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MICROGRIDS: AN OMEN OR AN OPPORTUNITY?

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More and more in recent years, new trends have been occurring that have challenged the electric utility industry: physical security concerns, cybersecurity concerns, new FERC requirements, rising costs of fuel, challenges in siting new generation plants, revenue being lost to distributed generation and net metering, and more.

One more trend has been occurring that is also starting to pose a challenge for electric utilities - microgrids. In the early days of our nation, people generated their own power. Then, over time, centralized utilities came into existence and began providing power to the majority of people, eliminating their need to generate their own power. Now, it seems, with the growth of microgrids, that trend could be reversing.

What is a microgrid? The complete definition is lengthy and complex. However, in short, according to The Microgrid Institute: "A microgrid is a small energy system capable of balancing captive supply and demand resources to maintain stable service within a defined boundary."

The Microgrid Institute identifies three types of microgrids:

- Isolated Microgrids (a.k.a. "islands"): These are microgrids that are not connected to a local utility grid.

- Islandable Microgrids: These are microgrids that are fully interconnected to a local utility grid and are capable of both consuming power from, and supplying power to, the utility grid. They can maintain some level of service during a utility outage. Operators remain tethered to the utility grid and switch seamlessly back and forth, drawing energy when they need it, and selling it back to the utility when they have surplus.

Non-synchronous Microgrids: These are microgrids that are connected to utility power supplies, but are not interconnected or synchronized to the grid. As such, they are capable of consuming power from, but not capable of supplying power to, the grid.

Microgrids combine various distributed energy resources (DERs) to form the whole system. These include: natural gas or diesel cogeneration/CHP; fuel cells and microturbines; renewables (photovoltaic modules, wind, biomass); and/or small hydro. Microgrids also utilize batteries for storage capacity, and include energy management and automation systems.

According to Navigant Research, spending on microgrid projects is expected to increase almost five-fold over seven years - from $4.3 billion in 2013 to $19.9 billion in 2020. An article on microgrids in the June 17, 2014, issue of The Los Angeles Times noted that, "Experts say the batteries, combined with renewable energy sources, could eventually threaten utilities' long-held monopoly over the country's power industry."

Why are microgrids increasing in popularity? Many of the reasons relate to increasing customer demands related to power. That is, more and more customers:

- insist on more reliable and sustainable service (especially in light of recent superstorms and other natural disasters);

- have increasing concerns over grid security and survivability;

- want lower-cost energy (especially as costs for renewable sources, especially solar, continue to decrease); and

- are committed to the benefits and efficiencies of renewable energy.

Second, and on an even more practical level, microgrids are able to meet the needs for electrification in remote locations, especially in developing countries. In fact, a lot of countries are leapfrogging traditional rural electrification offered by utilities and going straight to microgrids, much as they have bypassed landline phone service in favor of cellphone service.

Third, interestingly, some utilities are promoting microgrids themselves, in that they understand the need for grid optimization, congestion relief, and investment deferral (especially as related to new generation plants), and how microgrids can help with these.

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According to Navigant, customer groups for microgrids can be organized into five categories: industrial/commercial, community/utility, campus/institutional, military, and remote. Microgrids are especially appealing to facilities that have a critical need for uninterrupted power, such as data centers, hospitals, and military bases. For example, Fort Bliss, Texas, has installed a microgrid.

Even facilities that don't have such critical needs are getting involved. For example, the University of California at San Diego (UCSD) has a 42-megawatt microgrid using PV panels, fuel cells, and natural gas generators, covering over 90 percent of the power requirements for its 1200-acre campus. It save the university $850,000 a month in energy costs. Another university, Caltech, generates more than 80 percent of its electricity from a microgrid, which includes solar, steam and natural gas.

Walmart is looking into microgrids to keep its stores and warehouses powered in bad weather. Already, 41 stores in California are partially powered by fuel cells that run on natural gas or biodiesel harvested from landfills. Within two years, the retailer plans to test cells that can power its stores if the main grid goes down.

Other facilities with operational microgrids include eBay and the U.S. Food & Drug Administration in Maryland. Currently, a 34-unit residential complex in Sacramento is being built with an integrated microgrid. The system will automatically switch residents to the cheapest power source, whether that be solar or conventional, while storing backup power for use if the grid goes down.

So what are the implications of microgrids for utilities? Most of the articles being written on microgrids note that, for the most part, utilities have been slow to accept microgrids, and even worked to thwart them, since they are disruptive to their current business models. And, of course, there are challenges to keeping up with demand. A 2012 report by American Society of Civil Engineers estimated that utilities will need to raise cumulative spending by $763 billion by 2040 if the grid is to properly modernized and hardened against natural disasters. Beyond the strategic implications of microgrids, there are technical implications. That is, for microgrids to work, existing utility grids need to be upgraded to deal with power flowing out and back in.

However, utilities can actually take advantage of the trend toward microgrids, getting involved in them themselves. For example, they can switch from being entities that primarily generate power to entities that help manage the surge in distributed generation that will be flowing their way via microgrids, and finding ways to collect revenue in order to keep the grid stable.

Some utilities are already moving in this direction. San Diego Gas & Electric is taking the lead in a microgrid demonstration project, and Duke University is working on developing microgrids.

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