White paper

Microgrids: utility friend or foe?

The idea of a small, self-sustaining power system is hardly new. Microgrids have been around for decades, and in a sense the power industry itself began with a collection of microgrids serving urban areas more than a century ago. In recent years, however, a confluence of factors has made them a hot topic of debate for utilities. The question is: is the increasing proliferation of microgrids something the industry should fear or embrace?

Either way, there is no doubt that microgrids are on the rise. A recent Navigant Research report identified over 400 microgrid projects currently under development globally. The same report projected annual microgrid spending to rise from $10 billion in 2013 to more than $40 billion by 2020.

Historically, microgrids have been used primarily to serve island communities or remote industrial sites such as mines—places with significant demand but without a business case for being served via transmission lines from distant power plants. More recently, however, "embedded" microgrids located within existing distribution systems have come to the fore. The main reason: reliability.

Critical loads such as hospitals, data centers and industrial facilities running highly sensitive processes simply cannot afford to be without power even for a moment. These facilities have traditionally relied on backup generation (i.e., diesel gensets) to fill the void in an emergency, but the increasing frequency and duration of weather-related outages has forced them to rethink this approach. What do you do, after all, when your diesel supply runs out and the fuel supply chain itself is still down? Unfortunately many utility customers faced precisely that scenario when superstorm Sandy hit the Northeast US in 2012.

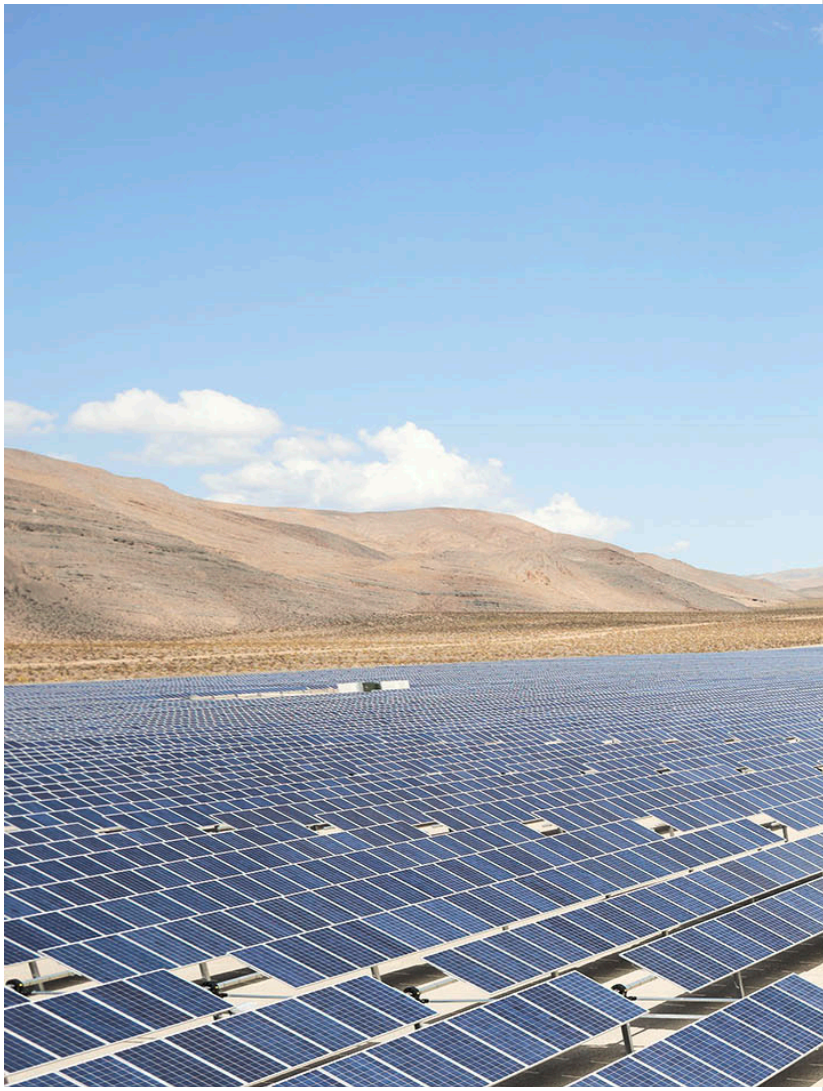
Microgrids offer an alternative for ensuring power reliability by integrating and automating distributed energy resources. And as renewable energy costs decline and energy storage technology continues to advance, truly self-sufficient microgrids are becoming more and more attractive.

Microgrids: what's not to love?

From the utility customer's vantage point, there is plenty to love about microgrids. Reliability tops the list, but there are other reasons particularly for industrial customers with critical loads. Businesses looking to increase their use of renewable energy can benefit from microgrids that balance the output of variable sources such as wind and solar, and manage energy storage devices. There is also a cost-saving aspect particularly with regard to combined heat and power (CHP) systems, which allow customers to realize greater efficiencies by capturing waste heat from power generators.

Historically, utilities have viewed microgrids with a certain amount of healthy skepticism, which can be attributed to two simple facts. First and foremost, microgrids represent a threat to utility revenues under traditional regulatory models for cost recovery. Every kilowatt hour customers generate themselves is one less the utility can sell. Second, microgrids present operational challenges in terms of maintaining balance between generation and load, but also in terms of safety concerns related to equipment remaining energized even while the surrounding grid is down.

There are some positives for utilities contemplating microgrid development in their service territories. First, microgrids can enable more renewable energy to be deployed within the utility's network by smoothing the output of wind and solar. Second, microgrids in some cases can provide ancillary services back to the distribution system. Third, microgrids facilitate the proliferation of distributed generation resources that can defer the need for new centralized generation to be built.



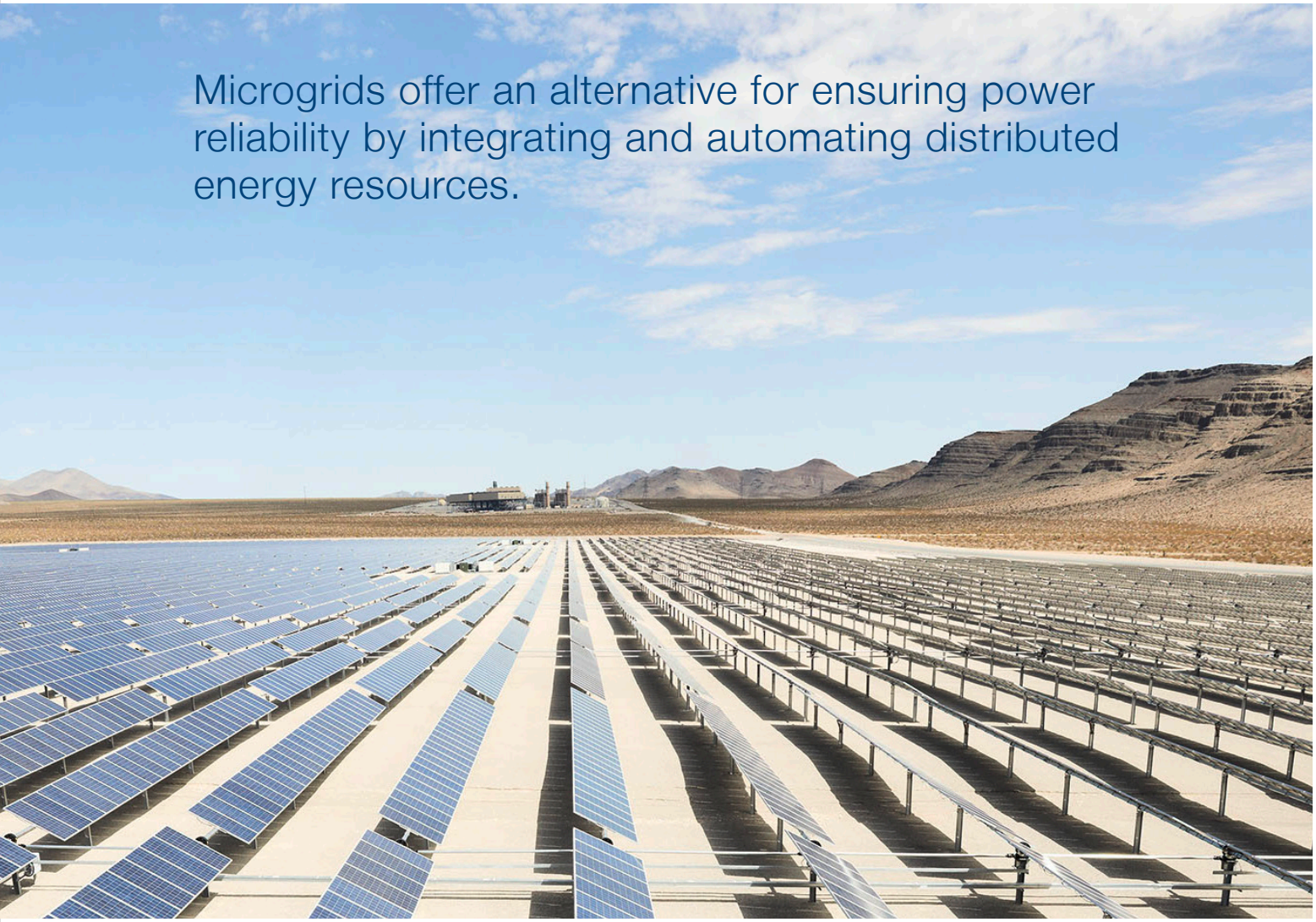
Finally, microgrids themselves can represent a new revenue stream for the forward-looking utility. Instead of viewing them as a competitor, some utilities are getting into the microgrid game themselves, building and operating systems for customers with critical power needs. Such services fall outside the utility's conventionally regulated offering and as such they can be priced as a premium service.

Critical load as microgrid catalyst

Ultra-reliable power has a business case for a variety of businesses and institutions (e.g., hospitals, microprocessor manufacturing) but one sector in particular is growing like no other: data centers. Today's state-of-the-art facilities draw tens of megawatts and energy costs are perhaps only second to uptime on the data center's list of priorities. Data centers are therefore uniquely suited to microgrid applications, but the benefits of them extend beyond the data center itself.

Companies operating large data centers tend to be highly visible organizations that are more sensitive to sustainability concerns than businesses in more obscure industries. They often face a high level of scrutiny over where their energy supply comes from and how efficient their operations are. Having a large amount of on-site generating capacity from renewables like rooftop solar makes for good PR, but owning and operating such a system is clearly outside the core competency of a Google or Amazon. Enter the local utility, with the experience and expertise needed to oversee a successful microgrid implementation. How much of the data center's load can be met with renewables? What if the utility alleviated the data center capital expense of backup power by installing prime power in a microgrid? How should the data center meet the remainder of its demand? Can the microgrid even be set up as a direct current system to marry DC sources like solar with the DC devices that make up the majority of a data center's load? These are all questions that utilities are in a strong position to answer.

Another aspect for utilities to consider regarding microgrids that emphasize renewable energy is that the utility can use any excess generation to serve the surrounding grid. This, in turn, contributes to meeting renewable portfolio standard requirements. It also provides the means to offer "green power" alternatives to commercial and residential customers, another premium service that generates revenue outside the traditional cost of service model.



Microgrids as part of re-development

Embedded microgrids built around a critical load are still somewhat novel, but there are a number of facilities under construction today. One example is a redevelopment project at an industrial complex in New England. The facility is still in partial use and even has an active railway. The project developer has a vision to build a microgrid for the digital age and bring data centers into a campus environment.

Seeking to attract business tenants with these amenities and its central location, the owner needed a microgrid to incorporate both fuel-based and renewable distributed energy resources to provide another selling point: highly reliable electricity.

Urban infill projects of this nature are becoming more common, and they make excellent candidates for embedded microgrids. In the New England case, the developer is looking at participating in demand response programs offered by the local utility. Having such capabilities on site is attractive as a draw for a data center or other critical load but it relies on having a well-engineered system and the expertise to operate it effectively. Still, we could be looking at a long-term trend toward microgrids that are able to add value to the surrounding grid in addition to disconnecting from it.

Incentives are just the beginning

Any discussion of microgrids needs to include government incentives, and those offered by the state of Connecticut played a substantial role in driving the project just described. Indeed, Connecticut and neighboring New York have implemented several policies in support of microgrids in an effort to better prepare for severe storms like Sandy.

However, grants for demonstration projects and tax credits for renewable energy installations have only so much influence on the microgrid market. Equally important are the various regulations that govern microgrid development and operation. Following is a summary of several factors that play a role in how hospitable a given market is toward microgrids.
Interconnection standards. The release of IEEE 1547.4 in 2011 provided a baseline for microgrid interconnection. Today 44 states have established standards for connecting microgrids to local utility distribution systems.

Renewable portfolio standards. Currently 30 states have requirements regarding the percentage of renewable energy sources in the generation mix of utilities operating within their borders. Microgrids offer utilities an alternative to developing large-scale renewable plants in meeting these requirements. Some states also have standards regarding energy efficiency that microgrids can help address.

Net metering. Most states (44) now have regulations providing for the output of small distributed generation resources to be compensated by the local utility for excess power supplied to the grid. Payments might be at the retail or wholesale rate, or they may be set according to a feed-in tariff. Regardless of the form they take, these payments have a direct impact on the economic viability of any microgrid project, but particularly those that anticipate "exporting" a substantial amount of power to the surrounding distribution grid. At issue now is size: at what point does a given generation source cease to be part of a "microgrid" and become part of a "utility."

Building, environmental and safety codes. Microgrids must adhere to all applicable regulations but their construction will be expedited to the extent these requirements can be harmonized and the associated review/inspection processes coordinated.

National targets. Most microgrid regulations are administered at the state level, but policies at the federal level regarding energy efficiency, emissions reduction and the expansion of renewable energy sources all have an indirect impact on microgrids.

This is just a cursory overview, but it shows the multifaceted nature of the regulatory environment that microgrid projects must navigate.

Looking forward

In a recent interview with Greentech Media, Horizon Energy CEO Steve Pullins made an important distinction with regard to the surge in interest around microgrids.

"This isn't microgrids challenging the regulatory model," he said. "It's customers challenging that model. Utilities shouldn't have misplaced aggression against microgrids."

There are many open questions about the future of microgrids in the US. What will be the standards for interconnecting embedded microgrids? Who has the right to sell power generated by distributed resources? The very definition of a utility could change.

What is certain is that microgrids that incorporate renewable energy sources, energy storage, demand response capabilities and energy efficiency are here today. The technology is proven, much of it with a long track record. As is the case in so many industries, it is the regulatory environment that lags technical capability. Utility customers are already asking how microgrids can help them achieve their requirements for reliability and sustainability—whether their utility has an answer or not.

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