

Before, During & After the Storm: Quantifying Resiliency and Reliability

PowerSecure Microgrids Achieved a 99.5% Uptime Rate During 2020 Natural Event-Related Outages

Introduction

The 2020 Atlantic hurricane season was the busiest on record, with 31 depressions, 30 storms and 13 hurricanes. Fires in the West were devastating this year, with California suffering its worst year on record. The Midwest has also been inundated with ice storms throughout the year. The overlapping timing and geographic spread of these events, combined with unexpected operational disruptions caused by COVID-19, made 2020 a particularly challenging year to ensure power resiliency in the U.S.

With 1,800 managed microgrid systems across the country, PowerSecure provides clean, reliable and resilient power to customers for everyday operations and during unanticipated grid outages. This paper summarizes PowerSecure's 2020 system resiliency performance across all of the year's natural event-related outages.

Key Components of a Resiliency Solution

Achieving a 99.5% uptime rate across hundreds of microgrid solutions operating in island mode is made possible only through careful system planning, technology selection and procedural adherence. All PowerSecure solutions possess the following key attributes, each designed to maximize the systems' reliability and resiliency.

Technology attributes:

- Built-in hardware redundancy, multiple engine configurations and clean energy options allow for power generation flexibility and continuity
- Digital management capabilities enable rigorous remote testing and fuel assessments

Procedural attributes:

- Strict testing protocols and procedural redundancies ensure that all systems can be supported under all conditions
- A dedicated service team optimizes all systems around customers' capacity needs and grid conditions (see next section)

From Everyday Operations to Emergency Mode

Since 2007, PowerSecure's PowerControl Service has successfully monitored more than 31,000 outage events, totaling over 145,000 hours of emergency power operations. PowerControl analysts provide system reliability during everyday microgrid operations and are also trained to operate in emergency mode to ensure enhanced system reliability.

Step 1: Enhanced System Testing

The Foundation: All PowerSecure microgrid systems come equipped with the industry's highest reliability performance rating of 99.6%, measured during regular operations. This level of reliability is achieved by (a) scheduling remote testing of every system and regularly exercising each with load, (b) taking every minor issue seriously before they become reliability issues, and (c) building in redundancy as part of the PowerSecure PowerBlock® design, which contains two 625 kW engines compared to others' single 1.25 MW engine.

Emergency Mode: Typically performed 48-72 hours ahead of a pending storm, PowerSecure conducts extra tests of all microgrid solutions that may be in the storm's path. Any system alarm that appears is assessed and resolved immediately, with monitoring and service teams working seamlessly to dispatch on-site resources as needed.

Step 2: Extra Fueling Services

The Foundation: PowerSecure continuously monitors fuel levels and works with over 280 fuel suppliers across the nation on behalf of its microgrid customers. Routine fueling ensures that systems are topped off and ready to go.

Emergency Mode: In addition to the routine fuel vendors, PowerSecure also contracts with emergency fuel suppliers during storms since local vendors tend to be affected by the same storm and do not have the capacity to handle the extra demand. These specialized resupply trucks are strategically and safely staged to ensure that systems are serviced throughout the event.



2020 Performance Results

In the following sections, PowerSecure's 2020 resiliency results are outlined on several levels: at a customer level, at an aggregated level across all customers, and extrapolated to estimate the economic benefit that can be achieved if resiliency is applied universally.

2020 Results: Resiliency Made a Big Difference at the Customer Level

The most intuitive way to appreciate the value of a microgrid's resiliency application is at the individual customer level.

Hurricane Laura made landfall on August 27, 2020, at 1 a.m. CDT near Cameron, Louisiana, as a Category 4 storm with maximum sustained winds of 150 mph. The damage from Hurricane Laura was extensive: the storm destroyed more than 14,000 distribution poles, 4,800 transformers and more than 300 substations, resulting in days- and weeks-long outages for hundreds of thousands of utility customers.

This example covers two retail customers near Lake Charles, which both lost grid power for extended periods of time. Both stores' microgrid system came online immediately as the outage happened and carried the facility's full load until grid power was restored, 12 and 21 days later.

Retailer A Microgrid		Retailer B Microgrid	
Islanded Operations	21 days 15 hours	Islanded Operations	11 days 23 hours
Maximum Load	414kW	Maximum Load	432kW
Average Load	299kW	Average Load	286kW
System Size	600kW	System Size	600kW

Figure 1. System performance at two retail outlets in Louisiana that experienced outages due to Hurricane Laura.

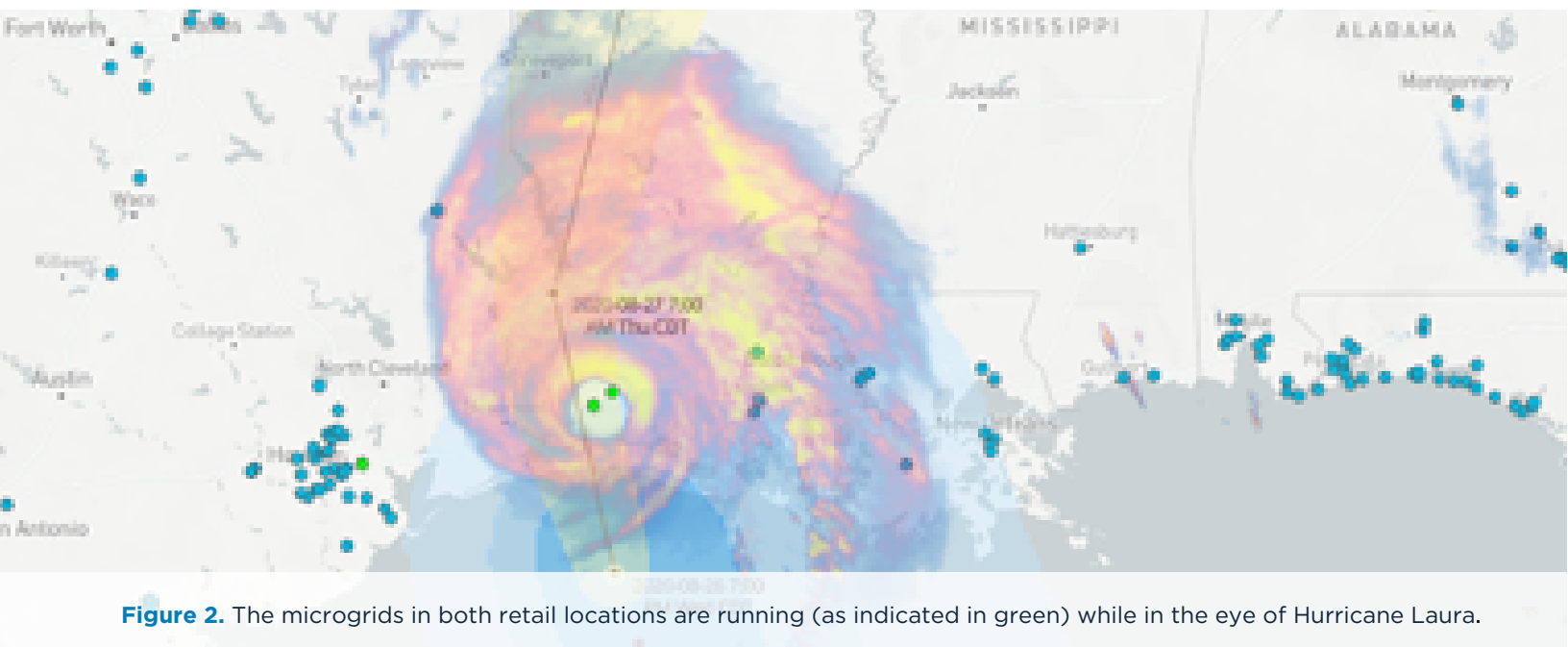


Figure 2. The microgrids in both retail locations are running (as indicated in green) while in the eye of Hurricane Laura.

In terms of the economic benefit stemming from microgrid power, neither store experienced the loss of produce that a utility power outage would have caused. After the initial storm cleanup was done, customers were able to shop for essential items like ice, water, food, baby formula, supplies and medicines, providing a much-needed lifeline to the community. The stores also proved to be of critical value for first responders, utility linemen and other essential service personnel working in the area with no other source to obtain essential supplies.



Figure 3. Shoppers buying essential supplies one week after landfall, while the local utility still had no power. Storm structure damage and debris can be seen on the right. The photo was taken by a PowerSecure service technician. [Click here to watch a video](#) about PowerSecure's work with Rouses Market.

2020 Results: PowerSecure's Aggregate Performance Achieved Significant Scale

In total, 566 PowerSecure systems across 283 unique customer sites in 19 states successfully provided power in island mode while customers were impacted by grid outages. During this time, PowerSecure systems supported a maximum of 152 MW of customer load for the equivalent total of 16 months of continuous uptime.

This translated into a successful system uptime rate of 99.5%, across all customers impacted by outages and for the full duration of those outages.

"When a storm hit Northwestern Arkansas and Kentucky, knocking out power for millions of customers, we were able to run our generators for six days straight in order to keep producing. We were the only facility in this area to continue processing products. If the plant had been closed for those six days, it would have cost us \$1.2 million."

— Engineering Manager at PowerSecure retail customer

"If you've ever been through a hurricane and been at a location where people just want the basic essentials, folks are just looking to a store that they can go to get those essentials. It's nice to be able to be there, serving those communities, opening our doors. The human impact is real."

— Ozzie Osborne, Director of Facilities Operations, Rouses Market

"PowerSecure was an exceptional partner for us. To know that they were here, embedded with us, before the storm, during the storm, after the storm, to make sure that we had reliable power, you can't put a price tag on that."

— Steven D. Sonenreich, President and Chief Executive Officer, Mount Sinai Medical Center

"As a regional Red Cross emergency evacuation center, our facility is required to have emergency power generation to serve the surrounding community. Ever since we got PowerSecure a few years ago they have delivered flawlessly. We could not be happier."

— Larry Bruce Parson, Lenoir Community College

In terms of sector-based performance, PowerSecure achieved a 100% uptime rate for the full duration of outages among its Manufacturing, Healthcare, Educational and Government/Utility facilities. These outages lasted an average of three to nine hours. PowerSecure achieved a 99.9% uptime rate for Large Retailers, and a 99.0% uptime rate for Grocery stores. On average, outages at these retail locations lasted longer, at 72 hours and 28 hours, respectively. This is summarized in Figure 4.

Sector	Average System Size (kW)	Average Load (kW)	Average Runtime (Hours)	% Uptime
Large Retail	2,261	705	72	99.9%
Manufacturing	1,475	623	3	100%
Healthcare	1,288	243	5	100%
Education	1,025	399	6	100%
Government/Utility	870	410	9	100%
Grocery	753	435	28	99.0%

Figure 4. Summary of PowerSecure’s resiliency performance across all natural event-related outages in 2020.

Outages tend to vary quite significantly in duration, and as such, there was a big range in the required uptime from PowerSecure’s microgrid systems in 2020. As Figure 5 shows, 23% of PowerSecure customers were kept powered exclusively through their microgrids for more than 24 hours. 3% of these outages lasted five or more days.

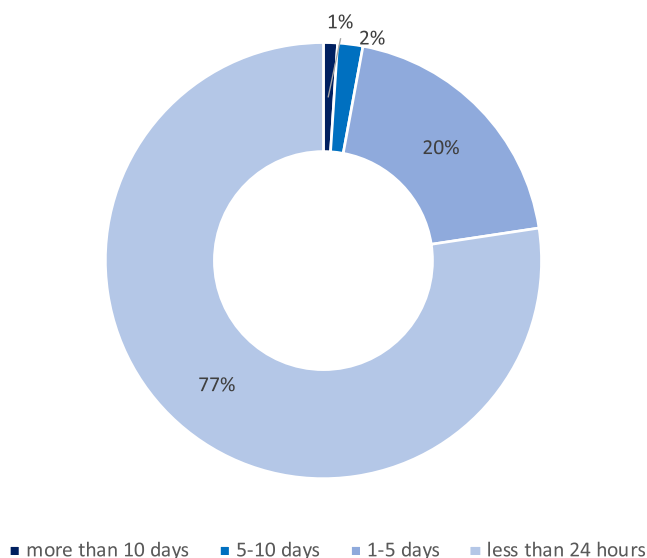


Figure 5. PowerSecure microgrids kept customers powered for as long as they needed it, ranging from several hours to several weeks.

2020 Results: **The Potential Economic Benefit of Resiliency is Significant**

While location- and outage-specific circumstances greatly affect the economic impact of an outage, the numbers are undeniably significant. Taking just one of the market segments that are highlighted in this paper, the magnitude becomes clear: one of PowerSecure's retail customers estimates that power outages in the past have cost his location between \$1,000 and \$290,000, depending on length and severity of the outage. Using the distribution of outages in Figure 5 and applying the anecdotal cost range to that distribution, the average power outage costs a grocery store an estimated \$8,500 in lost produce, damages and earnings. Individual event grid power outages with longer durations can have losses that can be hundreds of thousands of dollars per event, resulting in a significant financial impact to a retailer. Extrapolating the average losses across the 40,000 grocery stores in the U.S., the total avoided outage-related costs would be \$340 million for each outage event that a resiliency solution can prevent from happening.

If the same logic were applied to all major industry sectors that benefit from resiliency solutions — data centers, hospitals, government, large commercial and industrial customers and more — the macro-level economic benefit that would result from a microgrid solution with 99.5% uptime reliability is staggering.

Conclusion

Recent natural event patterns suggest that extreme weather events are only increasing in intensity and frequency. Eight of the ten costliest hurricane seasons have been in the past 20 years — with four of these in just the past five years — and wildfires are burning more often and more destructively.

In a year of extreme weather that seems to fit this pattern all too well, PowerSecure solutions delivered top-notch resiliency performance and tangible customer benefits in 2020: 566 PowerSecure systems in 19 states provided resiliency during this year's storms and fires, with an impressive 99.5% uptime rate. Not only did these systems achieve valuable outage cost savings, they also avoided business disruption when their customers and communities needed them the most.

About the Author

PowerSecure, a Southern Company subsidiary, is the nation's leading distributed energy innovation company. Our team of experts has developed, installed, managed and serviced 2+ GW of microgrid capacity over the past 20 years, as well as implemented over \$800 million of energy efficiency upgrades. We take a full-facility, lifecycle approach through production and management, delivering clean and resilient energy to our customers at the best possible value. By combining our product innovation capabilities with our 360 integrated processes, we offer you the best custom solution for your needs, backed by an unmatched level of expertise, quality and service.

Additional information on PowerSecure microgrid solutions can be found on the company's website www.powersecure.com.

2020 Resiliency Performance at a Glance

**A 99.5%
uptime rate**

was achieved by
PowerSecure microgrids
in 2020

Across

**566
systems**

providing resiliency
at 283 customer sites

In 19 states



Providing a maximum
total capacity of

152MW

to carry customers'
full facility loads

Over the total duration of
the grid outages, which
was the equivalent of

16 months



Where

23%



of outages
lasted longer than
24 hours.