Pepco–Maryland

Smart Grid Project

Scope of Work

The Pepco–Maryland Smart Grid Project entailed deployment of distribution automation (DA) technology on 67 circuits, an advanced metering infrastructure (AMI) system, a meter data management system (MDMS), a customer web portal, and a demand response program that involved direct load control and time-based rate programs. DA equipment included smart substation devices, automated distribution circuit reclosers/switches, fault indicators, and transformer monitors.

Objectives

The AMI installation was designed to provide customers and Pepco with access to detailed electric usage information which, when combined with demand response programs, can help customers reduce consumption and better manage monthly bills while also reducing peak load for the utility. DA technology was deployed to improve system reliability, reduce outages for customers, and decrease operations and maintenance costs.

Deployed Smart Grid Technologies

- **Communications infrastructure:** Pepco installed a wireless mesh network for the AMI system and designed it to be able to route DA traffic through the battery-backed wireless communications devices. This approach ensures that DA traffic remains on energized communications devices during power outages. The same cellular backhaul network is used to transport AMI and DA data to the appropriate collection systems.
- **Advanced metering infrastructure:** The project installed 552,982 smart meters across the Maryland service territory through December 31, 2013, and a MDMS to process the interval data for billing. AMI supports demand response and time-based rate programs and reduces the cost of meter operations.
- **Advanced electricity service options:** The new customer web portal gives customers access to their interval data, trending information, and energy saving tips to lower their monthly bills. It is also the platform used to control programmable communicating thermostats that were distributed as part of the direct load control effort. Pepco also offers net metering programs to enable distributed generation.

At-A-Glance

Recipient: Potomac Electric Power Company (Maryland)

State: Maryland

NERC Region: ReliabilityFirst Corporation

Total Project Cost: $213,336,964

Total Federal Share: $104,771,941

Project Type: Integrated and/or Crosscutting Systems

Equipment

- 552,982 Smart Meters
- AMI Communications Systems
  - Meter Communications Network (Wireless Mesh)
  - Backhaul Communications (Cellular)
- Meter Data Management System
- Customer Web Portal
- 151,887 Direct Load Control Devices
  - 100,177 Air Conditioner Direct Load Control Outdoor Cycling Switches
  - 51,710 Programmable Communicating Thermostats
- Distribution Automation Equipment for 67 out of 701 Circuits
  - Distribution Automation Communications Network (Wireless Mesh)
  - Control of 205 Automated Distribution Circuit Reclosers/Switches
  - 186 Circuit Sensors/Fault Indicators
  - 12 Transformer Health Monitors
  - Upgrades to 23 Substations with Smart Devices

Time-Based Rate Programs

- Peak-Time Rebate

Key Benefits

- Improved Electric Service Reliability and Power Quality
- Reduced Costs from Equipment Failures and Theft
- Reduced Meter Reading Costs
- Reduced Operating and Maintenance Costs
- Reduced Truck Fleet Fuel Usage

Potomac Electric Power Company (Maryland) *(continued)*

- **Direct load control devices:** As of December 31, 2013, the project had deployed 151,887 AMI-enabled load control devices for cycling residential air conditioning equipment during periods of peak demand. Participating customers are offered financial incentives for allowing the utility to control the devices and assisting with peak load reductions.
- **Time-based rate programs:** Pepco leveraged the new AMI interval data to offer customers a time-of-use rate that encourages peak load shifting to reduce stress on the system and lower operating costs.
- **Distribution automation systems:** The project deployed new automated feeder reclosers/switches and associated controllers, fault sensors/indicators, substation transformer monitors, electronic substation relays, substation distributed remote terminal units (DRTUs), and an automatic sectionalizing and restoration (ASR) program. These systems improve fault detection, isolation, and power restoration efforts and reduce the number of customers affected by outages. Fault sensors/indicators communicate with the control center when a fault occurs in selected underground residential developments. Transformer health monitors analyze the gases in the transformer insulating oil, alerting Pepco about needed maintenance and helping the utility avoid equipment failures.

Benefits Realized

- **Improved customer service options:** Customers are accessing the AMI data through charts showing hourly, daily, and monthly usage on Pepco's web interface, "My Account." Customers can access their monthly bills to date and usage charts for the previous five days on a single page. Customers can also download their energy usage data via Green Button, a secure and standardized electronic energy usage data format; Pepco was the first utility to provide enterprise-to-enterprise energy data via Green Button Connect.
- **Lower customer bills and reduced peak demand:** Maryland customers are also benefitting from dynamic pricing and direct load control programs. Collectively, customers participating in the dynamic pricing Peak Energy Savings Credit program have received more than $6 million in bill credits, as well as reducing peak load by approximately 4 million kilowatt hours in the summers of 2013 and 2014 combined.

  From 2009 through 2013, 24 direct load control curtailment events were operated through the Energy Wise Rewards program, reducing demand by 452 MW. Participating customers received a web-programmable thermostat or outdoor direct load control switch installed on their home.

- **Reduced operating and maintenance costs:** The AMI system provides the ability to send a signal to the meter to disconnect or reconnect service. Pepco began using this feature for credit collections in May 2014. Pepco estimates that this function will allow the utility to avoid over 5,000 truck rolls in 2014. Associated benefits include reduced carbon dioxide emissions, decreased dollar value of write-offs, fewer past due accounts, and reduced interest costs from carrying the debt on the past due accounts.

  Furthermore, AMI enables Pepco to avoid thousands of unnecessary truck rolls each year for "single no-lights" calls that turn out to be "okay on arrival." AMI provides the capability to "ping" a meter to determine whether the meter is communicating. Power is required at the meter in order for the meter to respond to the ping request. Therefore, Pepco is able to use the meter ping to verify that a customer has service without sending a crew, thereby avoiding costs associated with unnecessary truck rolls.
- **Reduced meter reading costs:** The elimination of manual meter reading saved Pepco over $2 million in 2012 and 2013 combined. In addition, Pepco can remotely execute on-demand reads that would have previously necessitated field visits. This capability has eliminated over $60,000 in off-cycle meter reading costs over the same period.

Potomac Electric Power Company (Maryland) *(continued)*

- **Improved electric service reliability**: From 2012 through 2013, the new DA systems prevented about 17,000 customer outages. As of mid-September, the number of avoided outages in 2014 was about 24,000. Furthermore, Pepco has begun to use AMI data for transformer load management. The accuracy of transformer loading data allows for more proactive replacement under a planned outage (as opposed to the prior practice of waiting for transformer over-loading, leading to asset failure). Transformer replacement under a planned outage results in a lower outage duration than that associated with emergency repairs and has a positive impact on SAIDI, SAIFI, and CAIDI reliability indices.

Lessons Learned

- **Advanced metering infrastructure:** Deploying the mesh radio network in advance of AMI meter installations made activations of the meters more efficient. Utilities implementing AMI should survey areas where communications are challenging and plan/resolve such challenges in advance of meter deployment. In addition, vendor contracts should include quality audits.
- **Direct load control:** Customer education was vital to project success and entailed significant effort. Customers generally do not have the same level of understanding about kilowatt hours as they do about miles per gallon. A variety of communications tactics are needed to increase awareness and understanding of smart grid technologies. A blend of traditional "snail" mail, door-to-door recruitment, and online outreach tactics allowed Pepco–Maryland to reach out to different customer segments.
- **Cyber security and distribution automation:** Cyber security should be addressed during planning activities. Project teams should work with equipment manufacturers to enforce the value of application-level encryption and encourage them to develop solutions. While smart systems can reduce operational costs, additional maintenance funding is needed to keep added equipment and systems operational. In addition, newer telecommunications and smart devices will not follow traditional utility asset life assumptions (e.g., 10–15 years versus 30 years), and planning should account for these differences.
- **General:** Having a central program management office to provide project management, change management, and process improvement and coordinate earned value reporting proved to be very effective. In addition, new skill sets were required to design, deploy, and maintain Smart Grid systems, which will change the paradigm of the utility worker.

Future Plans

Pepco will continue to develop advanced analytics based on asset-level data to further enhance asset management capabilities. The objective is to focus increasingly on predicting system/equipment health, identifying deficiencies, and optimizing investments and maintenance decisions.

The company will also continue to optimize the communications network that supports DA and direct load control to maximize the benefits gained from these technologies. DA technologies will continue to be deployed as the need arises.

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