NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Extreme Cold Weather Preparedness

Technical Rationale and Justification for EOP-011-3

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RELIABILITY | RESILIENCE | SECURITY




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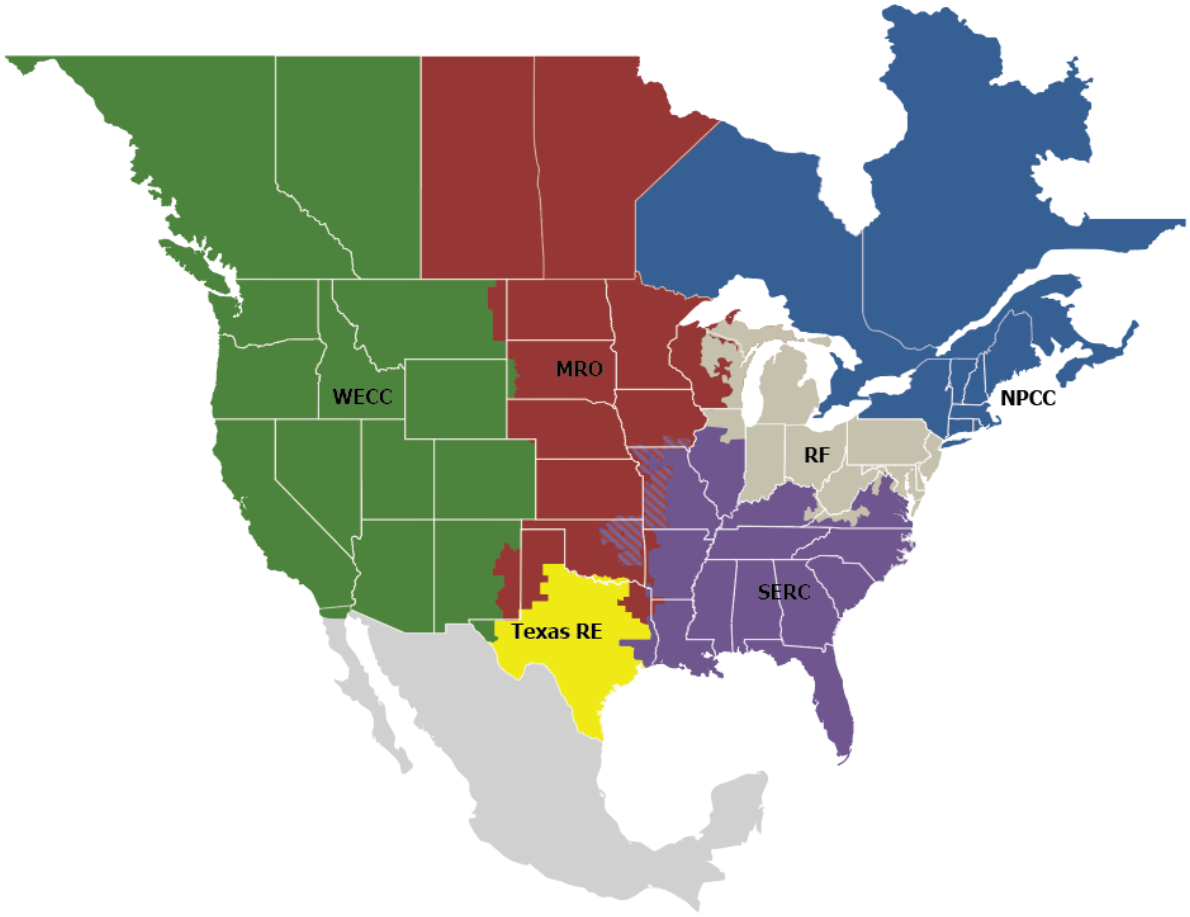
Table of Contents

Preface

Electricity is a key component of the fabric of modern society and the Electric Reliability Organization (ERO) Enterprise serves to strengthen that fabric. The vision for the ERO Enterprise, which is comprised of the North American Electric Reliability Corporation (NERC) and the six Regional Entities, is a highly reliable and secure North American bulk power system (BPS). Our mission is to assure the effective and efficient reduction of risks to the reliability and security of the grid.

Reliability | Resilience | Security
Because nearly 400 million citizens in North America are counting on us

The North American BPS is made up of six Regional Entity boundaries as shown in the map and corresponding table below. The multicolored area denotes overlap as some load-serving entities participate in one Regional Entity while associated Transmission Owners/Operators participate in another.



MRO	Midwest Reliability Organization
NPCC	Northeast Power Coordinating Council
RF	ReliabilityFirst
SERC	SERC Reliability Corporation
Texas RE	Texas Reliability Entity
WECC	WECC

Introduction

This document explains the technical rationale and justification for the proposed Reliability Standards EOP-011-3 and EOP-012-1. It provides stakeholders and the ERO Enterprise with an understanding of the technology and technical requirements in the Reliability Standard. This Technical Rationale and Justifications for EOP-011-3 and EOP-NEW is not a Reliability Standard and should not be considered mandatory and enforceable.

Background

From February 8 through February 20, 2021, extreme cold weather and precipitation caused large numbers of generating units to experience outages, derates or failures to start, resulting in energy and transmission emergencies (referred to as "the Event"). The total Event firm Load shed was the largest controlled firm Load shed event in U.S. history and was the third largest in quantity of outaged megawatts (MW) of Load after the August 2003 northeast blackout and the August 1996 west coast blackout. The Event was most severe from February 15 through February 18, 2021, and it contributed to power outages affecting millions of electricity customers throughout the regions of ERCOT, SPP and MISO South. Additionally, the February 2021 event is the fourth cold weather event in the past 10 years, which jeopardized bulk-power system reliability. A joint inquiry was conducted to discover reliability-related findings and recommendations from FERC, NERC, and Regional Entity staff. The FERC, NERC, and Regional Entity Staff Joint Staff Inquiry into the February 2021 Cold Weather Grid Operations ("Joint Inquiry Report") was published on November 16, 2021.

The scope of the proposed project is to address the ten recommendations for new or enhanced NERC Reliability Standards proposed by the Joint Inquiry Report. In November 2021, the NERC Board of Trustees approved a Board Resolution directing that new or revised Reliability Standards addressing these recommendations be completed in accordance with the timelines recommended by the joint inquiry team, as follows:

- New and revised Reliability Standards to be submitted for regulatory approval before Winter 2022/2023: development completed by September 30, 2022, for the Board's consideration in October 2022 to address Key Recommendations 1d, 1e, 1f and 1j;
- New and revised Reliability Standards to be submitted for regulatory approval before Winter 2023/2024: development completed by September 30, 2023, for the Board's consideration in October 2023 to address Key Recommendations 1a, 1b, 1c, 1g, 1h and 1i.

Requirement R1 and R2

R1. *Each Transmission Operator shall develop, maintain, and implement one or more Reliability Coordinator-reviewed Operating Plan(s) to mitigate operating Emergencies in its Transmission Operator Area. The Operating Plan(s) shall include the following, as applicable: [Violation Risk Factor: High] [Time Horizon: Real-Time Operations, Operations Planning, Long-term Planning]*

1.1. *Roles and responsibilities for activating the Operating Plan(s);*

1.2. *Processes to prepare for and mitigate Emergencies including:*

1.2.1. *Notification to its Reliability Coordinator, to include current and projected conditions, when experiencing an operating Emergency;*

1.2.2. *Cancellation or recall of Transmission and generation outages;*

1.2.3. *Transmission system reconfiguration;*

1.2.4. *Redispatch of generation request;*

1.2.5. *Operator-controlled manual load shedding during an Emergency that accounts for each of the following:*

1.2.5.1. *Provisions for manual Load shedding capable of being implemented in a timeframe adequate for mitigating the Emergency;*

1.2.5.2. *Provisions to minimize the overlap of circuits that are designated for manual Load shed and circuits that serve designated critical loads;*

1.2.5.3. *Provisions to minimize the overlap of circuits that are designated for manual Load shed and circuits that are utilized for underfrequency load shed (UFLS) or undervoltage load shed (UVLS); and*

1.2.5.4. *Provisions for limiting the utilization of UFLS or UVLS circuits for manual Load shed to situations where warranted by system conditions.*

1.2.6. *Provisions to determine reliability impacts of:*

1.2.6.1. *cold weather conditions; and*

1.2.6.2. *extreme weather conditions.*

R2. *Each Balancing Authority shall develop, maintain, and implement one or more Reliability Coordinator-reviewed Operating Plan(s) to mitigate Capacity Emergencies and Energy Emergencies within its Balancing Authority Area. The Operating Plan(s) shall include the following, as applicable: [Violation Risk Factor: High] [Time Horizon: Real-Time Operations, Operations Planning, Long-term Planning]*

2.1. *Roles and responsibilities for activating the Operating Plan(s);*

2.2. *Processes to prepare for and mitigate Emergencies including:*

2.2.1. *Notification to its Reliability Coordinator, to include current and projected conditions when experiencing a Capacity Emergency or Energy Emergency;*

2.2.2. *Requesting an Energy Emergency Alert, per Attachment 1;*

2.2.3. *Managing generating resources in its Balancing Authority Area to address:*

2.2.3.1. *capability and availability;*

2.2.3.2. *fuel supply and inventory concerns;*

2.2.3.3. *fuel switching capabilities; and*

2.2.3.4. *environmental constraints.*

2.2.4. *Public appeals for voluntary Load reductions;*

2.2.5. *Requests to government agencies to implement their programs to achieve necessary energy reductions;*

2.2.6. *Reduction of internal utility energy use;*

2.2.7. *Use of Interruptible Load, curtailable Load and demand response;*

2.2.8. *Provisions for Transmission Operators to implement operator-controlled manual Load shed in accordance with Requirement R1 Part 1.2.5; and*

2.2.9. *Provisions to determine reliability impacts of:*

2.2.9.1. *cold weather conditions; and*

2.2.9.2. *extreme weather conditions.*

Key Recommendation 1j: In minimizing the overlap of manual and automatic load shed, the load shed procedures of Transmission Operators, Transmission Owners and Distribution Providers should separate circuits that will be used for manual load shed from circuits used for underfrequency load shedding/undervoltage load shedding or serving critical load. Underfrequency load shedding/undervoltage load shedding circuits should only be used for manual load shed as a last resort and should start with the final stage (lowest frequency).

Requirement R1, Part 1.2.5

Minimizing the Overlap of Circuits

EOP-011 version 2, Requirement R1.2.5 states the TOP's Operating Plan shall include provisions for operator-controlled manual Load shedding that minimizes the overlap with automatic Load shedding. EOP-011-3 adds additional provisions and clarifies what the TOP must include in their Operating Plan to mitigate operating Emergencies. Specific clarifications are to minimize the overlap of manual Load shed and circuits that serve designated critical loads; minimize the overlap of circuits that are designated for manual Load shed and circuits that are utilized for underfrequency load shed (UFLS) or undervoltage load shed (UVLS); and provisions for limiting the utilization of UFLS or UVLS circuits for manual Load shed.

Minimizing the overlap of manual Load shed circuits and circuits that serve critical loads is necessary to prioritize certain critical loads which may be essential to the integrity of the electric system, public health, or the welfare of the community. The standard drafting team elected to keep the phase "minimize the overlap" instead of moving to language that specifically requires the separation of circuits in recognition of the fact that it is not always practical or warranted to completely separate circuits used for each of these purposes. This requirement can be accomplished in many different ways, such as creating separate and distinct lists for each circuit type, or by using prioritization and control-inhibit functions in an energy management system. This list is not exhaustive and there are certainly other acceptable methods of meeting this requirement.

Additionally, it is important to recognize that criticality designations must be considered in the context of the situation. Critical loads should not all receive the same level of priority, and the characteristics of a Load shed event (depth/duration/season) will impact the treatment of certain critical loads. Transmission Operators should consider establishing priorities for different types of critical loads. The critical Load designation, priority, and conditions during the event will influence which critical loads may be included in manual Load shed. For example, if system conditions continue to deteriorate and other Load shed options are exhausted, then some critical loads may need to be shed in the interest of preserving the system. It is important to have the awareness and flexibility to include or exclude certain loads based on the Load shed scenario.

The standard purposely does not state the method through which overlap is to be minimized. Transmission Operators may use a number of different approaches to satisfy this requirement. Each system is unique and will have various constraints that must be balanced in addressing these requirements.

Provisions

The term provisions, which has been carried forward from EOP-011-2, is intended to mean that it is the responsibility of the Transmission Operator to work with other entities, as necessary, to ensure that their Operating Plan is responsive to these requirements.

Limit the utilization of UFLS or UVLS for manual Load shed

In certain situations, it may be necessary and appropriate to utilize UFLS or UVLS circuits for manual Load shed. These situations may be driven by Load shed magnitudes, local constraints, or other factors. It is important for Transmission Operators to understand the circumstances where UFLS or UVLS circuits may be needed for manual Load shed. Their Operating Plans should identify system conditions that would allow for the utilization of UFLS or UVLS for manual Load shed and how it will be implemented. The Operating Plans should ensure that potential reliability impacts are appropriately considered and balanced. Three examples of such situations are discussed below.

Manual Load Shed Capabilities are Exhausted

During a major Load shed event, Transmission Operators may run out of circuits that are designated for manual Load shed. Due to the large amounts of Load shedding ordered, the duration of the Load shedding, and the exclusion of circuits serving critical Load, Transmission Operators may be forced to manually shed circuits that are utilized for UFLS or UVLS in order to maintain their obligation of total pro rata Load shed.

In such a situation, protecting system reliability requires the lesser evil of using some UFLS circuits to implement the required Load shedding. Transmission Operators should include provisions in their Operating Plans that balances the risk of the immediate emergency need to balance generation and Load to maintain reliability, with the potential for frequency disturbances in the future. In this case, Transmission Operators may elect to utilize UFLS circuits. In this scenario, the recommended practice is to start with the lowest frequency block to meet the Load shed obligations

Proactive Utilization of UFLS Circuits to Improve Outage Rotations and Balance UFLS Levels

Refer to NERC Lesson Learned on this topic:
https://www.nerc.com/pa/rrm/ea/Lessons%20Learned%20Document%20Library/LL20220301_Managing_UFLS_Obligations_Service_Critical_Loads_during_Energy_Emergency.pdf

Local Emergency Condition

Local emergency conditions are different from a system-wide short-supply situation. During local emergencies, it may be appropriate, and possibly necessary, to manually shed circuits that serve critical loads or that are utilized for UFLS or UVLS.

Requirement R2, Part 2.2.8

This part of R2 has been modified to refer back to Requirement R1, Part 1.2.5 in an effort to clarify that the Transmission Operator is responsible for addressing operator-controlled manual Load shed requirements in their Operating Plan. Balancing Authorities are expected to specify manual Load shed requirements for Transmission Operators within their areas in accordance with Part 1.2.5, but do not have the control or visibility to design and implement manual Load shed programs and UFLS/UVLS programs that meet the requirements of Part 1.2.5.