

Building a Smarter Distribution System in Pennsylvania

PPL Electric Utilities Corporation (PPL) provides electricity to 1.4 million customers across central and eastern Pennsylvania. Having installed smart meters and other advanced technologies over the last several years, PPL has experience with operating smart grid systems and achieving operational improvements. To further improve quality of service for its customers, PPL is implementing a \$38 million Smart Grid Investment Grant, which includes \$19 million in Recovery Act funds from the U.S. Department of Energy (DOE). PPL is installing a distribution management system (DMS), distribution automation (DA) devices, and supporting communication systems in a pilot program in the Harrisburg area. DOE's assistance has been crucial for the project. "Without the funding, we would have waited to let the technology mature in the industry," says Mike Godorov, manager of PPL's smart grid project. "We would have deployed the technology at a slower pace, which would have delayed the benefits to our customers."

Distribution Management System

Development of an advanced distribution management system (DMS) software is at the heart of the project. The DMS monitors and controls all of the smart devices being installed on the grid, such as automated switches, sectionalizers, and capacitors. The DMS builds on advanced technologies PPL has already installed—smart meters, an outage management system, and a mobile application connected to all utility trucks—and allows PPL to move forward with future automation projects. "Lack of an advanced DMS was the roadblock to pursuing DA systems," explains Mike Swenson, PPL's business project manager. "With the DMS software in place, there will be a stable platform for future automation projects when compared to traditional technologies, and we will get far greater benefit from the new equipment."

The DMS software with advanced applications is being developed and is not readily available in the U.S. market at this time. "With the DMS software that offers advanced



PPL's distribution management system

applications, we are in the 'beta world'," says Swenson. "Once the software is developed, other utilities will benefit from our experiences when they deploy their own distribution automation systems. They will have an off-the-shelf product to use."

Case Study – PPL Electric Utilities Corporation Smart Grid Investment Grant

To connect the smart devices on the distribution system to the DMS, PPL is implementing a communications solution that has not been widely used in the utility industry. The point-to-multipoint wireless WiMAX system—using base station radios and antennas at eight substations—provides complete coverage for the 150-square-mile project area.

Smart Grid Applications

“We have two primary goals for the project: reduce the time it takes to restore service to customers after an outage, and reduce overall energy consumption through improved Volt/VAR control and voltage stabilization,” Godorov says.

The new DA technologies are about 80 percent installed, and PPL and its customers are already seeing the first goal of improved outage management begin to manifest. Hurricane Irene, in August 2011, was the second-largest storm in PPL’s recent history; about 388,000 customers lost power. “During the restoration effort, we got a glimpse of the benefits that the smart grid technologies provide,” said Tim Figura, PPL’s distribution automation lead for the project. “After completing tree removal and the needed physical repairs, our crews were able to communicate in real time with system operators to reconnect the system, instead of the crew having to go back to the company’s facilities to make the reconnection. In each instance, the crew saved about 20 minutes of time.”

Once PPL’s distribution automation system is fully deployed, the new DMS will instantly identify a problem and automatically reconfigure the grid to minimize the number of customers affected by an outage.

Using automated capacitor banks and reconfigured substations, the DMS implements voltage control strategies. As a result, energy savings can be expected in the form of reduced customer energy use and lower distribution line losses. “Any customer system with a motor, such as heat pumps, air conditioners and refrigerators, is expected to save energy,” Godorov says.



PPL linemen installing a smart switch

Data from the DMS application is helping PPL improve the accuracy of its system model. “It is difficult to develop an accurate model for power flow analysis. Now, with information from both the smart meters and the DMS, we are able to ‘true-up’ the power flow model,” Swenson says. Accurate data allows PPL to more fully use its distribution system capacity by reducing system uncertainty.

Workforce Development

The SGIG project has helped maintain and create jobs. Because of the new systems, IT personnel have been in particular demand. PPL is also training existing personnel to work with the new technologies.

Godorov believes the workforce impacts extend beyond the utility, as PPL has employed contractors and made significant equipment purchases. “Suppliers have clearly needed to ramp up—their inventories have been emptied—and there are long lead times for many products.”

Next Steps

The pilot project in Harrisburg is smoothing the path for future expansion into other portions of PPL’s service territory. In the next five or six years, PPL expects to cover about half of its service territory with smart grid technologies.

Learn More

The American Recovery and Reinvestment Act of 2009 (Recovery Act) provided DOE with \$4.5 billion to fund projects that modernize the Nation’s energy infrastructure and enhance energy independence. For more information about the status of other Recovery Act projects, visit www.smartgrid.gov. To learn about DOE’s Office of Electricity Delivery and Energy Reliability’s national efforts to modernize the electric grid, visit www.oe.energy.gov.



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