HOW TO MAKE THE SMART GRID SMARTER

Endeavor Business Media in conjunction with
S&C Electric Company

INTRODUCTION

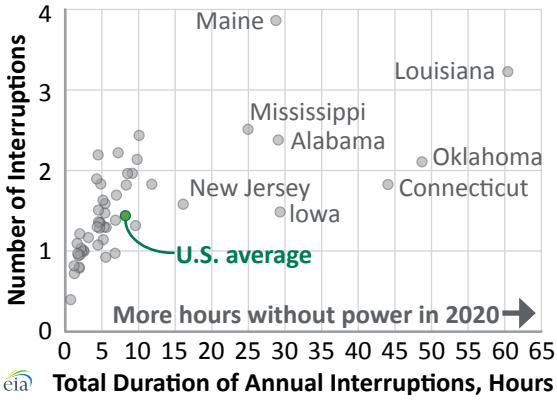
Over the past decade, many utilities have made earnest efforts to transform their distribution networks into "smart grids." But if the average utility grid has gotten so smart, why is the reliability of the U.S. grid as a whole getting worse?

On average, Americans spent eight hours without power in both 2020 and 2021, more than double the rates seen in any year from 2013 to 2015. Major blackout events increased by more than 60% from 2015 to 2020.

Part of the reason why reliability is getting worse is because the true performance of the grid—the performance that matters to customers—is a blind spot for utilities. Many utilities, and their regulators, use the

FIGURE 1. Average total annual electric power interruption duration and frequency per customer, by U.S. state (2020)

Source: U.S. Energy Information Administration



System Average Interruption Duration Index (SAIDI) excluding major events as their key reliability metric. By that metric, most utilities continue to do an excellent job operating their grid's reliability.

However, in a world where climate change is driving an increase in extreme weather events, it doesn't make sense to measure how good a utility is at keeping the grid on when the sky is blue. Utilities must refine their key metrics to ones that track every outage—true grid *resilience* measures that reveal how well the utility keeps on or quickly restores power when major events such as hurricanes and snowstorms occur.

It's an axiom in business that what isn't measured can't be managed. When utilities measure for resilience, they can seek the rest of the answer to why grid reliability is getting worse. That answer starts with the fact that, unfortunately, most utility grids in the United States just aren't that smart … yet. But they can be.

Defining a Smart Grid Built for Resilience

Utility leaders are speaking in good faith when they say they have invested in a smarter grid. The confusion occurs because the term "smart grid" can mean different things to different people.

Utilities across the U.S. have invested in advanced metering infrastructure (AMI), often known as smart meters. AMI is a critical building block for a smart grid, offering utilities vastly improved insights into customer power use and the ability to produce critical analytics.

Unfortunately, AMI provides important information but no means to take action. Utilities need capabilities such as smart switching on the distribution grid to maximize the number of customers who keep power during extreme weather and minimize the length of outages for those who don't.

True smart grids built to enhance resilience counteract the impact of extreme weather, enabling faster and even automated fixes to the grid through smart control.

Achieving smart control requires the installation of smart distribution grid technologies, such as replacing 110-year-old fuse technology with advanced lateral protection devices, such as S&C's TripSaver® II Cutout-Mounted Recloser, that automatically test whether faults are temporary or permanent, saving customers from unnecessary or extended outages. By turning the distribution grid into an Industrial Internet of Things, it meets the modern definition of a smart grid, which is one capable of making switches to avoid a disruption, such as a power outage, or identifying and isolating problems instantly so restoration is safer, quicker, and easier.

LET EMERGING GRID CHALLENGES SHAPE SMART DISTRIBUTION GRIDS

Understanding what a smart distribution grid built for resilience should look like starts with assessing the resilience challenges that lie ahead. While each utility faces unique issues depending on its geography, climate, customer demographics, and existing infrastructure, several trends shared across the industry are capturing the attention of utility leaders, including:

- The growing use of electric vehicles (EVs) and electric appliances in buildings
- The rise of distributed energy resources (DERs)
- The increase in extreme weather events

Electrification

Bolstered further in 2022 by the Inflation Reduction Act (IRA), EV adoption and the electrification of buildings in the form of heat pumps and electric hot water heaters will drive a wave of new electric load and demand peaks in many utility service territories.

The Edison Electric Institute predicted a third of all light-duty vehicle sales will be EVs by 2030 in a 2022 report released before the IRA created tax credits for new and used EVs. The Rocky Mountain Institute estimates IRA incentives will spur the installation of 7.2 million electric heat pumps.

Much of the grid edge isn't up to the task of powering a homeowner's large EV, much less a fleet of EVs. While grid operators are doing their best to avoid such situations, utilities that don't take decisive action risk facing the very unpleasant task of telling new EV owners they can't charge their cars because the electrical infrastructure where their home connects to the grid can't handle it.

DERs

A mix of state and federal programs, including more funding from the IRA, will accelerate the adoption of DERs, particularly home solar systems, battery storage systems, and combined solar plus battery storage systems.

In places such as California, where distributed solar adoption is high, homeowners have already felt the frustration of months- or years-long processes to get their systems connected to the grid. DER interconnection delays are as big a disappointment to utility customers as not being able to charge their EVs, yet more utilities will face that pressure as DER adoption grows.

Extreme Weather

Extreme weather in the U.S. is expected to get worse. From recent hurricanes such as Hurricane Ian, which knocked out power to nearly 3 million homes and businesses in Florida in September, to the deadly Christmas weekend winter storm that led to rolling blackouts and power outages across the East, extreme weather in 2022 exposed vast grid vulnerabilities.

A VISION FOR A SMART DISTRIBUTION GRID

Many utility leaders are working diligently to prepare their aging infrastructure to ensure their grids will remain reliable and resilient in a not-so-distant future defined by electrification, DERs, and extreme weather. However, their investment will be for naught if they don't also modernize historically overlooked and underinvested distribution grids. A lack of resilience will become increasingly intolerable as more customers rely on electricity to drive, for home heating, and for other fundamental needs.

The only way to accomplish resilience is by creating a smart distribution grid.

Utility leaders should assess the extent to which electrification, DERs, and extreme weather will impact their grids in the coming years and then establish a vision for strategic grid investments designed to efficiently and cost-effectively tackle each challenge. While each utility's vision for its smart distribution grid will differ based on its unique challenges, they will likely have several things in common:

- Investments in technology that help make an increasingly complex grid easier to manage and address the rapidly evolving needs of customer behavior (These investments should include technologies that enable distribution automation, self-healing, lateral protection, or undergrounding.)
- A plan that spans the *entire* system to ensure reliability and resilience for all customers, regardless of where they are or what the weather is like
- Devices that work together to understand what is happening on the grid and can work autonomously to restore power, ultimately mitigating or minimizing the scope of an outage

Achieving a smart distribution grid vision with those elements will result in positive impacts for the utility and its customers. While modernizing the grid requires an investment, a well-thought-out and well-executed plan results in a resilient grid that can support homes, businesses, and critical infrastructure and doesn't need rebuilding after each storm. Those benefits amount to direct returns for both utilities and customers that make the case for modernization.

CASE IN POINT: FLORIDA POWER & LIGHT

Extreme weather is the most clear and present use case for a smart distribution grid. Before a storm, utilities must implement a system of smart technologies from the substation to the grid edge that works together at all levels of the distribution system. That way, problems, such as faults or other stresses, can be minimized when the storm hits, then enable return to service faster for those who lose power.

When powerful Category 4 Hurricane Ian struck Florida's southwest coast on Sept. 28, 2022, roughly 2 million Florida Power & Light (FPL) customers initially lost power amid catastrophic winds, storm surge, and flooding. However, before the storm had even cleared FPL's service territory, the utility began restoring power to customers. Less than 24 hours after the storm moved through, FPL had restored power to more than 1 million customers, and nearly all customers were back online days later.

How did FPL accomplish this feat, given the long outages customers of other utilities faced after the storm or the lengthy outages faced throughout the Southeast in 2021 after Hurricane Ida?

The answer can largely be attributed to FPL's refusal to let regional weather challenges dictate its ability to provide reliable power and its implementation of a comprehensive system-improvement plan.

In addition to grid-hardening efforts and redefining system performance on major event days, such as severe storms, FPL decided to smarten the grid by investing in industry-leading distribution automation technologies.

Having worked with S&C Electric Company for years, FPL upgraded its feeders and laterals by installing thousands of S&C's fault-testing devices. When faults occur, fault-testing devices keep temporary issues from becoming permanent outages.

If persistent faults occur, self-healing technologies can isolate them and reroute power from alternate sources, minimizing the scope of an outage to the fewest number of customers possible. Many faults occur during the severe storms Florida experiences, and these smart devices act as "first responders" that can automatically restore power, even in the eye of the storm.

By investing ahead of Hurricane Ian, FPL's modern technology helped the utility operate at a high level to keep customers online during the storm and make it easier to quickly restore sections of the grid that did lose power.

FOUR STEPS TO START THE PATH TO A RESILIENT SMART GRID

After utility leaders assess how emerging trends will challenge their distribution grid and establish a vision for a smart grid that will deliver resilience and reliability, they must set a strategy to make their vision a reality. This starts with a series of planning and implementation steps:

Step 1 Choose a trusted partner with smart grid technology expertise that can provide an unbiased assessment of the utility's entire distribution system, from substations to the grid edge. Utility leaders sometimes think their grids are "smart enough" because of prior investments in minor automation capabilities, so it's critical for them to receive an independent assessment of how far their grids must go to become truly smart and ready for the future.

Step 2 With a grid assessment in hand, it is time to update distribution system planning to bring recommended investments onto the investment roadmap. To earn approval for rate increases that may be necessary to fund grid investments, it will be important to craft a clear and compelling case outlining the benefits customers will see—and the cost of *not* investing in a smart grid.

Step 3 When investments are mapped, utilities can conduct pilot programs to test new devices on the grid. Proving benefits and showing success through pilots can help convince regulators an investment is worth making. Maintain consistent communication with customers about the benefits they are receiving, such as avoided costs and reduced outages. During this scaling-up phase, it's critical to avoid analysis paralysis and death by 1,000 pilots. Extreme weather and a wave of electrification and DERs won't wait for endless pilots. Pilots should last months, not years, and utility leaders should be prepared to scale up successful pilots quickly.

Step 4 When utilities identify successful pilots in which new technologies are strengthening grid resilience, it's time to make big, bold decisions because the changes facing utility grids are coming fast. Pursuing smart distribution grid investments with proven technologies minimizes the risks, reduces the costs, and speeds up the process of creating a cutting-edge smart distribution grid.

CONCLUSION

The data are clear: When including major events such as extreme weather, utility grids are becoming less reliable. A growing lack of resilience is already leading to frustration and negative outcomes with customers and regulators, which will hurt a utility's bottom line in the long run.

The increase of electrification, DER deployment, and extreme weather will only turn up the pressure on grids and challenge resilience. Now is the time for utilities to measure for resilience so they can manage the challenge.

To ensure grids remain resilient, utilities must act before the wave of electrification and DERs arrives or the next big storm strikes. Utilities need distribution grid solutions that deliver smart control from the substation to grid edge to maintain grid reliability and resilience in the future.

With more than 100 years of grid expertise, S&C Electric Company is focused on helping customers ensure their grid is ready for the next 100 years with unparalleled expertise, industry-leading quality, and customer-centered innovation. We apply innovations to address the challenges facing the power grids of today and tomorrow. With a dedicated focus on reliability and resilience, we help reduce the duration of power outages from hours to seconds—or to no outage at all.

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