STRATEGIES TO IMPROVE SYSTEM RELIABILITY

PART 1 OF 3

How reliable is your power system? How often do you experience power outages? How long do your outages last? How flexible is your outage response? These are just some of the questions you may face when it comes to the reliability of your system.

According to the "2019 State of Reliability" report, published by the North American Electrical Reliability Corporation (NERC), "The electricity sector is undergoing significant and rapid change, presenting new challenges and opportunities for reliability." The report added, "The evolving resource mix, along with persistent cyber and physical security threats, present critical challenges to Bulk Power System (BPS) reliability and require the industry and the regulators to remain vigilant."

According to the US Department of Energy (DOE), "The reliability of the electric system underpins virtually every sector of the modern U.S. economy. Reliability of the grid is a growing and essential component of national security."

The DOE and NERC define SYSTEM RELIABILITY as "the ability of the system or its components to withstand instability, uncontrolled events, cascading failures, or unanticipated loss of system components." This includes sudden disturbances such as electrical short circuits or unanticipated loss of system components.

How is system reliability measured? Very simply, it is measured by overall power system availability. Items such as the frequency, duration, and extent of outages are some of the more commonly measured metrics for calculating system reliability. However, it is often discussed in more specific terms, such as System Average Interruption Duration Index (SAIDI), Customer Average Interruption Duration Index (CAIDI), and System Average Interruption Frequency Index (SAIFI). Each of these reference some specific facet of system reliability.

In recent years, the environment around system reliability has changed. Increasing concerns over climate change, natural hazards, physical attacks, cyber threats, and other intentional or accidental damage have become topics of discussion. The DOE believes that these metrics may need to be updated to more accurately address system reliability concerns. Furthermore, the DOE notes, "With the advent of more two-way flows of information and electricity (communication across the entire system from generation to end use, controllable loads, more variable generation, and new technologies such as storage and advanced meters), reliability needs are changing, and reliability definitions and metrics must evolve accordingly."

Currently, over 90 percent of electric power interruptions stem from disruptions on the distribution system. The transmission system has a much broader footprint. Damage to transmission assets can result in more widespread power outages that affect greater numbers of customers with significantly more economic consequences.

Utilities typically try to increase system reliability by including system redundancies or implementing a more stringent risk management system. These approaches are designed to provide a continuous power supply despite the risks that the power system will face.

Additionally, recent technology advancements and smart components can have a significant impact on a power systems ability to adapt and communicate in the event of an outage. Components such as advanced metering infrastructure, smart inverters, automatic reclosers, and other data with integrated communications exchange data with a centralized control center, notifying them of outage events. This alerts the system operators and may initiate an automatic distribution system reroute or self-healing process.

In addition to redundancy and smart component strategies, distributed energy resources such as residential photovoltaics, wind generators, and various types of microgrids are becoming more common place. These systems introduce a new set of challenges that can have a significant impact on reliability. Utilities must be ready for seamless integration, increased data availability, and intermittent generation and loading as these generation stations are integrated into the distribution system in order to ensure continuous and balanced power is supplied to the grid.

According to NERC's "2019 State of Reliability" report, utilities should focus on growing resource diversity in their systems. The report notes: "The Electric Reliability Organization (part of NERC) and industry should continue improving their ability to understand, model, and plan for a system with a significantly different resource mix." To address these challenges, utilities should focus on understanding the impacts caused by the following situations:

- Integration of solar generation panels
- Microgrid connection/disconnection from the main grid
- DC vs AC generation systems
- DC vs AC loads connected to the grid
- Increased load demand

Finally, system reliability is not a static process. Utilities must be dynamic and flexible. They must identify their overloaded assets, their aging infrastructure, and their most common pain points. They must build a plan to make necessary updates and changes to create the most reliable system possible.

Finley Engineering can help you with your system reliability. We can help you identify the strong points and the weak points that need attention. Finally, we can help you identify the most appropriate and cost-effective methods to address your weak points. This approach may help you prevent a looming system outage.

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