Smart Grids, Smart Meters and Integrated Communications

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• Integrated communications
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About BPL Global

- Formed in 2004, HQ in Pittsburgh
- Develop, deploy, and manage Smart Grid and Broadband solutions
  - Develop/support Smart Grid applications for utilities
  - Provide broadband services to utility customers
  - Regional Partners – utilities, ISP, and financial

Map of BPL Global HQ and Regional Offices:
- PITTSBURGH
- SAN FRANCISCO
- PARIS
- ATHENS
- KUWAIT
- SÃO PAULO
- HONG KONG
Where are we now?

We have work to do!

- Stand alone systems
- Incomplete & Inadequate Communications
- Unmonitored / Unmanaged devices
- Limited information (lots of data)

**Utility Internal**
- Asset Mgmt
- Outage Mgmt System
- Work Force Mgmt
- SCADA / Telemetry

**Customer Facing**
- Customer Information System
- Meter Data Mgmt
- AMR systems

**IT**
- Trouble Ticketing

**Backhaul**
- Fiber/wireless

**Last Mile / In-Prem**
- Medhaul

**Devices, Sensors**
- Sensors
- Distributed Resources
- Switching & Protection
- Cap Banks
- Recloser
- Fuses
- Grid Meters
- Analog Meters
- AMR/AMI Meters

**Customer premises**
- Cellular/PLC

**Distribution Substation**

**Distribution Grid**
What is a smart grid?

- Specific smart grid definitions vary
  - CEATI: activities, functionalities, technologies
  - DOE – Modern Grid Initiative: Integrated Communications, Advanced Components, Sensing & Measurement, Advanced Control Methods, Improved Interfaces and Decision Support
  - EPRI – IntelliGrid, methodology, technology, distributed information, business needs

- Different...but the same!
- This is not just a North American issue
Smart Grid Common Traits

- Advanced sensors and measurements
- Real time monitoring and control systems
- Integration of distributed energy resources
- Integrated communications
Advanced Sensors and Measurements

• Placed at critical points along the grid and monitored elements (cap bank, recloser, fuse points, etc.)
  • Must be low cost, easy to deploy with two way communication
  • Assessing the state and condition of grid elements – outage detection
  • Establishing capacity and failure probability in real-time
  • Providing the basis for advanced system protection

• Meters and Premise control devices
  • Use meters as a sensor not just a billing mechanism (real-time consumption data, PQ, etc)
Distributed Energy Resources

- DER is proceeding across the world
  - Address the supply/demand imbalance
  - Improves grid reliability and asset life
  - Buys time for major capital upgrades
  - Some driven by the utility, some by end users

- Must be integrated
  - Physically to the grid and its protection schemes
  - Requires two-way communications
  - Systems linkages are needed in the operations center

- Smart meters could play a key role
  - Extend operation
  - Could ease cold load pickup
Real Time Monitoring and Control Systems

- A smart grid system requires information in real time
  - “Real time” is driven by the applications that the utility desires
  - Systems must be flexible, scalable, and easily integrate to legacy and new applications
- System implementation will be incremental
  - First- Integrate data scheme for cross application usage
  - Second- present application data as useful information
  - Third- integration with business and operational processes
  - Fourth- advanced analytics and cross app correlation for decision support
  - Fifth- use the information to automate functionality on the grid
- The result is a grid that is robust, interactive and responsive to constantly changing supply and demand
Integrated Communications

- The key to a smart grid is communications
  - Must be fast enough to meet the real time needs of the system
- Many different technologies can be used
  - Wireless, Cellular, PLC, BPL
  - Each has strengths and weaknesses
Integrated Communications

- **Key considerations**
  - Ease of deployment
  - Cost – opex, capex
  - Latency
  - Standards
  - Data carrying capacity (speed)
  - Secure
  - Regulatory
  - Coverage capability

- **How much is needed?**
  - You are only carrying bits but the bits aggregate quickly—50 bits/sec/household handles most apps
  - Do the apps control equipment or just deliver information – latency vs. speed
  - Some advanced apps need more – video surveillance, work crew communications, etc.
# Integrated Communications

## Technology Comparison and Risk Profile

<table>
<thead>
<tr>
<th>Technology</th>
<th>Deployability</th>
<th>Cost – Capital</th>
<th>Cost - Ops</th>
<th>Latency</th>
<th>Speed</th>
<th>Regulatory</th>
<th>Standards</th>
<th>Coverage</th>
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- No one technology fits all applications
- Multiple factors must be considered
- A mix of technologies will be needed
Benefits of a smart grid

- It won’t be easy, cheap or short term
- A smart grid requires information from the premise (e.g. smart meters) and throughout the grid
  - Real time, two way, remote functionality
- Benefits are widespread and significant
  - A 2004 EPRI study quantified the benefits from a Smart Grid
  - Cost of implementation estimated at $165 billion over 20 yrs
  - Investment would yield a 20-year net benefit of between $638 billion and $802 billion

Estimated Net Present Worth ($Billions) of improvements for attributes over the 20-year study period
How do we get there

- One step at a time
  - Decisions made incrementally but with a holistic view
  - Evaluate and act on the biggest issues first – regulatory drivers, operational, etc.
- Implementation steps
  - Deploy sensor technology to identify operational conditions
  - Canadian regulatory drivers enable information from the premise – use it for more than just a billing mechanism
  - Add monitoring and control mechanisms to existing grid elements (e.g. cap banks, reclosers, switches, etc.)
  - Include IT to prepare for broad systems requirements
  - Integrate business and operational processes
  - Communications must be deployed along each step
  - Add advanced analytics and correlations as you go
  - Prepare for automation
Thank You!

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