Distribution Automation and the Modernized Grid

Improving service reliability and operating efficiency are common goals that most distribution utility companies have today. However, with the changing landscape of new loads and customer-sited distributed generation (DG) being connected to the grid, these conditions now present special challenges to the electric distribution system. The traditional need to provide reliable energy delivery with a renewed focus on resiliency, environmental impacts, and energy efficiency (including loss reduction and peak load management) creates an environment with plenty of obstacles. The variability and intermittency of renewable energy sources—both at the distributed and centralized levels—now add an additional level of complexity. Distribution automation (DA) has emerged as a key component of the smart grid, and provides a path to achieve these critical goals. In the context of smart grid deployments today, DA refers to an intelligent distribution system that uses a network of sensors and controls that provide greater reliability, flexibility, and agility.

People only need to look at their cell phones or tablets to understand the power of miniature networked intelligence. The implementation of the newest features keep updated versions flooding the market shelves every 18 months or so. At the same time, advanced technology is making its way into the latest grid equipment and apparatus. With integrated sensors and digital controls, there are new functions that embedded intelligence is performing today that are becoming more economical and practical to implement across the whole distribution system. Opportunities are limitless and, as a result, there are many differing expectations as to what may be facilitated by smart distribution equipment.

The U.S. Department of Energy's Modern Grid Initiative[1] articulates seven key characteristics that identify and measure progress via the implementation of the smart grid. They include enabling active participation by consumers; new products, services and markets; the ability to accommodate all generation and storage options; providing power quality; optimizing asset utilization and operating efficiency; the anticipation and response to system disturbances in a self-healing manner; and the ability to operate resiliently against both physical and cyberattacks as well as natural disasters.

The efforts of the American Recovery and Reinvestment Act (ARRA), which provided much of the funding for grid modernization, were focused on deploying smart meters. While these assets are improving the meter- to- bill process and enabling greater customer awareness of consumption information, they have yet to be fully exploited as distribution assets to improve the grid performance. A good example of what can actually be done is how an advanced meter infrastructure (AMI) system extended Alabama Power's outage system effectiveness in a historic storm (see below).

[1] "Metrics for Measuring Progress toward Implementation of the Smart Grid." U.S. DOE, June 2008. Even though these metrics were released seven years ago they are still relevant and the industry continues to work towards these goals.

On April 27, 2011, Alabama Power Company, the Birmingham-headquartered Alabama operating company of the Southern Company, experienced one of the most devastating and deadly natural disasters in U.S. history. Damage caused by a string of tornadoes striking Tuscaloosa, Alabama, and the surrounding area caused more than 400,000 customers to lose power at the storm's peak. Yet, just eight days after the storm passed, most of the affected area was up and running again. Alabama Power Company's automation systems played an important role in this rapid recovery. Alabama Power Company's parent, Southern Company, had begun laying the groundwork for effective response management and system modernization when it embarked on an initiative to have its utility subsidiaries integrate their current outage management systems (OMS) with advanced meter infrastructure (AMI) systems. The result was a successful merger of a proprietary OMS that had been in service for years with an open-standards-based, multi-application, fixed-base, two-way wireless communications network from an AMI system to gain a number of key benefits, including real-time situational awareness and grid stabilization. The ability to collect data from smart meters and deliver it over the AMI system added a new dimension to their utility operations because the information could be used to enhance their outage estimation systems.

It's evident that there are a number of steps utilities should take when considering the deployment of DA systems and technologies such as meeting economical, technical, and business challenges; executing appropriate deployment strategies; examining Information Technology/Operation Technology (IT/OT) migration; addressing big data; protecting privacy; and ensuring security.

The key to implementing these smart technologies into real life applications is seen in the ability to integrate them into a single hierarchal system. While each of the technologies are helpful in their own right, only by linking them together will one see the economies of scale required to gain broad industry adoption. Utility executives, regulators, and technology suppliers must take the bold steps necessary to start thinking of how these smart technologies can easily work as a single system. They must drive their organizations to make this the goal rather than implementing stand-alone smart systems that "keep up" with technologies in order to gain incremental system improvements.

NEMA's Distribution Automation Section represents manufacturers of DA equipment and systems used to supervise, measure, monitor, and control electrical loads on distribution grids and at distribution substations. Additionally, the section represents manufacturers of the communications and software which support DA.

The section has recently published a whitepaper that covers these topics in more detail. This paper includes NEMA recommendations in order that the benefits of DA systems can be fully utilized. It also contains case studies highlighting utility experiences. The paper is available at the following URL:
http://www.nema.org/DA-Modernized-Grid-Whitepaper

For more information about this section visit www.nema.org/Distribution-Automation
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