Power Metering and the Smart Grid

BY KELLY MAMER, PE, LEED AP

PUBLISHED IN MAINTENANCE SOLUTIONS
JUNE 2011

Smart Grid: Managers Have Incentives for Reducing Demand

Institutional and commercial facilities represent about 20 percent of the load on the electrical grid, so maintenance and engineering managers in these facilities have a significant impact on utilities that produce, transmit, and distribute electricity. In turn, the way those utilities produce and distribute electricity efficiently, intelligently, and economically also affects these facilities.

This naturally symbiotic relationship between supply/utility and demand/facilities — means managers should have a great deal of interest in the Smart Grid, which is the most important innovation utilities have undertaken in many years.

Controlling the Flow

The Smart Grid is an overlay or enhancement of the existing electrical grid using digital technology and smart meters to control the flow of electricity. It gives the utility better insight into when the grid is reaching peak loads in much greater detail, as well as the ability to control demand to avoid peak-demand periods. Rather than buy power on the spot market or bring additional supply online — usually at great cost — utilities use the Smart Grid's automation component, which allows them to control demand.

Utilities can control demand in two primary ways, and both rely on economic incentives to affect customer behavior. First, utilities can set up demand-reduction-incentive plans with facilities. The utility offers a facility a reduced rate for electricity with the understanding they can control some of the facility's load and shut it down during peak power periods. Second, they can offer a pricing structure that includes critical-peak pricing tariffs, under which electricity rates increase quickly during periods of high production and use.

In either case, managers have great incentive to adjust demand patterns as an intelligent, autonomous entity and support the Smart Grid. They can do this by using smart meters, load-communication schemes, and software programs that allow for a smart energy-use policy.

Power Meters Designed to Interface with the Smart Grid

Today's smart meters are critical components in an effective energy-management and power-monitoring program. Many meters incorporate technology specifically designed to interface with the Smart Grid via an energy-management system. Many facilities have installed meters on major switchboards or critical equipment and can use information the meters gather to determine when peak-demand periods are imminent or to monitor power quality. But to be able to truly impact demand, a significant investment in smart metering might be a more valuable use of capital.

For example, a facility that meters nearly every major piece of mechanical equipment and electrical feeder will have a great deal of information available when managers need to make decisions on load shedding. If a facility has agreements in place with its utility to reduce loads during periods of peak energy use, being able to closely match the load it sheds to utility requirements might lessen the impact of this load adjustment.

Using a control scheme that can shed the load at each metered point, as well as historical and trending data gathered via the meters over time, a manager can make intelligent, real-time decisions related to load shedding. At the same time, the experience gained during these periods will help managers facilitate improvements related to energy efficiency: The systems and equipment with the smallest impact on a facility in relation to the amounts of energy they use are prime targets for improved efficiency.

Intelligent monitoring points in a building-management system are not always meters. Many buildings feature smart thermostats or smart appliances, which provide data into, and can be controlled by an energy-monitoring system.

One challenge managers face when multiplying the amount of power metering and monitoring points is information overload. Fortunately, a number of companies are developing software solutions that automate building energy control.

These systems reduce large amounts of data into graphical interfaces technicians can easily understand. They give managers multiple options when requiring action, and they provide predicted demand simulators that can serve as training devices for analyzing hypothetical situations. As managers begin to understand the power of the data they collect and the amount of human error software systems can eliminate, the market for these smart automation systems will grow.

Smart Grid Improves Power Quality, Reliability

Facilities also are continuing their efforts to become more sustainable, and one of the key functions of the Smart Grid — accommodating all power generation and storage options — can play a part. The design of today's electrical grid cannot integrate consumer-owned renewable sources, characterized by their intermittent production. Many financial incentives exist for sustainability initiatives, but the expanded use of these technologies affects a utility's ability to manage its peak generation.

One goal of the Smart Grid is to seamlessly interconnect fuel cells, renewable sources, microturbines and other distributed generation technologies at all levels. This goal includes improvements dealing with fundamental challenges of bidirectional power flow on distribution systems, along with support of innovations related to energy storage. All of these innovations will enhance a manager's ability to control energy costs.

One key benefit for facilities from the Smart Grid involves the improvements in grid efficiency and resiliency that utilities have planned. As the grid becomes more intelligent, it will be able to automatically self-monitor and assess its reliability and adapt to changing conditions.

This enhanced functionality will mean greater reliability for customers, improved power quality, and potentially fewer failures of bulk-power systems. The communications overlay on the energy-distribution network also might have potential for new services, such as fire-alarm monitoring that can automatically shut off power in specific areas.

Most utilities have Smart Grid programs. Many of them involve testing of the technology via installation of utility -controlled smart meters or smart equipment. For managers interested in tapping the potential of Smart Grid technology, the first step is to contact their utilities. Preparing an energy measurement and use policy for the facility also is critical.

As energy costs continue to fluctuate, the economic incentives will only grow. Adding a more intelligent energy management system will enable managers to take control of their organizations' energy future.

Ironically, although the creation of the Smart Grid and the standards by which the Smart Grid is being developed largely affect utilities — and utilities must install most of the infrastructure required to make the Smart Grid a reality — many of the top advances in Smart Grid technology have been in the consumer infrastructure market. The challenge for utilities is building the infrastructure needed to make the Smart Grid a reality to prevent a backlash against utilities if the technology cannot do what facilities expect.

Fortunately, the grid is becoming smarter every day. Managers who take advantage of the technologies evolving in the wake of the Smart Grid's development will find themselves with greater power to control their organizations' energy futures.

Kelly Mamer, P.E. LEED AP, is associate principal of Sparling, an electrical and technology consulting firm with offices in Seattle, San Diego, Portland & Houston. He has more than 20 years of electrical engineering experience in healthcare, government, higher eduction, commercial and retail facilities.