Is There a Microgrid in Your Facility's Future?

Part 2 of 4: Growth of Microgrids

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Life Is On

Growth of Microgrids

Editor's Note: *This article is Part 2 of a four-part series. [Click here to view Part 1: Definition of a Microgrid.]*

Many organizations are looking at microgrids, according to a recent "Microgrids Overview" report by Navigant Research, which says total global microgrid capacity is expected to grow from 3.5 gigawatts in 2019 to nearly 20 gigawatts in 2028.

"As technologies have advanced and costs have declined, the deployment of microgrid/power-generation systems located at commercial and institutional sites has increased," observes Dan Chisholm, Sr., President of MGI Consulting. He says that PowerSecure, a subsidiary of Southern Company, a leading provider of utility and energy technologies, has deployed over 2 gigawatts of microgrid/power generation systems.

Microgrids can help an organization become more resilient by improving power reliability. Having a reliable supply of electricity is a rising concern for many organizations, according to the survey. Forty percent of respondents said they were more concerned about power outages than in the past. (See Figure 5.)

Figure 5: ***Are you more concerned about power outages than in the past? (R=852)***	
Much more concerned	10%
Somewhat more concerned	30%
Not more concerned	60%

That rising concern is not hard to understand. Severe weather events pose an ongoing threat to utility power, and changes in the climate promise more weather-related natural disasters, from hurricanes to wildfires. Other risks to grid-supplied power include the looming danger of cyberattacks that could interrupt the flow of electricity from utility providers.

According to the ASCO/Building Operating Management survey, improved power reliability would be a major factor in justifying the investment in a microgrid, as would reduction in overall electrical costs. (See Figure 6.)

Figure 6: ***Which factors would justify a microgrid for your building(s)?***

	Significant Factor	Minor Factor	Not a Factor	R
Opportunity for interaction with the larger electrical grid	29%	39%	32%	582
Part of a smart-building strategy	44%	39%	17%	600
Power reliability	70%	19%	11%	607
Preparation for electrification of loads	31%	43%	26%	576
Reduction in carbon footprint	41%	41%	18%	599
Reduction in overall electrical cost	67%	22%	11%	618

The two biggest concerns about microgrids are cost/payback and lack of knowledge, according to an open-ended question on the survey. Another issue is regulations. Among survey respondents, 23 percent called regulations a significant obstacle to microgrids, while another 59 percent said they weren't sure. (See Figure 7.)

Figure 7 ***True or false: Regulations are a significant obstacle to the creation of a microgrid. (R=606)***	
True	23%
False	18%
Not sure	59%

UNIVERSITY HAS MICROGRID SUCCESS STORY

Western Michigan University (WMU) has had a microgrid on its main campus in Kalamazoo, Mich., for 23 years, says Peter Strazdas, Associate Vice President, Facilities Management. Two 5-megawatt natural gas turbines produce electricity and steam in a combined heat and power (CHP) system. In winter, the CHP system provides all the electricity that the university needs while meeting 60 percent of its demand for steam.

The summer is a different story. When the electric chillers start running, WMU has to buy power from the utility. It's an expensive proposition because those purchases represent the university's peak demand, which raises the school's electric bill for an entire year in the form of demand charges.

Now the university is about to expand its generating capacity by adding a pair of 2.5-megawatt peaker gas turbines. "We can ramp them up and ramp them down depending on the demand on campus," Strazdas says.

WMU also has a .9 megawatt back pressure steam turbine that it uses in warmer weather, when it has more steam than it needs. "We have free steam coming in and free electricity coming out the other end," Strazdas says. With those turbines, plus a contribution from solar panels on campus, WMU can produce about 16 megawatts of electricity — nearly enough to meet its peak demand of nearly 17 megawatts.

"We're producing electricity for less than we can buy it," Strazdas says. Over the years, the CHP microgrid has avoided tens of millions of dollars in electric charges. "It's a very powerful story," Strazdas says.

Strazdas says that evaluating a prime power microgrid requires careful analysis of a range of factors, from the expected cost of purchasing utility power to the projected demand for electricity to the interconnect agreement with the utility, which spells out requirements for power quality as well as rates for electricity. Another factor to be weighed is the cost of natural gas. Right now, it's at historic lows. "We're hedging out five years," Strazdas says. By paying a small premium for gas right now, WMU gets a guaranteed rate for five years.

While cost-savings was the primary driver for the university's CHP system, the WMU microgrid provides another important benefit: reliability. "With a microgrid, if you maintain it, by and large you are much more reliable than the public utility," Strazdas says.

And maintenance is critical. "Maintenance must be budgeted," Strazdas says. Owners have to decide whether they want to pay a fixed cost for a service agreement or handle maintenance in-house and bring in contractors as needed. WMU has a hybrid approach. The inhouse staff is highly skilled and highly motivated, Strazdas says, and it handles ordinary maintenance. But the university turns to the turbine manufacturer for major projects, like rebuilding turbines.

AIRPORTS BUILD MICROGRIDS

Organizations are learning about the risks and costs associated with power outages from their own experiences or from their competitors. After several high-profile power outages resulted in cancelled flights and passenger disruptions, airports began exploring ways of increasing power reliability. In mid-October 2019, Pittsburgh International Airport (PIA) decided to install a microgrid to tap the airport's own on-site natural-gas wells and solar panels as its primary sources of power. The connection to the electrical-utility grid is being maintained for backup and emergency power.

The airport's microgrid will consist of five natural-gas-fueled generators and approximately 8,000 solar panels, capable of producing more than 20 megawatts of electricity. The airport's current peak demand is approximately 14 megawatts.

The power source for the generators will come from onsite wells along with natural gas from the interstate pipeline system. The Allegheny County Airport Authority Board of Directors awarded Peoples Natural Gas a 20-year contract to build, maintain and operate the microgrid at no cost to the airport. The microgrid is expected to be online by summer 2021.

Another airport, this one in Detroit, has seen firsthand the value of microgrids. Wayne County Airport Authority (WCAA) currently operates two campuses at Detroit Metropolitan Airport. Both the North Campus and the South Campus have microgrids that provide site-level backup generation using natural gas. The two microgrids offer WCAA assurance that the airport can continue to operate independent of the electric utility grid, according to John Philbrook, Director of Power Systems.

The South Campus microgrid was built into a new energy center and terminal development project completed in 2000. "This is the best way to accomplish a microgrid, since the incremental cost of site-level backup generation is lowest during initial construction," explains Philbrook.

A regional electrical outage in August 2003 proved the worth of Detroit Airport's first microgrid. The North Campus was unaffected, while the South Campus was disabled. That disparity became a business issue. "The airlines in the North Terminal demanded that we provide them the same reliability as the airlines in the South Terminal, which continued to fly during this outage," Philbrook says.

Currently, WCAA is working to combine the two microgrids' direct-fed or radial- distribution with loop distribution for additional reliability. Philbrook admits that having all site-level generators operating on natural gas is a risk. "But the natural gas distribution system is very robust here in Michigan, and large standby reservoirs of diesel fuel require periodic treatment for water, algae, aged fuel, etc. Since natural gas distribution pumps are all backed up by diesel generators, we consider the risk of a simultaneous regional electrical outage with a natural gas outage to be reasonable," Philbrook says.

COMMUNITY MICROGRIDS

Because it caused so many people to work from home, the COVID-19 pandemic has highlighted the importance of residential power reliability. And that heightened awareness could spur interest in what are known as community microgrids.

Today, most microgrids serve a single organization or a few locations in the same area. A community microgrid serves a wider area and could supply both commercial and residential customers.

One early example of a community microgrid comes from Brooklyn, N.Y. The Brooklyn Microgrid connects commercial and residential buildings that produce solar power. The microgrid is connected to the New York City grid, allowing solar energy producers in the microgrid to sell excess solar power to other electricity consumers across the city via a mobile app.

The Brooklyn Microgrid meets a criterion associated with the community microgrid movement: It is based on renewable energy produced in the area where it is consumed. The Clean Coalition, a non-profit group that aims to accelerate the transition to renewable energy and a modern grid, says that community microgrids have "high penetrations of local renewables and other distributed energy resources, such as energy storage and demand response."

Editor's Note: *This article is the second of a four-part series:*

- *Part 1: Definition of a Microgrid*
- *Part 2: Growth of Microgrids*
- *Part 3: Going Green*
- *Part 4: Economic Opportunity*

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