RELIABILITYFIRST 2023-24 RRA: TOP REGIONAL RISKS THROUGH THE LENS OF GRID TRANSFORMATION

Looking at the top risks in tandem provides another important perspective on the risks in the RF region. This infographic looks at the interdependence through the lens of the transforming electric grid as the way that power is generated, transmitted and consumed evolves. As decarbonization, decentralization and digitization impact how we plan, operate and protect the grid of the future, the risk interrelatedness is increasingly important. For more detail on each of these risks, click here to view our 2023-24 Regional Risk Assessment.

Changing Resource Mix

As the changing generation resource mix is moving toward a cleaner grid, coal-fired generation units are being retired at a rapid pace. This leaves natural gas as the dominant existing fuel. This mix of resources, reliant on natural gas and renewables, creates an increased vulnerability during extreme weather events.

Misoperations

The increasing penetration of inverter-based resources (IBRs) may impact grid controls systems, possibly leading to an increase in misoperations. While misoperations are not a new risk, the replacement of thermal-based generation with asynchronous generation may impact short-circuit fault currents, impacting the way protection systems and relays detect and respond to faults. Recent NERC event reports include lessons learned regarding IBRs responding to voltage and frequency disturbances, impacting reliable operations.

Cyber Security

The growth of low-impact IBRs and distributed energy resources can create new cyber security vulnerabilities. This may include aggregates of solar and wind generation being operated by foreign control centers, plus new cyber security challenges. As electrification of the grid increases, interconnectivity of electronic devices, new variable loads (such as electric vehicle charging stations), and modifications to existing IT/OT technologies (e.g., cloud and virtualization) all impact cyber security vulnerabilities. These risks can be exploited through increased usage of ransomware, malware, and other threats deployed by adversaries to grid reliability and security.

Physical Security

The grid of the future may be more susceptible to physical security threats due to the distributed and decentralized nature of the assets, especially new resources located in remote or open areas. Reasonable measures regarding monitoring, barriers, and controls must be implemented not only to protect the highest risk assets, but also the aggregate of lower risk assets from harm.

Environmental Factors

Following Winter Storm Elliott, reports recognized that the freezing equipment and subsequent failure of natural gas supply was a significant factor in power outages across the US. In addition, renewable energy availability declines sharply during these types of extreme weather conditions, adding more challenges during a time when people need power the most.

Supply Chain

As the renewable energy portfolio across the country continues to proliferate, it has been widely accepted that battery technology will be needed to maintain resource adequacy during periods when the intermittent renewables are not available. The raw materials used to make the lithium-ion batteries to support the grid are the same materials used to make electric vehicle (EV) batteries. The surge in demand for these raw materials has created supply chain constraints resulting in delays in construction of these facilities. Renewable energy developers, in a few cases, have rescinded their interconnection applications, citing supply chain constraints as a barrier to development.

Situational Awareness

Operators in the control room need tools, technology, and training to identify and mitigate the risks associated with an increase of behind-the-meter resources, both intermittent distributed energy resources plus large electric loads such as data centers, electric vehicle charging stations, heat pumps, etc. Visibility and communication are needed for balancing load and generation as the grid continues to transform, and control center technology outages (including losses of state estimation, forecasting tools, and communication tools) increase this risk profile if not mitigated.

Modeling

Situational awareness is only accurate if industry provides accurate modeling to the planners and operators of the grid. As the grid transforms, operators need to be able to anticipate how the grid will respond to faults and disturbances. Accurate models are key for performing the analysis needed to mitigate the risks.

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