NERC
NORTH AMERICAN ELECTRIC
RELIABILITY CORPORATION

Extreme Cold Weather Preparedness

Technical Rationale and Justification for EOP-011-4

February 2023

RELIABILITY | RESILIENCE | SECURITY




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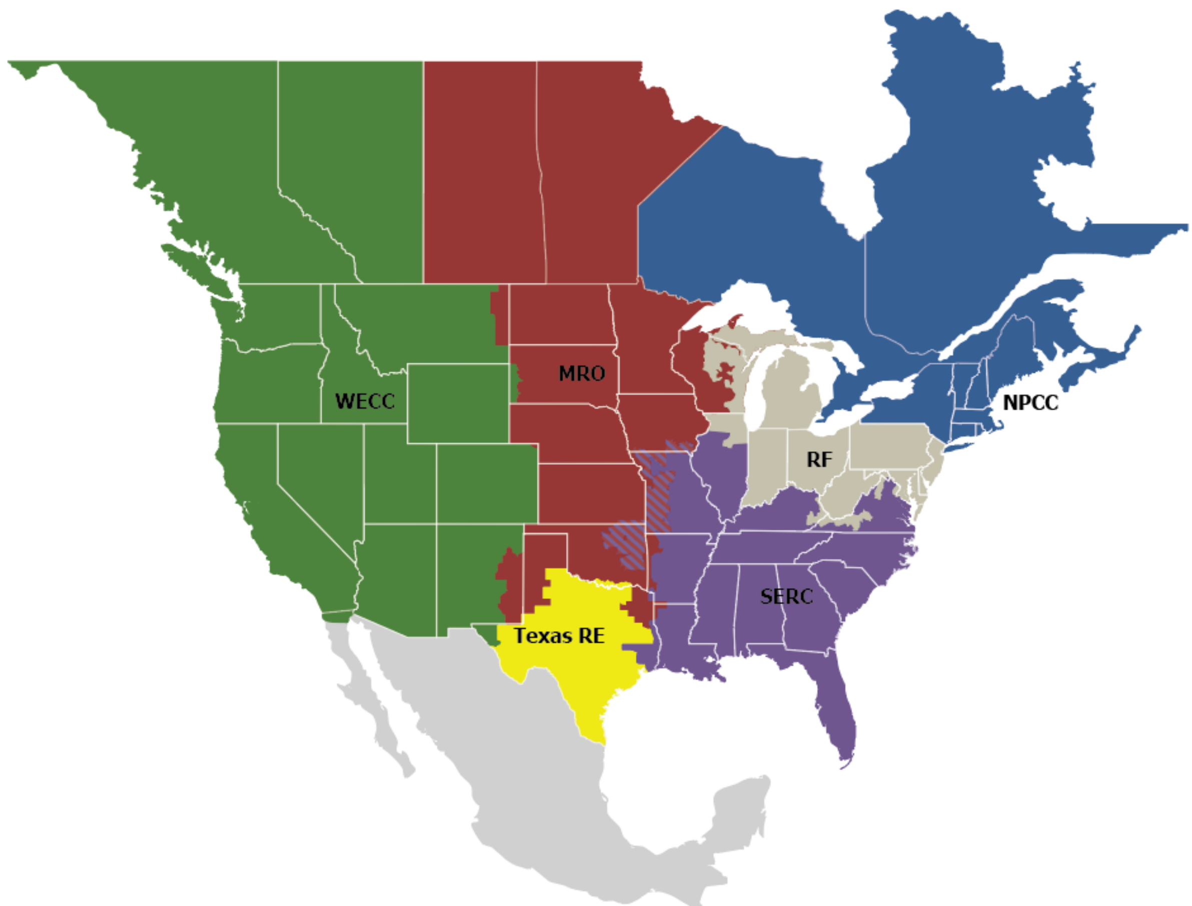
Preface

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-011-4. It provides stakeholders and the ERO Enterprise with an understanding of the technology and technical requirements in the Reliability Standard. This Technical Rationale and Justification for EOP-011-4 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 (Board) 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.

Applicability

4.1. *Functional Entities:*

4.1.1 *Balancing Authority*

4.1.2 *Reliability Coordinator*

4.1.3 *Transmission Operator*

4.1.4 *Distribution Provider identified in the Transmission Operator's Operating Plan(s) to mitigate operating Emergencies in its Transmission Operator Area*

4.1.5 *UFLS-Only Distribution Provider identified in the Transmission Operator's Operating Plan(s) to mitigate operating Emergencies in its Transmission Operator Area*

4.1.6 *Transmission Owner identified in the Transmission Operator's Operating Plan(s) to mitigate operating Emergencies in its Transmission Operator Area*

Requirement R1 and R7

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 or automatic 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);*

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;*

1.2.5.5. *Provisions for the identification and prioritization of designated critical natural gas infrastructure loads; and*

1.2.5.6. *Provisions for the identification of Distribution Providers, UFLS-Only Distribution Providers and Transmission Owners required to mitigate operating Emergencies in its Transmission Operator Area.*

1.2.6. *Provisions to determine reliability impacts of:*

1.2.6.1. *Cold weather conditions; and*

1.2.6.2. *Extreme weather conditions.*

R7. *Each Distribution Provider, UFLS-Only Distribution Provider, and Transmission Owner identified in a Transmission Operator's Operating Plan(s) to mitigate operating Emergencies in its Transmission Operator Area shall develop, maintain and implement one or more Operating Plan(s). The Operating Plan(s) shall be provided to the Transmission Operator. The Operating Plan(s) shall include the following, as applicable: [Violation Risk Factor: High] [Time Horizon: Real-Time Operations, Operations Planning, Long-term Planning]*

7.1. *Operator-controlled manual or automatic Load shedding during an Emergency that accounts for each of the following:*

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

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

7.1.3. *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);*

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

7.1.5. *Provisions for the identification and prioritization of designated critical natural gas infrastructure loads.*

<u>Key Recommendation 1i:</u> To protect critical natural gas infrastructure loads from manual and automatic load shedding (to avoid adversely affecting Bulk Electric System reliability):

- *To require Balancing Authorities and Transmission Operators provisions for operator-controlled manual load shedding to include processes for identifying and protecting critical natural gas infrastructure loads in their respective areas;*

- *To require Balancing Authorities, Transmission Operators, Planning Coordinators, and Transmission Planners respective provisions and programs for manual and automatic (e.g., underfrequency load shedding, undervoltage load shedding) load shedding to protect identified critical natural gas infrastructure loads from manual and automatic load shedding by manual and automatic load shed entities within their footprints;*
- *To require manual and automatic load shed entities to distribute criteria to natural gas infrastructure entities that they serve and request the natural gas infrastructure entities to identify their critical natural gas infrastructure loads; and*
- *To require manual and automatic load shed entities to incorporate the identified critical natural gas infrastructure loads into their plans and procedures for protection against manual and automatic load shedding. (Winter 2023-2024)*

Applicability, Requirement R1.2.5.6 and Requirement R7

Expansion of Applicability

In many cases, Transmission Operators (TOP) are dependent on Distribution Providers, UFLS-Only Distribution Providers, and Transmission Owners to implement portions of Requirement R1.2.5. The SDT determined that is necessary to expand the Applicability of EOP-011-4 to these Functional Entities to address all entities responsible for performing operator-controlled or automatic load shedding per Key Recommendation 1i.

EOP-011-4 Requirement R1.2.5.6 is a new requirement that was added to require that Transmission Operators identify any Distribution Providers, UFLS-Only Distribution Providers, and Transmission Owners required to mitigate operating Emergencies in their Transmission Operator Area. The Transmission Operator has the overarching responsibility to mitigate operating Emergencies. If a Transmission Operator relies on other Functional Entities to accomplish various aspects of manual or automatic Load shedding, they must be identified in the TOP's Operating Plan(s).

EOP-011-4 Requirement R7 is a new requirement that is specific to Distribution Providers, UFLS-Only Distribution Providers, and Transmission Owners identified by the Transmission Operator in Requirement R1.2.5.6. It includes the relevant portions EOP-011-4 R1.2.5 that address operator-controlled or automatic load shedding. The SDT found it appropriate to place these requirements specifically on Distribution Providers, UFLS-Only Distribution Providers, and Transmission Owners because many times they are the entities performing operator-controlled manual or automatic Load shedding and have the capability of ensuring that these requirements are appropriately implemented for the Loads they represent.

Requirement R1, Part 1.2.5 and Requirement R7, Part 7.1

Identify and Prioritize Critical Natural Gas Loads

EOP-011-4 Requirement R1.2.5.5 was added to require Transmission Operators to include provisions to identify and prioritize critical natural gas loads in their Operating Plan(s). EOP-011-4 Requirement R7.1.5 mirrors this requirement and is applicable to Distribution Providers, UFLS-Only Distribution Providers, and Transmission Owners. In addition to the following content, entities are encouraged to review guidance from Reliability Guideline: Gas and Electrical Operational Coordination Considerations (add hyperlink).

Manual AND Automatic

EOP-011-4 Requirement 1.2.5 was modified to include "automatic Load shedding" in addition to "operator-controlled manual Load shedding." The result of this modification is that Requirement R1.2.5.5, which requires the identification and prioritization of critical natural gas Loads, is also applicable to automatic Load shedding. It is important to identify and prioritize critical natural gas Loads not just for the purposes of manual Load shed but also in consideration of automatic Load shedding schemes. This modification does not prohibit the inclusion of critical natural gas Loads in automatic Load shedding, but it does require the prioritization of critical natural gas Loads. This change was also incorporated into the new EOP-011-4 Requirement R7.1.

Identification of Critical Natural Gas Loads

Critical natural gas loads must be identified so that they can then be prioritized from an operator-controlled manual and automatic Load shedding perspective. The identification of critical natural gas loads can be accomplished in several ways and the SDT did not prescribe specific methods in the drafting of EOP-011-4. Methods may include:

- Distribution of criteria to natural gas infrastructure entities soliciting information to identify critical facilities that would likely adversely affect BES reliability if de-energized;
- Reliance on self-identification of critical gas infrastructure driven by local jurisdictional requirements;
- Use of historical info and coordination with resources and gas suppliers from existing Operating Plans.

Prioritization of Critical Natural Gas Loads

The SDT recognizes that it is not reasonable to set a broad expectation of “protecting” critical natural gas Loads as initially recommended in the Joint Inquiry Report. Instead, it is more appropriate for entities to consider how critical natural gas infrastructure loads are prioritized under various conditions. 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. Prioritization should consider the relative criticality of various loads within the natural gas supply chain as compared to their potential impact to BES reliability. For example, critical natural gas loads such as compression facilities that directly impact gas pipelines serving gas-fired generators should be prioritized above gas production facilities.

Most entities will find it appropriate to completely exclude a subset of the most critical natural gas infrastructure Loads that directly impact BES generators from manual and automatic Load shed. It is recommended to prioritize other critical natural gas Loads so that they are only shed if necessary, based on the Load shed magnitude.

An example method of prioritizing critical natural gas loads may include:

- Identifying critical natural gas Loads with the highest level of criticality and potential impact to BES reliability such that they can be completely excluded from operator-controlled manual Load shed and automatic Load shed programs;
- Prioritizing other critical natural gas Loads not included in automatic Load shed programs such that they are only shed if necessary, based on the Load shed magnitude; and
- Prioritizing other critical natural gas Loads included in automatic Load shed programs such that they are allocated to the lower frequency, or longer time-delay, steps in a UFLS program to ensure that they are less likely to be interrupted.

Requirement R2

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 excluding critical natural gas infrastructure loads as Interruptible Load, curtailable Load, and demand response during periods when it would adversely impact the reliable operation of the BES;*

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

2.2.10. *Provisions to determine reliability impacts of:*

2.2.10.1. *Cold weather conditions; and*

2.2.10.2. *Extreme weather conditions.*

Key Recommendation 1h: To require Balancing Authorities' operating plans (for contingency reserves and to mitigate capacity and energy emergencies) to prohibit use for demand response of critical natural gas infrastructure loads.

Requirement R2, Part 2.2.8

EOP-011-4 Requirement 2.2.8 was added to require Balancing Authorities to include provisions to identify and prioritize critical natural gas loads in their Operating Plan(s), similar to EOP-011-4 Requirements R1.2.5 and R7.1.5

applicable to Transmission Operators, Distribution Providers, UFLS-Only Distribution Providers, and Transmission Owners. The Technical Rationale verbiage above regarding the identification and prioritization of critical natural gas Loads applicable to Requirements R1.2.5 and R7.1.5 is also applicable to Requirement R2.2.8.

It is important to stress that in the verbiage above applicable to R1.2.5 and R7.1.5, and the Key Recommendation 1h and Recommendation 28 from the Joint Inquiry Report, it is recognized that “critical” is situational, i.e. depending on the local conditions, and may change during the course of a severe weather event. That is, during an event, any element of natural gas processing and delivery may become “critical”. Continued communication between electricity and natural gas providers is crucial to maintain situational awareness to avoid unintended consequences of load shedding of critical natural gas loads.

It is also recognized that BES registered entities are not expected to become experts in natural gas infrastructure, nor are natural gas entities expected to become experts in electrical generation. Those natural gas loads determined to be critical may also change more gradually over time as changes occur in the BES and natural gas supply system, requiring regular review of prioritization schemes. The goal of pre-event planning and emergency response is to promote sufficient knowledge so that discussions of natural gas facility criticality can be conducted prior to and during severe cold weather to allow Reliability Coordinators, Balancing Authorities, Regional Entities, Transmission Operators, Transmission Owners, and Distribution Providers to adjust load shedding schemes as necessary to maximize availability of natural gas resources and minimize impact on the BES.

Requirement R2, Part 2.2.9

Key Recommendation 1i requires the Balancing Authorities to include in their Operating Plan(s) for their Balancing Authority Areas provisions for operator-controlled manual load shedding that identifies and protects critical natural gas infrastructure loads in their respective areas. Further, the recommendation also includes provisions within these operating plans to require manual and automatic load shed entities within their respective footprints to protect identified critical natural gas infrastructure loads from manual and automatic load shedding.

The current provision R2 Part 2.2.9, which references Transmission Operator responsibilities under R1 Part 1.2.5., satisfies the requirements of Key Recommendation 1i with respect to the Balancing Authority. Requirement R1 Part 1.2.5 identifies and protects critical natural gas infrastructure loads from manual and automatic load shedding within the Transmission Operator’s Operating Plan(s), which the Balancing Authority relies on when it directs load-shedding provisions (*See* Requirement R2 Part 2.2.9). In addition, as described above, Requirement R7 applicable to the Distribution Provider, UFLS-Only Distribution Provider, and Transmission Owner, identifies and protects critical natural gas infrastructure loads from manual and automatic load shedding, and are essential in the implementation of a Transmission Operator’s Operating Plan(s). Therefore, the objectives of the recommendation that load-shedding entities identify and protect critical natural gas infrastructure loads are satisfied within the Transmission Operator’s Operating Plan(s).