RPU Smart Grid: Cumulative RPU & Customer Net Cost/Benefit

- VOLUNTARY RATE / MANDATORY TECHNOLOGY APPROACH
- MANDATORY RATE / MANDATORY TECHNOLOGY APPROACH

Cumulative Net Cost/Benefit ( Millions )

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<tr>
<td>Cost</td>
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<td>Benefit</td>
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Recommendations for RPU
Smart Grid Future

• Due to advantages in cost and features, RPU should plan
migration to an AMI platform.
  – New customers
  – AMR attrition
  – Statistical dispersion
  – TOU deployment

• In order to maximize customer benefits with Smart Grid,
significant consumer education is needed.
  – First major activity.
  – What to do with usage information
  – What are impacts and how to use dynamic cost information
  – Manage fears of “intrusion” and personal information
  – Align expectations with realities of Smart Grid

• Upgrade SCADA and outage management system with regards
to Smart Grid goals.

• Plan for increased amounts of data to be processed. Upgrade
the CIS with eye towards this data coming and TOU rates
being more widely deployed.
Possible Time Line

Year 1
• Customer dialog and education about Smart Grid
• RPU decision on mandatory versus voluntary TOU
• Identify and prioritize poorest performing distribution system areas
• Designs for communication system
• Designs for Back office systems upgrades
• Design customer programs (rates, ancillary services, DSM)

Year 2
• Continue consumer education, roll out of programs, devices
• Design TOU rates
• Initiate AMI deployment in strategic locations
• Initiate communication and computer systems upgrades
• Initiate distribution system upgrades at poorest areas

Year 3
• Begin offering TOU rates and other customer programs
• Tie meter data management system to customer and outage systems
• Continue distribution and meter system upgrades

Year 4+
• Evaluate, monitor and refine customer programs
• Continue distribution and meter system upgrades
• Evaluate, monitor, and refine internal RPU data sharing, organization, and processes
What do you think?
Where do we go from here?
Prudently adopt Smart Grid technologies which provide customer value in reliability or service.