PECO’s Smart Grid and Smart Meter Program

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February 25, 2013
Exelon at a Glance

*Exelon Corporation is one of the largest electric companies in North America with more than $18 billion in annual revenues. Exelon's family of companies includes energy generation, power marketing, transmission and energy delivery*

- Generation Companies
  - Nuclear, Fossil, Wind, Solar
- Utility Companies
  - PECO, ComEd & BGE
- Shared services including HR, IT and Finance
- A founding member of the PJM Interconnection
  - PJM Interconnection is a regional transmission organization (RTO) that manages the high-voltage electric grid and the wholesale electricity market that serves 13 states and the District of Colombia
PECO

- Subsidiary of Exelon Corporation
- Serving the greater Philadelphia Pennsylvania area for over 100 years
- 2,100 square miles (5,400 km²) service territory
- Electric and Gas Utility
  - 1.7M Electric Customers, 8,932 megawatt peak load
  - 470K Gas Customers
The Smart Grid and PECO

• PECO has been deploying and benefiting from the Smart Grid for many years, as evident in our:
  – SCADA Platforms, both Transmission and Distribution SCADA
  – Distribution Automation Solutions
  – AMR Deployment

• The State of Pennsylvania has recently passed legislation requiring all Utilities to modernize their systems, including Smart Meters
  – Funding mechanisms are included in the legislation
  – This program has been complemented with additional $200M US Federal funding

• This combination of programs is the catalyst for PECO to create the Smart Future, Greater Philadelphia program, whose goals include:
  – Promoting Innovation, Opportunity and Sustainability Through Smart Grid Technology
Smart Future, Greater Philadelphia Program

• PECO’s $650 million Smart Grid / Smart Meter initiative is one of the largest investments in the company’s more than 100 year history and will enable us to provide electric service more reliably and efficiently and provide future new products and services to our customers
  – Work is underway at PECO to deploy Smart Meters for all of our 1.6 million electric customers thanks to $200 million stimulus grant awarded by the US Department of Energy
  – Currently over 370,000 Smart Meters have been installed
  – We expect to complete the full system-wide deployment by the end of 2014.

• The two-way information system created by the Smart Grid / Smart Meter network is designed to improve electric service reliability and also help advance use of renewable energy sources
  – Smart Meter technology will equip customers with the information they need to better understand how they use energy and how they can save energy
  – With this technology PECO also will be able to offer customers enhanced rates and other ‘dynamic pricing’
# Program Scope

### Smart Meters (AMI)
- Install Advanced Metering Infrastructure Communications Network
- Build Meter Data Management System, Middleware & Integrate Systems
- Deploy 600,000 Smart Meters
- Customer acceptance testing

### Communications Support Systems:
- Install 367 miles of fiber optic cable through 71 substations
- Install Tier 2 backhaul communications to support telemetry backhaul, AMI and Distribution Automation
- Update Distribution Management System & GIS (nearing end of life)

### Distribution Automation
- Deploy an additional 100 Reclosers that sense problems and limit their impact
- Install 21 Underground Vacuum Circuit Breakers to modernize the network
- Communicate with 300 more existing devices to improve service

### Intelligent Substations
- Remote Terminal Unit upgrades and migration to IP centric telemetry at substations
- Installation of substation distribution line relays at 10 substations
- Install disturbance monitoring equipment at 31 substations

### Smart Home/Business Demonstrations
- Dynamic Pricing Plans
- Liberty Smart Buildings
- Drexel Smart Campus
- PHA In-Home Display Pilot
- Electric vehicle pilot

### Smart Meters (AMI)
- A method to enable two-way information flow
- System status, customer outage status, usage and pricing signals delivered to and from location

### Smart Distribution System
- Real-time reporting of status and outages
- Automated controls of relays and reclosers
- Efficient field force management
- Effective interconnection of renewable energy sources

### Smart Utility
- More efficient data collection, processing and back office functions
- Enhanced operational and customer insight
System Design Principles

• **Security**
  – Robust end-to-end, aligned with industry best practices (FIPS 140-2 compliant or certified)

• **Converged Communications**
  – Smart Grid applications will share a converged shared communications infrastructure but will be logically isolated (tunneled)

• **Interoperable**
  – Industry standard open protocols will be utilized preferentially end-to-end
  – Avoid use of proprietary protocols

• **Privately owned communications**
  – Privately owned communications enables Exelon to maintain governance and control over all aspects of the technology

• **No Unanalyzed Single Points of Failure (Self Healing)**
  – The comm. architecture will be designed with no unanalyzed single points of failure
  – Consistent with the deterministic philosophy, failure modes and backup schemes shall be incorporated to form a “self healing” architecture

• **Maintenance Management & Monitoring**
  – Inherent to the communications Architecture will be Comm. Maintenance Management & Monitoring, i.e. the ability to maintain, monitor and control network devices

• **Defined Standards**
  – Architectural Design Standards will exist to embody & enumerate the details of the Fundamental Design Principles
### Outage Restoration & Verification

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Hurricane Irene *</th>
<th>Hurricane Sandy **</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Customers Impacted</td>
<td>~508,000</td>
<td>~1,130,000</td>
</tr>
<tr>
<td>Peak Customers Impacted</td>
<td>480,000</td>
<td>608,000</td>
</tr>
<tr>
<td>Single Customer Event Cancellations</td>
<td>2,300</td>
<td>4,257</td>
</tr>
<tr>
<td>Primary Event Cancellations</td>
<td>350</td>
<td>820</td>
</tr>
<tr>
<td>Escalations – Single Events to Primary Events</td>
<td>700</td>
<td>1,042</td>
</tr>
<tr>
<td>Total Events (avoided and/or more effective truck rolls)</td>
<td>3350</td>
<td>6119</td>
</tr>
<tr>
<td>Estimated Fewer Days to Total Restoration</td>
<td>1-2 days</td>
<td>2-3 days</td>
</tr>
</tbody>
</table>

**Cancellations** – Power On verified, OMS event cancelled  
**Escalations** – Verified neighboring meters out, job escalated from single event to multiple event

*Hurricane Irene August-September 2011; 100% AMR  
**Hurricane Sandy October-November 2012; 90% AMR / 10% AMI
Avoided Generation

- PECO recently completed a project to install a second transmission feed its Clay substation
  - A twenty-five (25) day substation outage was required
  - During the outage, over 50 distribution circuits within the southern Chester County service territory were affected and out of configuration
  - This temporary configuration affected 32,779 customers

- There was a need to closely monitor these circuits to ensure that voltage is maintained within the established tariff limits
  - Standby generation was strategically placed at points of concern
  - The AMI system was used to monitor voltage in these areas
    - ~175 AMI meters were installed to provide hourly voltage data

- The AMI meter data based analysis helped avoid running the standby generation saving over $1M (USD)
PECO’s Smart Grid
Distribution Automation Vision

• PECO’s goal is to deploy an AMI network with the capability to support Smart Grid applications and communicate AMI and Distribution Automation data on a converged network:
  – Distribution Management System (DMS)
    • Automatic Fault Detection, Isolation, and Service Restoration
  – Distribution SCADA control of reclosers, regulators and capacitor banks
  – Conservation Voltage Reduction (CVR) Application
  – Communicating Faulted Circuit Indicators
    • Real Time Fault Locating
  – Analytics
Analytics for Distribution

• There are many opportunities for integrating Analytics into a Smart Grid Solution
  – Identifying Overloaded/Stressed Assets
    • Proactive Transformer Replacement
  – Locating Transformer Voltage Problems
  – Connectivity Model Improvements
    • Auto-Generating Secondary Circuit Models
    • Correcting Meter Phasing
    • Detecting Transformer Connectivity Problems
  – Improved Fault Locating
    • Using Substation Power Quality and Relay Data
    • Using Feeder Monitors to Locate Faults and Estimate Cause
  – Using AMI Data to Detect Theft and/or Unmetered Load
    • Unbilled revenue
    • Tamper detection & Irregular Usage Patterns
  – Reliability Analysis, Storm Analysis and Momentary Analysis
Thank You

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