PHI’s Distribution Automation Projects

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Acknowledgement

- "This material is based upon work supported by the Department of Energy under Award Numbers: DE-OE000300, DE-OE0000301, DE-OE0000204”

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Presentation Topics

- PHI intro
- SGIG Award Summary
- Smart Grid Evolutionary Steps
- Automation Technologies
- ASR Overview and Demonstration
- ASR implementation timeline
- Summary of Benefits
- Q&A
Pepco Holdings, Inc. Quick Facts

- Incorporated in 2002
- Service territory: 8,340 square miles
- Customers served (~2M)
  - Atlantic City Electric:
    - 545,000 – electric
  - Delmarva Power:
    - 503,000 – electric
    - 125,000 – natural gas
  - Pepco:
    - 793,000 – electric
- Total Population Served: 5.6 million
- Regulated transmission and distribution is PHI’s core business
## PHI SGIG Awards Summary

<table>
<thead>
<tr>
<th>Company/Regions</th>
<th>AMI</th>
<th>DLC</th>
<th>DA</th>
<th>CI</th>
<th>Total Project Costs</th>
<th>DOE Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pepco Maryland</td>
<td>$137.7</td>
<td>$51.4</td>
<td>$15.0</td>
<td>$5.5</td>
<td>$209.6</td>
<td>$104.8</td>
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<tr>
<td>Pepco DC</td>
<td>$68.2</td>
<td>$7.1</td>
<td>$9.1</td>
<td>$4.8</td>
<td>$89.2</td>
<td>$44.6</td>
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<td>ACE</td>
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<td>$7.0</td>
<td>$37.4</td>
<td>$18.7</td>
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<tr>
<td>Smart Grid Workforce Training Grant</td>
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<tr>
<td>Total</td>
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<td>PJM Syncrophasor</td>
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<td></td>
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<td>$1.4</td>
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</tbody>
</table>

*$$ Are in millions
5 evolutionary steps to achieving the Smart Grid

Smart Grid Investment Grant (SGIG) funding accelerated this process

- **Step 1**: Intelligent devices infrastructure
  - AMI, or ‘Smart Meters’
  - Distribution Automation Devices
  - Demand Response Devices
  - Substation IED Controllers

- **Step 2**: Communications infrastructure
  - Enterprise communication system for rapid and accurate transmission of data
  - Integration of fiber and mesh broadband networks

- **Step 3**: Integration
  - Corporate IT systems integrated to allow rapid processing of data
  - Open architecture based design to facilitate sharing of information

- **Step 4**: Analytical infrastructure
  - Development of new data analysis capabilities
  - Increased ability to display information (in form of dashboards, etc.)

- **Step 5**: Optimization
  - Capability of real-time optimization of distribution network performance
  - Decisions based on near real-time information, no longer only historical data
# Smart Grid Devices and Technologies

## Home Intelligence
- Smart Meter

## Feeder Automation
- Automatic Circuit Reclosers (ACRs)
- Automatic Sectionalizing and Tie Switches
- Advanced Voltage Control
- VAR Control / Capacitors
- Network Protector Monitoring & Control
- Network Cable / Vault Monitoring
- Smart Remote Terminal Units (RTUs)
- Fault Detectors

## Substation Automation
- Automatic Sectionalizing & Restoration (ASR) scheme
- Substation Local Area Network
- Microprocessor, or ‘Smart’ Relays
- Application Servers
- Smart Monitoring & Controls
- Distributed Smart Remote Terminal Units (RTUs)
- Voltage Control, Substation-Level by Smart Relays or EMS

## Transmission Automation
- Synchrophasor
- Motor Operated Disconnect (MOD)
- Dynamic Ratings
- Static VAR Compensator (SVC)

## Distribution Automation

## Demand Response (DLC & Dynamic Rates)
- Smart Thermostat
- In-Home Display
- Plug-In Hybrids

## Distributed Generation
- Micro-generation (solar, wind)
- Electric Vehicles/Vehicle-to-Grid

## Energy Efficiency
- Smart Appliances
- Weatherization

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*Image of smart grid devices and technologies.*
PHI’s Smart Grid Domains and Integrated Communications Infrastructure
Distribution Automation (DA) Project Types

- **Automatic Sectionalizing & Restoration (ASR) Schemes**
  - DA ASR entails the installation of certain devices that are intended to work together to identify distribution feeder faults, automatically isolate identified faulted area, and reroute electricity supply to segments of the outage feeder un-impacted by the fault. This will reduce the number and length of electric system outages, resulting in increased reliability and customer satisfaction.

- **Dissolved Gas Analysis (DGA) monitors on substation transformers**
  - This on-line system will continuously monitor eight critical fault gases and other transformer insulating oil key parameters for a timely assessment of transformer conditions to schedule maintenance and help prevent failures.

- **URD Fault Detectors System – FDS (Pepco MD)**
  - This system will identify the location of faulted URD transformers by conveying a signal back to the control center in order to reduce time spent by crews in locating faults.

- **Network Transformer Protector Remote Monitoring System - RMS (Pepco DC)**
  - This system will provide real time remote control/monitoring capability as well as power quality information such as phase currents, transformer loading, power factor, etc. to network transformers through implementation of two way communication and installation of intelligent sensors for an enhanced reliability of the network system.

- **Capacitor Bank Automation**
  - This project will add feeder capacitors that have supervisory controlled capability and visibility. This will allow remote control of feeder reactive power (VAr) and resolution of high/low voltage issues.
Outage Impact Reductions (DOE Scheme 1)
Reliability Impacts: DOE Scheme 1

Change in Customer Interruptions (CI)

- Sustained CI w/o operation of DA switches: 11,439
- Sustained CI w/ operation of DA switches: 4,985
- Sustained CI Reduction: 6,454

Change in Customer Minutes Interrupted (CMI)

- CMI w/o operation of DA switches: 1,908,333
- CMI w/ operation of DA switches: 876,705
- CMI Reduction: 1,031,628

Results from 11 successful operations.

These reductions resulted in a 24% improvement in feeder group SAIFI/SAIDI.
ASR Commissioning Timeline:

- First four schemes encompassing 41 feeders and 14 substations activated
- Total of 41 substations and 118 feeders under the SGIG program.
- An additional 30-50 feeders in the DPL service area between 2011-2014.
Summary of DA/ASR expected benefits:

- Distribution Automation will help PHI achieve its smart grid vision.
- It will result in key benefits to customers and the company:
  - Improved feeder and system reliability → increased customer satisfaction
  - Increased visibility, control, and optimization of the distribution system.
  - Operational savings from reduced field trips and restoration times.
  - Increased knowledge of transformer health resulting in better maintenance and asset end of life control.
Next Steps for PHI

- Continue to execute Smart Grid programs and realize Smart Grid vision (all programs will continue beyond DOE SGIG).
- Continue to engage and educate customers to maximize benefits of smart grid implementation.
- Continue to support development of a secure grid by working with industry and federal consortiums to develop industry standards.
- Continue to encourage innovation in the marketplace through new capabilities of the smart grid, including renewable integration and electric vehicle grid infrastructure.

*Success will be measured in the eyes of the customer!*
Questions