EET&D MAGAZINE

Quarterly Issue 4, 2020 – Volume 23

THE MOVING TARGETS OF RELIABILITY AND RESILIENCE

BRIAN LEVITE

When the lights go out and people hear the telltale whine of computer fans slowing to a stop, the energy system that supports most aspects of daily life becomes truly visible because of its sudden absence. It's at this point utilities and their customers alike wonder: Will the power be out for a minute? An hour? A week?

In any of those scenarios, a power outage will affect the economy, learning and even public health. So, how do utilities go about prioritizing keeping the lights on or getting them back on quickly when they go out? How much should they spend on *reliability* and *resilience*? How do utilities balance these priorities against each other?

The market increasingly expects energy systems to deliver more services and increase reliability, even as stresses to the system are increasing and our generation base is shifting. When a global pandemic is added to this equation, there is a pace of change utility systems and regulatory models simply aren't designed to handle.

Reliability is typically defined as an energy system's everyday ability to avoid outages and resilience as an energy system's ability to withstand storms and come back online after a major outage. The aging energy grid is not being replaced and updated at the rate needed to stay ahead of worsening reliability numbers. In fact, the American Society of Civil Engineers gives the U.S. energy infrastructure a D+ rating, stating: "Without greater attention to aging equipment, capacity bottlenecks and increased demand, as well as increasing storm and climate impacts, Americans will likely experience longer and more frequent power interruptions."[1]

As people have begun to work and attend school from home, due to the COVID-19 pandemic, energy-demand patterns have changed. While commercial energy demand is down, demand for daytime heating, ventilation and air conditioning (HVAC) and plug loads of residential customers is up, shifting the load burden to different parts of the electricity distribution system. This may affect the loading of circuits and make peak demand a bigger challenge in residential areas.

As some return to work, a societal shift to increased work-from-home policies may make some of this trend permanent. It is clear, though, increased remote work and virtual learning mean power users are more reliant on reliable and resilient electricity service.

So, what investment in reliability would regulators consider appropriate? A 2020 survey of commercial and industrial businesses determined 40 percent of respondents experienced financial impacts of $50,000 or more during a typical energy outage (with 21 percent of respondents claiming to have outages at least monthly).[2] →

[1] https://www.infrastructurereportcard.org/cat-item/energy/

[2] https://www.sandc.com/globalassets/sac-electric/documents/sharepoint/documents---all-documents/technical-paper-100-t125.pdf?dt=637352767010635122

Solutions to improve reliability exist, such as advanced reclosers, modern grid protection and controls and more aggressive vegetation monitoring and management. The right investment and solutions have to do with what the goals are. If regulators and utilities want to minimize long outages but are okay with more frequent power blinks, intelligent reclosers and switchgear may be the answer. If these parties want the total number of outages reduced, but are okay with a longer response time for each outage, they might shift away from grid investments and focus on vegetation management to minimize temporary faults. If they want reduced blinks, they might focus on using smart technology on laterals at the grid edge.

It is important to note policymakers do not necessarily need to focus on one outcome over another. A balanced approach is possible, but in a capital-scarce environment, understanding outcome preferences will be important.

Energy resilience is a different animal with different strategies to combat it. When a major event takes down the power system, energy resilience is the ability to bring the grid back online quickly (in whole or part).

No part of the country is immune to major disruption events. There are wildfires in the West, ice storms in the North, tornadoes in the Midwest and hurricanes in the East and South. While there is a debate in economic circles around how bad natural disaster damage is for the economy, access to electricity in the days after a natural disaster is critical to saving lives.

Finally, cyberattacks are another threat. In 2016, a malware-based cyberattack shut down one-fifth of Ukraine's electrical grid in what investigators have called a "dry run" for future attacks. Energy systems will be a key target in the international conflicts of the future, making resilience to cyberattacks a matter of national security.

> **Energy resilience is a different animal with different strategies to combat it.**

No matter the cause, the longer the outage, the more aspects of the economy and society will be impacted. This is the "time value of resilience." As society considers where to prioritize energy-resilience investments, we must consider what is most critical. The longer the grid is down, the more aspects of the community are at risk. Increased reliance on electricity and the Internet for commerce and learning will make the impact of every outage more severe. When this is coupled with the changing usage patterns caused by such things as transportation electrification and social distancing, utilities are faced with reevaluating how their energy resilience efforts are directed.

So, how do utilities shape their preparation for major events and ensure grid resilience? If they aim to keep critical facilities such as hospitals and first responders up and running, microgrids and well-communicated disaster preparations are probably the ideal tools for local resilience. If they want to bring the entire system back online as quickly as possible, grid hardening, undergrounding of lines and major investments in self-healing switchgear approaches are likely the smart investments.

Once regulators have prioritized our goals around reliability and resilience, they need ways to realize those goals. The present system of ratemaking throughout most of the U.S. is unlikely to enable rapid transition. First, the metrics used to track reliability (SAIDI and SAIFI) do not typically include power blinks and ignore outages caused by major events. This means the industry is only tracking a subset of outages and are not providing utilities any incentive to dig deeper into the most problematic areas.

SAIDI and SAIFI are also system-average numbers, an approach that can result in making reliable parts of the network even more reliable when that's easier than addressing the worst-performing feeders. There are almost no metrics in U.S. state regulation to address energy resilience. Regulators need a suite of new performance metrics that address all aspects of outage events while also demonstrating the energy resilience of a system.[3] These metrics will allow utilities and regulators to more effectively track how they are doing at addressing service challenges and help understand which solutions are working best.

Metrics are not enough, though. Utilities require financial incentives for reliability and resilience innovation. All utilities want to do their best on this front, but building outcomes on these (and other outcomes important to customers) into their financial remuneration will truly unlock the innovation and investment needed to change the grid.

Performance-based regulation (PBR), which involves tying utility profits not simply to capital investment but desired outcomes, has proven to be an effective approach. The global pioneer of PBR has been the UK's RIIO approach. In the first round of this new regulatory scheme, customer satisfaction and reliability increased. Utility profits went up, and customer costs for the distribution grid went down.[4]

Modern energy systems, such as self-healing grids, automatic reclosing technology and non-wires solutions, help utilities mitigate the increasing risks to both reliability and resilience. However, increasing storm activity, an aging grid, and cybersecurity threats will mean more pressure on these solutions.

On a typical day, society demands energy reliability. When things are at their worst, people and businesses desperately need energy resilience. The industry can invest in a reliable electricity system that will minimize outages, and it can invest in a resilient system that will come back online after major outages. Doing this effectively will mean deciding what outcomes are desired most, allocating funding to make the necessary investments and instituting regulatory changes that will allow utilities to see improved financial outcomes from improved customer experiences.

[3] You can read the paper on improving reliability here: https://www.sandc.com/en/gridtalk/2020/july/21/moving-beyond-average-reliability-metrics/

[4] https://www.utilitydive.com/news/uk-riio-sets-out-to-demonstrate-how-a-performance-based-regulatory-model-ca/555761/

ABOUT THE AUTHOR:

Brian Levite is the regulatory affairs director at S&C Electric Company. He joined S&C from Hitachi, where he helped develop the company's microgrid offering. Prior to Hitachi, Levite worked at the National Renewable Energy Lab, the Department of Energy and the Environmental Protection Agency, developing and implementing government programs focused on energy efficiency and renewable energy. Levite earned a master's degree in public policy at American University and is a Certified Energy Manager. He is the author of the book *Energy Resilient Buildings and Communities: A Practical Guide.*