Transmission Resilience Overview

Definition and Scope

The NATF/EPRI definition of electricity sub-sector resilience* is:

> The ability of the system and its components (both equipment and human) to 1) **prepare** for, 2) **anticipate**, 3) **absorb**, 4) **adapt** to, and 5) **recover** from non-routine disruptions, including high impact-low frequency (HILF) events, in a reasonable amount of time
>
> where:
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> 1) **Prepare** involves both longer-term mitigation strategies (e.g., system hardening, sparing strategies/acquisition) and shorter-term preparations (e.g., reconfigurations, staging)
> 2) **Anticipate** provides situational awareness before and during an event
> 3) **Absorb** requires inherent robustness of the system and supporting processes during an event
> 4) **Adapt** entails flexibility and scalability of the system and supporting processes during an event
> 5) **Recover** relates to response and recovery activities during an event

**See "Understanding the Definition of Resilience (Companion Document)" for additional detail and explanation.*

Background

The electric grid serves a vital societal function and is an essential aspect of national security. Every sector of the national economy, including food production, banking, manufacturing, and retail distribution, depends on it. Electricity users have come to expect a high degree of reliability and availability, and meeting those expectations is a fundamental requirement for all electric utilities.

Beyond the economy, extended power outages can also have severe consequences to society at large for things such as national defense, communications, water and wastewater, healthcare, emergency management, transportation, and law enforcement. Considerations during outages also include interdependencies among critical infrastructures (e.g., the gas and electric industries); needs for workforce support; and local, state, and federal collaboration and assistance.

While delivery of electric service has been very consistent and highly reliable for much of the past 100 years of development, expansion, and continuous operation of the power grid in North America, the industry realizes that a focus solely on reliability is insufficient to improve system integrity and availability of electric power. As the threat landscape changes and becomes better known, it is apparent that the electric grid also needs to be resilient – capable of timely recovery from more severe, non-routine, larger impact, and longer duration events – to minimize the impacts on society overall.

NATF Resilience Activities

The North American Transmission Forum (NATF) has worked to support and improve transmission system resilience. In 2013, the NATF, in conjunction with the Electric Power Research Institute (EPRI), began holding resilience workshops on geomagnetic disturbances (GMD), which evolved into resilience summits. These summits cover resilience holistically, including discussions on electromagnetic pulse, cyber resilience, resilient communications, system hardening, spare equipment strategies, incident command system, climate resilience, and more. The NATF has several other programs to enhance resilience, some of which are listed below.

Resilience Practice Group (RPG)

- Forum of subject matter experts for resilience information sharing and activities
- RPG Core Team advises and sets the course for resilience activities

Transmission Resilience Maturity Model (TRMM)

- Free, easy-to-use tool (publicly available)
- Jointly developed (U.S. Department of Energy, Pacific Northwest National Laboratory, and EPRI)
- Designed for utilities to evaluate/trend resilience program maturity and resilience readiness
- NATF-facilitated TRMM assessment offering for members

Summits, Workshops, and Webinars

- Routine webinars for disseminating resilience information
- Annual workshops or summits (summits are in collaboration with industry partners, including EPRI)
- Special webinars (e.g., resilience program management/roadmap, TRMM, sparing strategies)

RESTORE Spare Sharing Program

- Optional, self-funding program available to NATF members at minimal additional cost
- Voluntary agreement to share available spare equipment (transformers) following major event
- Complementary to other industry programs (STEP; Grid Assurance)

Status and Approach

As evidenced by the broad range of summit topics over the years, much progress has been made on resilience activities and research. Improving resilience requires a systematic, strategic approach and cost-effective solutions that may be unique to individual utilities. Strategies for hardening the system, upgrading assets, and acquiring and maintaining spare equipment need to be cost-effective, flexible, and agile, while supporting adoption of new technologies. A comprehensive plan to address resilience requires an “all hazards” approach.

Efforts to improve reliability and resilience involve risk-based strategic decisions that may be different for individual utilities. Available resources, risk tolerance, geographical location, and regulatory policies influence the type of investments, planning, designs, construction, upgrades, and operations for each system. New threats, hazards, and vulnerabilities continue to emerge even as utilities work to protect against today’s challenges, so utilities must remain vigilant.

Resources

The NATF produces resources for members and the industry at large. Resilience documents available to the industry are posted on the NATF public site at https://www.natf.net/documents.