

PowerSecure's Commitment to On-Site Power Reliability

Introduction

Mission-critical enterprises use microgrids with on-site power systems to achieve the highest possible reliability. Power outages are increasingly unacceptable at military bases, health-care facilities, data centers, distribution centers, and retail facilities. A disturbance that is literally faster than the blink of an eye can damage equipment, ruin products, slow or halt employee productivity, inconvenience customers, and even compromise safety and security. Power reliability is not an option, it is a necessity.

PowerSecure, a subsidiary of Southern Company, has been designing, building, installing, and maintaining nearly 2.5 GW of turnkey mission-critical power solutions for two decades. This whitepaper provides a “behind-the-scenes” view into how PowerSecure microgrids achieve and maintain the highest level of reliability available on the market today.

Executive Summary

PowerSecure's microgrids are built around a growing installed base of distributed energy resources at customer sites. The nearly 2,000 power systems range in size from 125kw to 2800kW, with 92% rated 500kW or more.

PowerSecure provides customers with high reliability microgrids that leverage multiple fuel assets consisting of renewables, energy storage, fuel cells and generator assets, and they serve two distinct tasks.

- **Standby Generation:** When a utility outage occurs, PowerSecure proprietary controls provide power to a customer's load within seconds to maintain a steady-state operation until the local utility restores service. Our proactive remote management by PowerControl® 24/7 and autonomous local controls use “blip less” transfers in advance of many outages. The technical expertise of PowerSecure's in-house Service organization, its geographic reach and national network of fuel suppliers provide maintenance and fuel to keep systems running for as long as necessary.

Hurricane Barry hit the Louisiana coast as a Category 1 hurricane on July 13, 2019. Prior to landfall, PowerSecure monitored the storm's track, replenished system fuel, pre-positioned replenishment fuel tankers, and transferred at-risk customers to “storm mode.” This provided a seamless transfer to isolated (“island”) microgrid operations before the impending storm impacted customer sites.

“Hurricane Barry came and went, and thanks to PowerSecure and their PowerControl monitoring services CertainTeed Gypsum was able to avoid power quality issues including any blinks and outages by opting to operate in storm mode for 15.5 hours.”

Janice Beavin, Energy Procurement Lead, CertainTeed Gypsum

- **Load Management:** PowerSecure’s microgrids can provide a variety of utility-driven load management functions that enable customers to save on energy-related expenses. In many locations, load management can be used to generate revenue or bill credits by providing critical distribution grid services to the local utility.
 - **How does a microgrid reduce your expenses?** An on-site microgrid allows the customer to switch to island mode, separating from the grid and reducing utility loads on demand. Demand response aids the utility during peak pricing periods and by reducing grid congestion during periods of high demand, especially during weather extremes.
 - **How can a microgrid provide you with revenue?** A customer’s microgrid can be compensated by the utility for help in stabilizing the distribution grid with services including frequency response, renewables firming, or demand response.

Reliability starts with high quality equipment. PowerSecure is committed to the reliability of our microgrids. Our dedication to excellence begins with high-performance Volvo engines meeting or exceeding EPA Tier 4 Final requirements, the cleanest diesel engines available. PowerSecure then integrates engines (either diesel or natural gas options) into our PowerBlock® with a generator, controls, switchgear, integral fuel and DEF tanks, and a sound-attenuating enclosure. Each PowerBlock can house one to six generators rated 625kW. The PowerBlock can be installed as a standby generator or as the centerpiece of an advanced microgrid that can include PV, fuel cells, battery storage and legacy assets such as turbines. PowerSecure has installed over 750 PowerBlock systems.

Reliability improves with automated 24/7/365 monitoring. Customers who demand the highest possible reliability and performance use PowerSecure to monitor, maintain and manage their microgrid and mission-critical power systems. Once installed, detailed information from multiple sensors within the PowerBlock and across the entire microgrid is transmitted in real-time to one of two PowerControl® 24/7 Operations Centers. Taking people out of the reporting loop greatly accelerates data collection and avoids input errors. This enables PowerSecure to use proactive maintenance, which can range from tasks as simple as topping off diesel fuel reserves in advance of a major storm, to dispatching technical personnel to investigate unusual patterns or changes in equipment performance.

Reliability must be measured. Nothing can be controlled or improved without accurate measurements. PowerSecure’s unique automated monitoring and data collection systems allow weekly, monthly, quarterly, and yearly reporting on the microgrid fleet’s reliability and availability.

Reliability Growth Management (RGM) Program. PowerSecure’s automated monitoring system allows accurate, frequent review of the reliability of every monitored system in the fleet. Each failure is investigated and assigned to one or more causes: components, design, manufacturing, installation, commissioning, and/or operations. Once identified, causes are investigated and resolved by the appropriate personnel, with the goal of complete defect elimination. The benefits of our RGM program are shown in Figure 1.

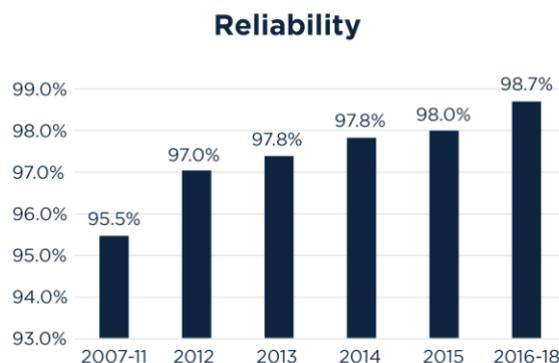


Figure 1- PowerSecure's History of Continuous Reliability Improvements

This RGM program of continuous improvement has resulted in the highest documented reliability in the industry. Over the period January 2016 to March 2019, the PowerSecure fleet accumulated 64,075 start demands, 5,237 system-years in service, and 24.5 years of total system run time. Operations were successful 98.7% of the time.¹ The number of machines, the number of starts, and the total running time is many times greater than all the published data available from previous studies combined. Compared to the industry average of 95.4% success, systems managed and monitored by PowerSecure were 3.6 times less likely to fail during an outage. It is important to note that this reliability is calculated based on the performance of the entire microgrid, including feeders, switchgear controls, and not just the engine generation equipment.

Through their assessment, MTechnology demonstrated several facts that had long been assumed but never proven:

- There was no significant difference in reliability as a function of system power rating. Smaller systems are just as likely to start and run as much larger systems.
- Failures tend to occur during or immediately after system start. After 14 hours of running, system failure rates per hour have declined 100 times compared to the first 30 minutes of operation.

¹ To see the complete report from MTechnology, download IEEE paper “Reliability Assessment of a Large Diesel Generator Fleet,” at www.ieee.org. This paper will be presented at the IEEE Industrial Applications Society Fall 2019 Meeting in Baltimore, Maryland.

- Most systems serve one or more utility-driven load management applications, including demand response, coincident peak capacity markets, automatic frequency response, and generation during peak spot market prices. The average system used in these applications runs about 40 hours per year, about 4 times the number of typical systems tested monthly. This ensures frequent turnover of diesel fuel, which manufacturers recommend should be stored for no more than 6 months. Fresh fuel is almost certainly part of the reason that PowerSecure-managed systems outperform identical machines operated by others

Higher Reliability via Redundancy. Because PowerSecure measures reliability, we can configure systems to meet virtually any customer requirement for truly critical installations. Most facilities employ one extra machine, called N+1 redundancy, as a minimum. As shown below, N+1 redundancy alone does not predict reliability.

PowerSecure’s approach of multiple distributed energy resources configured in a modular, scalable system configuration provides higher system reliability while appropriately optimizing the cost of such system. Table 1 shows the reliability of a 1-unit 2500kW emergency diesel generator starting after a utility outage vs. an N+1 2-unit installation and an N+1 5-unit PowerBlock. The load is less than 2500kW.

Table 1: Critical load reliability with 98.7% reliable PowerSecure generators

Number of Units	1	2	5
Unit Power Rating (kw)	2500	2500	625
Reliability for 2500 kW critical load	98.7%	99.97%	99.83%

Each generator has 98.7% reliability for completing an outage successfully. Adding a second 2500 kW generator increases the reliability for a 2500 kW critical load to 99.97%. A much more economical solution is the 5-unit PowerBlock, with 99.83% reliability and only 625 kW of extra capacity. Only the customer can determine which level of reliability is required for their site. With their commitment to reliability and automated monitoring capabilities, only PowerSecure can confidently calculate the reliability of each configuration.

For more information about our offerings, please contact Eric Dupont at 919-556-3056, or edupont@powersecure.com.

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 15 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.