NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Essential Reliability Services

Transformation of the Electric Power System

The North American electric power system is transforming to a resource mix that relies less on coal and nuclear while integrating more natural gas, wind, solar, distributed generation, and demand response resources. Additionally, the power system will change further as microgrids, smart networks, and other advancing technologies continue to be deployed. Recognizing that these changes represent a fundamental shift in the operational characteristics of the power system with potential reliability implications, a NERC task force assessed the impacts and identified measures to monitor continued grid reliability and resiliency. Generating resources need to be able to provide voltage control, frequency support, and ramping capability as Essential Reliability Services (ERSs) to balance and maintain the electric grid. Without these minimal characteristics, the grid could not be operated reliably. This document, along with the more extensive report,[1] provides details on the value and importance of ERSs that should be considered as decisions are made regarding the changing resource mix and technologies.

The power grid is changing, requiring careful monitoring and planning to ensure resilience and system reliability.

While the reliability attributes of conventional generators are well documented, the task force evaluated the capabilities of the newer resources to see whether they are able to provide ERSs. Some new resources are capable of providing ERSs that support frequency, ramping, and voltage, but may not be doing so today. As we transition from large generators (like coal plants) toward these newer resources, ERSs will continue to be required to maintain reliability. Proper planning and providing system operators with the ability to manage resources in real time will be required to ensure that the appropriate levels of ERSs are available so that reliability is maintained as the resource mix evolves.

Policy Considerations

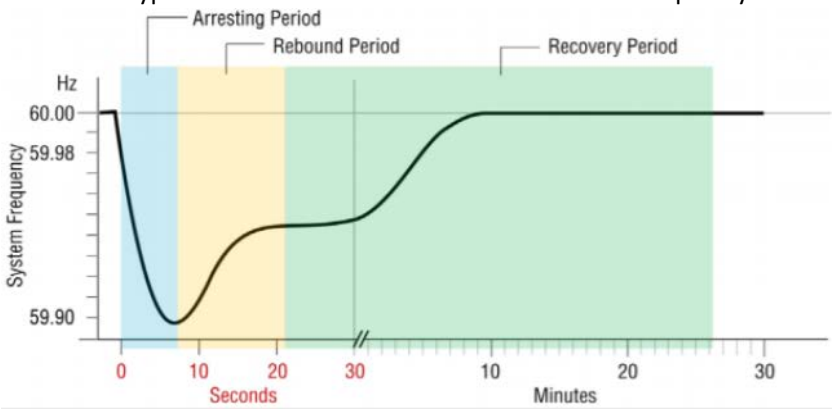
Federal, state, and local jurisdictional policy decisions have a direct influence on changes in the resource mix and can also affect the reliability of the electric grid. As resources retire, in addition to replacing lost capacity, it is necessary for policy decisions to recognize the need for ERSs from the current and future mix of resources. Analyses of these emerging changes must be done to allow for effective planning and provide system operators the flexibility to modify real-time operations for reliability of the grid. Policies need to encourage this type of planning and support the necessary flexibility. As such, the NERC ERS recommendations will assist in informing policy makers of the implications of the changing resource mix and will strengthen the ability of the electric power industry to manage the evolution of the system in a reliable manner.

[1] North American Electric Reliability Corporation (NERC) ERS Framework Report, December 2015

The Building Blocks of Reliability

Based on the analysis of geographic areas that are experiencing the greatest level of change in their types of resources, a number of measures and industry practices are recommended to identify trends and prepare for the transition in resource mix. These recommendations consider both real-time operations and future planning to support frequency, ramping and voltage of the system.

Frequency – The electric grid is designed to operate at a frequency of 60 hertz (Hz). Deviations from 60 Hz can have destructive effects on generators, motors, and equipment of all sizes and types. It is critical to maintain and restore frequency after a disturbance such as the loss of generation. As shown conceptually in the figure, frequency will immediately fall given such an event. This requires an instantaneous (inertial) response from some resources and a fast response from other resources to slow the rate of fall during the arresting period, a fast increase in power output during the rebound period to stabilize the frequency, and a more prolonged contribution of additional power to compensate for lost resources and bring system frequency back to the normal level.



Ramping – Adequate ramping capability (the ability to match load and generation at all times) is necessary to maintain system frequency. Changes to the generation mix or the system operator's ability to adjust resource output can impact the ability of the operator to keep the system in balance.

Voltage – Voltage must be controlled to protect system reliability and move power where it is needed in both normal operations and following a disturbance. Voltage issues tend to be local in nature, such as in sub-areas of the transmission and distribution systems. Reactive power is needed to keep electricity flowing and maintain necessary voltage levels.

Each reliability building block has an associated video animation to explain the concept of that particular essential reliability service. Please click on each title above to access the corresponding video. Additionally, they are all available here: The Basics of Essential Reliability Services.

Moving Forward

Objectives of the task force were to understand the power system behavior we have today, how this behavior may change in the future in light of the changing resource mix, what attributes we expect from resources in the future, and how to make the transition in a reliable way. The task force made general recommendations, including:

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All new resources should have the capability to support voltage and frequency. Ensuring that these capabilities are present in the future resource mix is prudent and necessary.	Monitoring of the ERS measures, investigation of trends, and use of recommended industry practices will highlight aspects that could become reliability concerns if not addressed with suitable planning and engineering practices.	The task force recognizes that Distributed Energy Resources (DERs) will increasingly impact the planning and operation of the grid. The task force recommends further examination of the forecasting, visibility, and participation of DERs as an active part of the electric grid.