VIEW POINT

Reliability and Resilience

Working Toward a Common Goal

Reliability is about keeping the lights on. Resilience is about planning for, operating through and recovering from a major electric system disruption.

Electricity is Vital

Our society depends on electricity to power homes and businesses and to support critical services such as health care, communications and data processing.

As rapidly as our dependence on electricity has grown, and the means of producing it have evolved, so have the threats to the systems that supply it.

Natural disasters, such as catastrophic storms or earthquakes, have always been risks to the reliability of the bulk electric system (commonly called "the grid"). Today, grid operators face additional threats that could disrupt grid operations directly or the infrastructure the grid relies on, such as telecommunications or fuel supply. These threats include more frequent or more severe natural disasters, physical attacks on equipment, and cyberattacks.

Grid operators can anticipate and prepare for some threats but they cannot foresee everything, especially as the threat landscape changes and our world becomes increasingly interconnected. As a result, the grid must be not only reliable, but also resilient.

The Federal Power Act Definition of Reliable Operation:

"Operating the elements of the Bulk-Power System within equipment and electric system thermal, voltage, and stability limits so that instability, uncontrolled separation, or cascading failures of such system will not occur as a result of a sudden disturbance, including a Cybersecurity Incident, or unanticipated failure of system elements."

Resilience reflects how grid operators manage risks of high-impact vulnerabilities and disruptions.

Vulnerabilities can weaken the electric system, and disruptions can happen simultaneously and persist for long periods. Operators must prepare for, be capable of operating through and be able to recover from major disruptions quickly, no matter what the cause.

Reliability: Keeping the Lights on Every Day

Since the inception of commercial electric service in the 1880s, a key focus of the industry has been on operating the electric system reliably. Reliability has meant designing, running and maintaining electricity supply resources, transmission and distribution systems to provide an adequate, safe and stable flow of electricity. When customers flip the switch they can be confident the lights will turn on.

Traditionally, threats to the reliability of the bulk power system have included loss of generation, loss of transmission or loss of customer demand. The failure of major equipment could threaten reliability, as could extreme weather, such as major storms or extreme heat or cold.

Resilience: Enduring Extremes

Resilience is linked to the traditional concept of reliability but encompasses additional concepts. Resilience focuses on preparing for, operating through and recovering from significant disruptions. Planning for resilience requires being mindful of both risks and the costs of mitigating those risks.

Resilience has become an increasingly important factor in system planning and operations, given the evolving threats and the potential consequences of widespread or extended interruptions. Some of these more extreme risks are considered during traditional reliability planning, but threats evolve quickly and reliability standards may not be able to keep pace. There are various dimensions to resilience and no standard fits them all. There are also a wide range of disturbances that could produce severe downstream effects on the bulk electric system and could test the system's resilience even if the grid is not directly impacted.

Resilience is intertwined with the traditional concept of reliability.

Determining if, and how much, investment is needed to address resilience is a challenge for grid operators and their stakeholders. Cost must be balanced with both the likelihood of an event and the societal impact of the loss of electricity for an extended period.

Striking that balance – including developing metrics and thresholds that could trigger investments – requires ongoing discussion between grid operators and stakeholders, including industry participants, regulators, legislators and consumer advocates.

Common Objectives of Reliability and Resilience

The concepts of reliability and resilience are intertwined. Core functions of planning and operating the grid are rooted in objectives shared by both reliability and resilience.

- **Keep the Power On.** Grid operators work around the clock to balance supply and demand and keep the power flowing. They plan and coordinate the dispatch of power plants and the operation of high-voltage transmission equipment that transports bulk electricity over long distances.
- **Minimize the Risk of Outages.** Grid operators plan far ahead for a robust high-voltage transmission system that can provide a reliable and efficient flow of electricity and minimize the risk of interruptions.
- **Withstand Disruptions and Minimize the Impact of Outages.** Grid operators monitor and adjust the bulk power system so that it can withstand disruptions. A robust grid can prevent or minimize the impact of outages on consumers.
- **Quickly and Efficiently Restore the System.** Electric system operators must be prepared to quickly and efficiently restore the electric system after an outage.
- **Incentivize Reliability.** Competitive markets offer incentives that help to maintain a reliable system and also can be designed to enhance resilience.