Wire Intelligence

By Lisa V. Wood, executive director of the Institute for Electric Efficiency

We will judge tomorrow's smart grid by its ability to manage—efficiently and in real time—electricity's acquisition by and movement to customers that demand it. That basic industry tenet is confounded by the fact that the grid itself is changing from a generally unidirectional system of central generation plants, high-voltage transmission wires, step-down substations, local circuits, and end users to a far more complex, interconnected system. Transitioning to a multidirectional grid is a challenge, and utilities are integrating sophisticated monitoring and control technologies into their distribution systems to meet it.

The integration of information technology (IT) in energy has revolutionized the way utilities control and manage their distribution systems. By using IT to make their wires smart, utilities are improving their abilities to integrate distributed power sources, commercial building management system demand response, household responses to price signals, electric car charging, and battery storage. Enhanced two-way communication systems and voltage-control programs are leading the way to enhanced reliability and operational efficiencies that reduce customer bills.

Here are some success stories.

The Power of Technology

Virginia's Dominion Power, for one, controls voltage by incorporating two-way communication and voltage-feedback reads from its customers' smart meters. The utility applies a conservation voltage reduction (CVR) algorithm to the feedback data to ensure that voltage remains tightly in the lower half of a regulated band. Initial results from pilot efforts on a handful of circuits indicate that this control provides immediate benefits to consumers—a tighter and lower voltage range results in average energy savings of 2.8 percent. At the same time, it helps the utility support distribution system technologies like distributed generation and battery storage. Dominion can achieve efficiency savings and improve service and system performance—all without customer action.

PECO, in Pennsylvania, faces overall energy-savings goals of 1 percent in 2011 and 3 percent in 2013, and a 4.5-percent peak-load reduction goal during the peak 100 hours in 2013. In its CVR project, the utility focused on lowering voltage by 1 percent from historic levels on its distribution feeders, remaining within regulatory voltage requirements, and reducing energy consumption and demand. Diligent monitoring prevented the voltage from dropping too low. Initial projections of energy savings and demand reduction associated with the CVR program were 110,000 megawatt-hours (MWH) and 11.3 megawatts (MW), respectively. While the projections represented 10 percent of PECO's MWH goals in 2013, the program's actual results far exceeded the utility's expectations. In fact, the CVR program already has saved 300,000 MWH, equal to PECO's anticipated savings from its compact fluorescent light bulb initiative!

Consolidated Edison (ConEd) incorporates real-time building management data into its system management decisions. [See "Con Edison Builds a Smart Distribution Grid" in the May/June 2011 *Electric Perspectives*.] With 61,000 commercial buildings in New York City (which represent two-thirds—34,000 gigawatt-hours—of all electric consumption in the utility's service territory), there are many potential demand response opportunities. ConEd's smart grid project seeks to tap into 15-20 MW of building load and provide demand reductions when usage is at peak or when the grid is congested. Commercial buildings in the city also can offer additional power flows into the grid through integration of distributed generation from renewable energy. Since these new sources of power require monitoring and management, ConEd is installing two-way communications and remote controls on 180 transformers.

Courtesy: ABB

Remote wireless grid sensors enable real-time smart grid applications, such as conservation voltage reduction, and increase the efficiency of power lines.

AEP Ohio also invests in distribution automation, integrated voltage-VAR control, and storage to help manage system load and deliver operational efficiencies. Within AEP Ohio's gridSMART demonstration area, 17 circuits have integrated voltage-VAR control with two-way communication network capability to deliver a tighter and lower voltage range along the distribution circuit. Initial results, independently verified by Battelle, show that the circuits with the voltage control technology reduced energy consumption and peak demand by 2-3 percent, on average. In addition, AEP is integrating community energy storage systems into its smarter distribution systems for power factor corrections and to supply backup power to households.

IT investments in the electric distribution system can result in substantial energy and peak demand savings. And such savings should count towards utility energy efficiency goals. Utilities across the country are poised to operate their systems more efficiently, save customers money, and better manage the integration of new generation and new technologies into the grid. What a difference IT makes! ◆

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