CenterPoint Energy’s Distribution Automation Strategy

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“To be recognized as America’s Leading Energy Delivery Company… and more”

- Public company traded on the New York Stock Exchange (CNP)
- Headquartered in Houston, TX
- Operating 3 business segments in six states
  - Electric transmission and distribution
  - Natural gas distribution
  - Interstate pipelines and natural gas gathering
- Serving nearly 5 million electric / gas customers
- $17 billion in assets
- $8.5 billion in revenue
- More than 9,000 employees
- Over 130 years of service to our communities
CenterPoint Energy – Houston Electric

- Chartered in 1882
- 5,000 square-mile service area
- 1.86 million metered customers
- 73.6 billion kilowatt hours delivered yearly for about 60 certified competitive retailers
- Transmission and Distribution System
  - 3,640 miles of transmission lines
  - 34,000 miles of medium voltage lines
  - 8,000 miles of “backbone” medium voltage lines
  - 225 substations

CenterPoint’s Challenge:
Effectively monitor and control millions of line devices and miles of delivery wire which if laid end to end almost circle the earth twice around the equator.
“The greatest challenge facing electric distribution is responding to rapidly changing customer needs for electricity. Increased use of information technologies, computers, and consumer electronics has lowered the tolerance for outages, fluctuations in voltages and frequency levels, and other power quality disturbances. Source: “Grid 2030” A National Vision for Electricity’s Second 100 Years, p 7

**“Rapidly Changing Customer Needs”**

"Utility “Smart Grid” strategies converge on changing customer expectations."
Utilities are at a crossroads…..
Fact: According to the DOE Grid 2030 report, in the next 20 years, the U.S. will spend $450B on electric infrastructure; just to meet load growth.

We have a choice…

Perpetuate a traditional 20th Century Solution  OR  Invest in a 21st Century system that facilitates the digital age, improves reliability and security, enables productivity and economic growth, enables efficient use of electricity and promotes consumer services.
Current Electric Utility Environment

- Increase shareholder value
- Increasing costs
  - Labor
  - Gas – Overall rates
  - Copper, aluminum, steel – Transformers / conductors
  - Vehicle Fuel
  - Taxes and franchise fees
- Continued regulatory pressure to decrease rates
- Regulatory reliability concerns / awareness
  - Northeast blackout
  - Hurricane impacts
- Increasing Deregulated Texas Electric Market Demands on performance
- Increased management / accounting controls – Sarbanes / Oxley
- Aging workforce – both internal and field (Knowledge / Skill Transfer costs)
- Electric Utility Energy Market Changes
- Rapidly Changing Customer Needs

The overall utility environment is demanding higher performance in an ever increasing cost environment.
Distribution Automation

Key Elements:
- An Intelligent Grid component
  - A substation automation component
  - A distribution automation component
  - An automated field crew dispatch component
- An Automated Meter Infrastructure (AMI) component
- A business systems component
- A communications system component
Visibility Throughout the Grid is Key

“Intelligence” through End-to-end Data Integration
The CenterPoint Energy backhaul communications network can be segregated into four distinct segments or tiers:

- **Tier 1**: Major backhaul: Data Center to the substations
- **Tier 2**: Minor backhaul: Substations to the IG device or meter relay (Utility Grade BPL)
- **Tier 3**: Wireless Meter Data Collector communicates with the meter
- **Tier 4**: Meter to ZigBee wireless connections to home energy management devices
Intelligent Grid “Utility Grade” … Tier 2 Architecture

BPL is used as a utility grade data backhaul medium. Therefore, to meet the utility requirements, the communications architecture requires fewer BPL repeaters to achieve the necessary bandwidth.

Utility Grade BPL Network - MV Circuits Only… (Fewer BPL Repeaters are spaced farther apart)

Meter data collectors, utility sensors, switches for utility automation

Traditional BPL to The Home (BPL repeaters at every transformer to provide capacity and access)

To Homes or Businesses

Wired BPL
Basic OpenWay Metering System Features

- **Basic Network Data Collection**
  - Customizable Reading intervals
  - On Demand Reads
  - Remote Demand Reset
  - Remote or Virtual Connects / Disconnects
  - CPP / TOU Rate Updates
  - Demand Response
  - Tamper / Theft Event Flags
  - Outage / Restoration

- **Remote Device Configuration / Firmware & Feature Updates**

- **System Monitoring via Enterprise Software (Tivoli, OpenView)**

- **Local connectivity to remote devices (Zigbee)**

- **Intelligent Grid Support – Meter is a grid sensor**

- **Utilizes mesh network technology and 2-way communication to meters**
Distribution Automation (cont.)

Activities/Tasks Completed:
- Developed plans
- Prepared analyses
- Carried out feasibility tests
- Participated in workshops with external consultants
- Decision on utilizing (DAS) to address challenges facing the utility
Benefit Categories:

- Improving power reliability and quality
- Mitigating the effects of the aging workforce
- Optimizing capital expenditures
- Maximizing asset utilization
Distribution Automation Strategy (cont.)

How?:

- Reduce unplanned outages
- Reduce outage restoration times
- Improve grid control
- Automate crew dispatch
- Enable right sizing of equipment
- Extend equipment life
- Capture institutional knowledge into databases
- Improve technical and system planning processes
Distribution Automation Strategy

Key elements of the strategy are:

- Automate meter reading
- Enable remote electric service turn on/turn off
- Increase distribution grid reliability
- Increase fault isolation capabilities through:
  - Fault locating
  - Enhanced grid switching
  - Enhanced feeder interconnection
- Reduce or prevent outages
- Reduce or prevent equipment failures
- Improve substation equipment utilization
- Reduce substation maintenance costs through substation automation
- Improve response to outages
- Automate and optimize Crew Dispatch operation
- Address aging workforce issues
Distribution Automation Strategy (cont.)

Key elements of the strategy are:

• Provide a comprehensive real time view of the distribution grid and all attached assets through:
  - Distributed sensing
  - Grid communications
  - Data analytics
  - Information integration

• Distribute information as needed throughout the utility and beyond

• Provide improved grid:
  - Observability
  - Controllability
  - Automation
  - Information distribution
The main advantage for BPL lies in the fact that a significant portion of the network infrastructure already exists and...

...given the pervasiveness of the electric grid, BPL technology allows the utility to overlay a robust communications layer on the existing electric grid / network.
Industry View of the Intelligent Grid

The electric power industry has recognized the Intelligent Grid concept as a significant need for utilities as they move into the 21st Century.

Three Most Widely Used Industry Definitions:

1. The U.S. Department of Energy’s Office of Electric Transmission and Distribution (OETD) has presented its vision of the Grid of the Future, with special emphasis on distributed power grid intelligence and on quality of the delivered electric power. The OETD definition of the Grid of the Future is summed up in this statement:

   “Grid 2030 envisions a fully automated power delivery network that monitors and controls every customer and node, ensuring two-way flow of information and electricity between the power plant and the appliance, and all points in between.”

From GRID 2030: A National Vision for Electricity’s Second 100 Years
US DOE Office of Electric Transmission and Distribution
Industry View of the Intelligent Grid (cont.)

Three Most Widely Used Industry Definitions (cont.):

2. The EPRI viewpoint is described in the IntelliGrid vision statement:

“The IntelliGrid Architecture vision for the power system of the future is:

- A power system made up of numerous automated transmission and distribution systems, all operating in a coordinated, efficient and reliable manner.
- A power system that handles emergency conditions with ‘self-healing’ actions and is responsive to energy-market and utility business-enterprise needs.
- A power system that serves millions of customers and has an intelligent communications infrastructure enabling the timely, secure and adaptable information flow needed to provide reliable and economic power to the evolving digital economy.”

From: http://intelligrid.info
Industry View of the Intelligent Grid (cont.)

Three Most Widely Used Industry Definitions (cont.):

3. The DOE’s Pacific Northwest National Laboratory (PNNL) collaborated with other firms to create the GridWise program. This collaboration has grown into a consortium of public and private stakeholders. GridWise is largely focused on extending power grid information to consumers to enable intelligent consumer choices through its vision of the Intelligent Grid:

“The term GridWise denotes the operating principle of a modernized electric infrastructure framework where open but secure system architecture, communication techniques, and associated standards are used throughout the electric grid to provide value and choices to electricity consumers.”

From: US DOE Office of Electricity Delivery and Energy Reliability
GridWise is a trademark of Battelle Memorial Institute
Industry Value Recognition

- Electric power industry recognizes the value of the Intelligent Grid

- Over 30 of the largest electric utilities in North America are working on Intelligent Grids
  - Developing Roadmaps
  - Developing Business Cases
  - Building and testing Intelligent Grid infrastructure-CenterPoint Energy
  - Evaluating Intelligent Grid Benefits:

  * Consolidated Edison
  * PHI
  * Progress Energy
  * Entergy
  * Xcel Energy

  * FPL
  * Sempra Utilities
  * National Grid
  * First Energy
  * TXU-ED

  * SoCal Edison
  * NSTAR
  * Exelon
  * Hydro Quebec
Industry Value Recognition (cont.)

- Benefits being evaluated:
  - Reliability and quality improvements
  - Asset utilization and life cycle optimization
  - Aging workforce mitigation
  - Regulatory compliance, including NERC compliance

Note: The next level of improvement in utility operations will come from integration of:
  - Information management technology
  - Grid operations
  - Utility business processes
Value of the DAS to CNP

- Significant future cost avoidance
- Alleviates pressure caused by staff loss due to aging workforce
- Provides a quantum leap improvement in quality of delivered electric service
  - Technical measures of quality
  - Terms of customer and business partner experiences
- Alternative approach to grid operation, maintenance and customer service
- Relies upon:
  - Advanced grid sensing
  - Robust communications
  - Advanced automation and analytics
- Provides dramatically improved grid observability
- Enables:
  - Automated control
  - More informed decision making
  - Choices in the electric energy delivery chain

The Distribution Automation System is a data-rich system. More and better data leads to better decisions.
Business Driver View

• The Federal Energy Bill of 2005 – mandated reliability
• More reporting requirements
• Aging workforce – need to operate with fewer and less skilled staff
• Aging infrastructure – need to extend life of existing equipment
• Increasing annual demand – need to carry more power more reliably
• Resistance to build out of new transmission lines – need to use existing assets more fully
• Increasing expectations of customers for reliability, quality, and services
• Financial performance pressure for public utilities
• Fallout from the 2003 blackout – increased pressure for grid stability and observability
• NERC – increased data security requirements for critical infrastructure
• New state regulatory requirements
Regulatory Issues That May Affect the CenterPoint Energy DAS

Automated Meter Infrastructure (AMI)

  - Time of use
  - Metering standards suggested in the Act
  - Time-differentiated rates. (Docket 32854).
- Rulemaking Relating to Advanced Metering (Docket 31418)
- Regulatory certainty of recovery of the investment
  - P.U.C. Subst. R. 25.130(b)(2)
Regulatory Issues That May Affect the CenterPoint Energy DAS (cont.)

Broadband over Power Lines (BPL)

- Texas Telecommunications Law (SB-5) provisions related to utility use of BPL:
  - Right to use public roads / utility easements for BPL transmission
  - Open access on the network
  - Provides cost recovery for portion of BPL that is used by electric utility for operations
  - Utilities not required to install BPL
  - Provides exclusive access by the utility to the electric infrastructure to preserve safety and reliability of the electric grid
  - Allows a state or municipality to impose fees on provision of BPL services, but no greater than those imposed on other providers;
  - Ensures that revenues of an affiliate BPL operator are not deemed to be revenues of the electric utility.
Regulatory Issues That May Affect the CenterPoint Energy DAS

PUC Terms and Conditions

• No more than three consecutive meter reading estimations
• Meter Readers must leave door hangers beginning the next month after an estimated reading explaining why the meter was inaccessible
• The Company must perform a reread on meter reads failing the High/Low check
• Following three instances of inaccessible readings within a calendar year, the customer may chose to:
  - Have an OMR meter installed
  - Relocate the point of attachment to an accessible location, or
  - Have service disconnected until the meter is made accessible
  - The customer’s Retailer decides which option applies if the customer fails to choose. The Company executes the Retailer’s decision.
• The Company must initiate priority service order response for some connect/disconnect workloads as requested by Retailers.
• The time allowance for completing service order workloads is greatly reduced.
NERC Critical Infrastructure Cyber Security

- NERC Standards provide a cyber security framework for the identification and protection of Critical Cyber Assets to support reliable operation of the Bulk Electric System.
- The current interpretation of the requirements is that they apply to transmission, but not to distribution. However, it is the opinion of many in the utility industry that use of routable protocols anywhere in the utility system is likely to be of concern to NERC.
Higher values through wholesale integration in a single, seamless communication system…
Meter and In-Home Communications

- Retail Apps
- Custom User Self-Service Utility Apps
- Portal
- Water Heater
- LV 120 V
- Meter Relay
- BPL Repeater
- Compressor
- Pool Pump
- Compressor
Meter and In-Home Communications

Energy Management and Conservation via a Zigbee connection to home devices
Financial Summary

Key Capital Assumptions:

**AMI System:**
- Project build-out: 60 months
- Electric meters installed: 2.0M (excluding growth)
- Gas meters installed: 1.1M (excluding growth)
- Electric meters equipped with connect/disconnect functionality – 100%

**Communication Backbone Network:**
- Project build-out: 60 months
- Substations to connect – 100%

**Intelligent Grid / Substation Operations:**
- Project build-out: 84 months
- Cameras, RC switches, line sensors for both 12kV and 35kV circuits
Background…..

2005… Evaluate BPL as an viable communication medium

In 2005, the objective was to determine whether high speed communications using BPL technology would meet the needs of the intelligent grid on the CNP grid.

2005 Phase Activities
- Working with IBM to provide end to end system integration, business transformation knowledge, and other utility experience
- Implemented BPL network in a 250 home area to test configurations and evaluated with in-home BPL to the receptacle in 30 homes.
The BPL system met high speed broadband expectations into the home.
The cost vs. benefit for a retail play posed a challenge.
An Intelligent grid application of BPL had a significantly positive result.
As a result, CNP and IBM developed a “Utility Grade” BPL deployment option
Opened BPL Technology Center to test and demonstrate
Legislation passed supporting development of BPL
Based on results from 2005 tests, a Distribution Automation Strategy was developed that utilized BPL as a backhaul
Approval to extend testing to include a limited deployment of new Intelligent Grid and Advanced Metering strategy in 2006
2006 – 2007….. Intelligent Grid / AMI Strategy

Continued Limited Deployment

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<tr>
<th>Year</th>
<th>Stage</th>
<th>Details</th>
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<td>2004</td>
<td>Economic Viability &amp; Technical Testing</td>
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<tr>
<td>2005</td>
<td>Small Scale Pilot w/ IBM</td>
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<tr>
<td>2006-2007</td>
<td>Limited Deployment w/ IBM</td>
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2006 Year End - Current Status

**AMI**
- 500+ electric meters installed with integrated remote connect / disconnect
- 3 gas meters installed
- Established connectivity to BPL network.
- Data acquisition tested to 5 minute intervals.
- 2 way communications to the meter

**Communications**
- Fiber / Microwave backhaul to 3 substations complete.
- 20 BPL circuits are communicating.
- Actual performance averages 30+ mbps

**Intelligent Grid**
- Testing connectivity to automated switches, voltage regulators, etc.
2007
Limited Deployment Plan / Status

1Q – 07 Plan
• Install 10,000 advanced electric and 1000 gas meters.
• Implement advanced metering software.
• Complete 20 more 12kv BPL circuits with battery option.
• Integrate OpenWay Relays into BPL network.
• Install 13 sensors on 12 kV circuits and test fault locating for high impedance faults.
• Test the intelligent grid functions on 12kv / 35kv

2Q – 07 Plan
• Test and evaluate the advanced gas and electric meters.
• Continue to test the intelligent grid on 12kv & 35kv
• Complete deployment of substation automation and begin testing

3Q – 07 Plan
• Compile test results.
• Conduct additional testing as required.
• Deliver test results.
Questions?