

Microgrid 360: A Gold Standard for Microgrids

Introduction

For more than 100 years, the centralized grid has represented one of the most asset-intensive resources in our nation, ranging from generation, transmission lines and substations, to distribution lines, transformers and circuit breakers. And yet, we have been able to safely and efficiently manage our grid in real-time, and do so while ensuring a 99.99% reliability level. Indeed, it is the presence of this safety, reliability and affordability gold standard that allows multiple utilities and its vendors to effectively co-manage this vast and interconnected system.

A microgrid, on the other hand, is a relatively newer concept that is tied to the loads it serves. As a localized group of electricity generation sources, storage options and loads, a microgrid is typically connected to the centralized grid and can run synchronously with it, but can be islanded and operated autonomously as needed. Because of its connectivity, a microgrid's safety and reliability requirements are similar to that of the centralized grid. At the same time, as a customer-sited solution, microgrids have the additional complexity and benefit of addressing customer-specific requirements.

In other words, while the centralized grid is an impressively high-performing asset that can be effectively managed by multiple entities, a modern microgrid needs to be both high performance *and* high customization. This raises the question of, can a universal gold standard emerge for microgrids, or is there too much customization involved?

Microgrids: A Sea of Custom One-Offs or a Gold Standard in the Making?

On one hand, each microgrid is certainly unique, as customer-specific customization occurs on many levels. First, a microgrid must be sized and connected appropriately to handle a certain amount of baseload under normal operations, and all mission-critical loads in island mode. This depends heavily upon the variability of a facility's load. Next, there are many fuel-based and renewable sources that can power a microgrid, but they must adhere to the facility's clean energy goals and make economic sense. Once set up, a microgrid should be able to take advantage of market-specific economic value opportunities, which may range from simply reacting to real-time prices to participating in demand-side programs. In some regions and applications, the addition of a combined heat and power system might make sense, while in others, a very basic microgrid may be the right approach. When it comes to testing, monitoring and performance management, there are as many nuances as there are microgrid providers.

On the other hand, there are clear standards that all microgrids must adhere to, such as federal, state and local emissions requirements, utility interconnection requirements, siting limitations, local permitting, and customer requirements. In many ways, these requirements themselves form the gold standard for how we consistently develop a microgrid. The issue, however, is that standards only cover a limited portion of the design and management of a microgrid.

An Alternative Gold Standard Framework

Based on the above, we believe the right way to achieve a microgrid gold standard is not in the configuration of the end solution, but in the process of designing, delivering and optimizing it, i.e., even though each microgrid solution may be unique, the same gold-standard of rigor has been applied in its creation and ongoing management.

What this means is that it is the microgrid provider following a series of *gold standard processes* that optimizes each microgrid for its intended, custom application. This process, which results in a gold-standard microgrid, is what we have coined as Microgrid 360.

What is Microgrid 360?

After more than 2,000 microgrid installations over 18 years, we see microgrids as long-term living assets that are performance optimized over their lifecycle. The two key words here that form the basis of Microgrid 360 are “long-term living asset” and “lifecycle”.

First, long-term living asset means the following: (a) we develop our microgrids so they can be reliably operated for a very long term, similar to the centralized grid, and (b) we constantly performance manage our microgrids to maximize economic value, even as facility energy usage trends evolve and marketplace pricing shifts.

Second, we treat lifecycle systemically at a corporate level. The typical definition of a microgrid lifecycle only spans the lifetime of a single configuration. In our definition, lifecycle relies on system-wide feedback, where we take data points and lessons learned from all of our past deployments, so that our next microgrids are always best-in-class from day one. We are able to do this because we internally manage all aspects of a microgrid across its lifetime.

This notion of a complete feedback loop - or 360-degree view and expertise - and our ability to create superior performing microgrids because of it, is Microgrid 360.

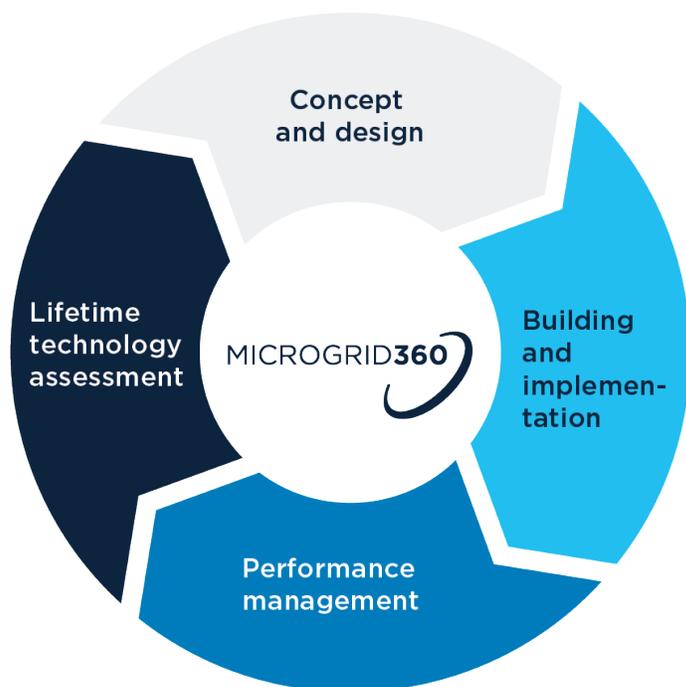


Figure 1. PowerSecure’s 360-degree view and expertise around microgrids is the basis for our Microgrid 360 process.

The process includes: (1) microgrid concept and design, (2) building and implementation of the microgrid, (3) microgrid performance management, and (4) lifetime technology assessment across our full portfolio of microgrids. All of these steps inform the next set of microgrid solutions that we develop.

PowerSecure’s Microgrid 360 Processes

The following three processes form the basis of our Microgrid 360 approach:

1) We optimize time-to-successful-implementation by vertically integrating the right expertise in-house

Any customer who has failed to successfully implement a microgrid or faced multiple unanticipated delays learns the hard way that there is a clear delineation between vendors who understand the theory of microgrids vs. those who also have hands-on expertise.

We bring end-to-end expertise to our customers, from the concept and design of a microgrid, through its development and implementation, and ongoing performance management. To maximize our performance across the board, we have product innovators, engineers, builders, commissioning experts, regulatory and market experts, interconnection experts, field implementers, energy-efficiency expertise, and an ongoing service and system monitoring team within our vertically integrated organization.

This end-to-end expertise yields multiple customer benefits: faster time to implementation and delivering a superior solution. For example, by incorporating proprietary switchgear, controls and other custom technologies into our designs, we

not only optimize system performance, but we reduce cost and minimize development time of our solutions.

By how much? Customers who work with multiple vendors typically get through microgrid concept to implementation in no less than 2 years. With PowerSecure, the same effort is handled seamlessly by a team with cross-functional expertise, so that a superior microgrid solution can be delivered in 12-18 months.

2) We are product innovators so that we can deploy the right technologies from the start and facilitate future upgrades

Even though microgrids are, by definition, a system developed of several technologies that are often manufactured by different vendors, there is ample room for innovation and differentiation.

For example, PowerSecure is the sole provider of factory-certified Tier 4 Final Volvo engines in the U.S. The clean energy profile, price point and modularity of PowerSecure's Tier 4 Final system makes it well-suited to be the most versatile foundation for a microgrid solution.

In addition, our product development teams create proprietary solutions that are optimized for microgrid applications, ranging from custom components such as switchgear and energy asset controllers to more complete solutions such as custom components incorporating a microgrid controller.

By combining the above with the latest fuel cells, renewables, natural gas technology and energy storage options, we form the most advanced microgrids in the country. And because we are technology experts who understand the inner workings of all of our components, we are able to upgrade them over time as an ongoing service to our customers.

3) We drive product and component choices based on lifetime performance and industry-leading QA processes

As a company that centrally monitors and controls 24/7/365 through our in-house PowerControl center and provides a national field service team that manages all the microgrids that we have designed and implemented, we have the unique advantage of being able to see what products and components really stand the test of time based on how we have used them before.

In addition, we conduct extensive quality control procedures and provide 100% testing on our factory floor as well as onsite at our customer's facilities. Our ability to simulate the sequence of operations and performance optimization environment on the actual microgrid assets makes us very unique in the market. All of these data

points are communicated back to our design teams so that our microgrids are always built around the highest-performing assets based on the extensive empirical evidence that we collect on a daily basis.

Stated another way, our 360-degree lifetime view of microgrids is the source of our ever-growing product intellectual property portfolio, which we bring to benefit all of our microgrid customers.

Conclusion

Microgrid 360 is a gold-standard process for developing microgrids, which is both customer- and internally-focused. It allows for our teams to work most effectively and gain cumulative expertise with each system we develop, and it helps deliver the highest-quality and highest-performing microgrids in the industry to our customers. We adhere to Microgrid 360 regardless of whether we are developing a basic or advanced microgrid system. Microgrid 360, coupled with over 2000 microgrid installations in operation today, provides past and future customers with the highest reliability in the industry at 98.7% while also achieving reduction in carbon footprint at an attractive rate of return.

About the Author

PowerSecure is a pioneer in developing distributed energy systems and in the integration of multiple energy resources for advanced microgrid deployments. Over its 18 year history, PowerSecure has gained 85% of the US market share for installed microgrid sites. The company offers a lifecycle approach to microgrid solutions, and designs, builds, owns and operates microgrids including on-site generation with ultra clean diesel Tier 4 Final, natural gas generation systems, fuel cell energy systems, battery energy storage, and renewable energy. In addition, PowerSecure offers energy efficiency services to optimize the energy load of its customer facilities.

PowerSecure was recently recognized for the innovative Butler Farms Microgrid in Lillington, NC that received Power magazine's 2019 Distributed Energy Award. Beginning in October 2019, the company will offer its "Microgrid 360" campus tour to prospective customers, where they can see PowerSecure's own microgrid in action. Registration for the tour is available on the company's website www.powersecure.com/microgrid360.