NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Extreme Cold Weather Preparedness

Technical Rationale and Justification for TOP-002-5

September 2023

RELIABILITY | RESILIENCE | SECURITY




3353 Peachtree Road NE
Suite 600, North Tower
Atlanta, GA 30326
404-446-2560 | www.nerc.com

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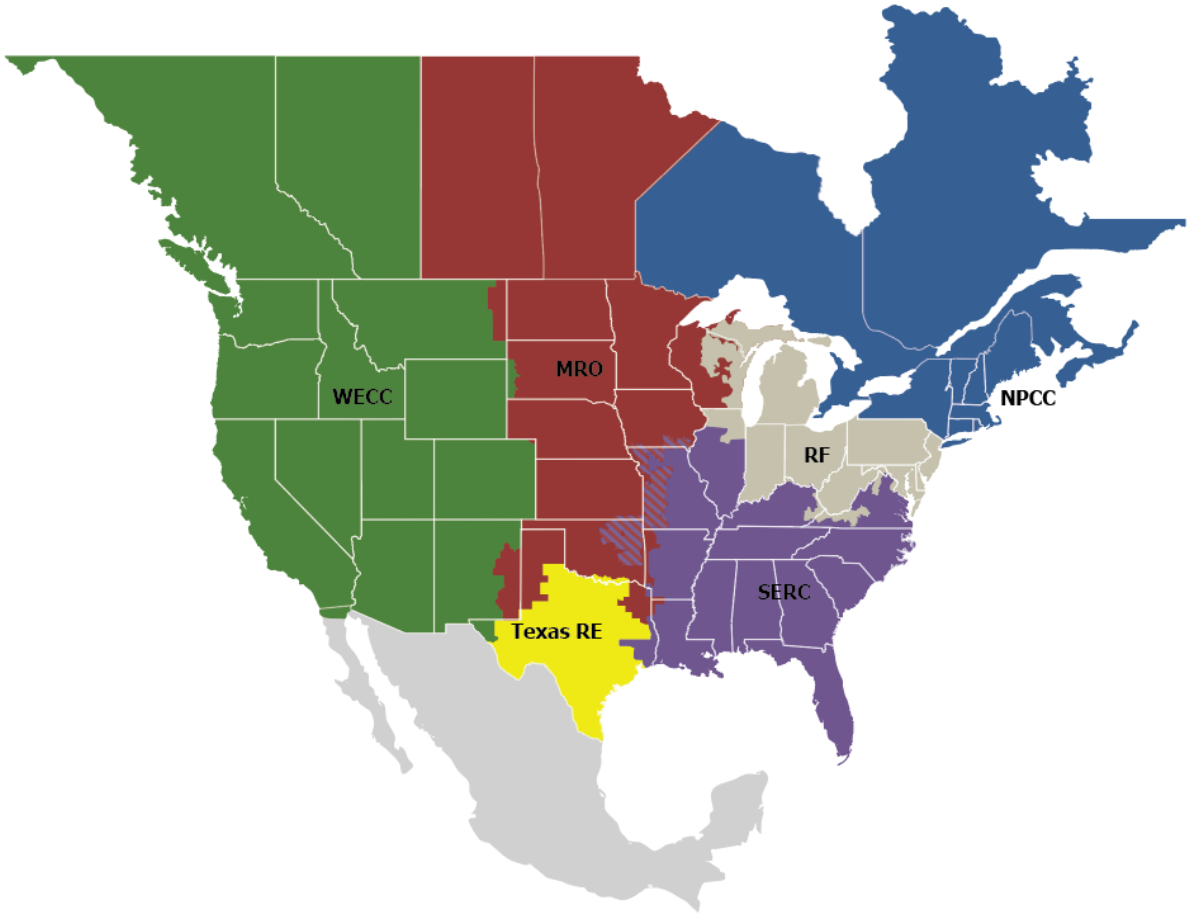
Preface

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 Standard TOP-002-5. 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 TOP-002-5 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 develop recommendations from FERC, NERC, and Regional Entity staff. The FERC, NERC, and Regional Entity Staff Report into the February 2021 Cold Weather Outages ("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 was completed by September 30, 2022, and submitted 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.

TOP-002-5

Requirement R8

R8. *Each Balancing Authority shall have an extreme cold weather Operating Process for its Balancing Authority Area, addressing preparations for and operations during extreme cold weather periods. The extreme cold weather Operating Process shall include, but is not limited to:*

8.1 A methodology for identifying an extreme cold weather period within each Balancing Authority Area;

8.2 A methodology to determine an adequate reserve margin during the extreme cold weather period considering the generating unit(s) operating limitations in previous extreme cold weather periods that includes, but is not limited to:

8.2.1 Capability and availability;

8.2.2Fuel supply and inventory concerns

8.2.3 Start-up issues;

8.2.4 Fuel switching capabilities; and

8.2.5 Environmental constraints.

8.3 A methodology to determine a five-day hourly forecast during the identified extreme cold weather periods that includes, but is not limited to:

8.3.1 Expected generation resource commitment and dispatch;

8.3.2 Demand patterns;

8.3.3 Capacity and energy reserve requirements, including deliverability capability; and

8.3.4 Weather forecast.

<u>Key Recommendation 1g:</u> The Reliability Standards should be revised to provide greater specificity about the relative roles of the Generator Owners, Generator Operators and Balancing Authorities in determining the generating unit capacity that can be relied upon during "local forecasted cold weather," in TOP-003-5:

-Based on its understanding of the "full reliability risks related to the contracts and other arrangements [Generator Owners/Generator Operators] have made to obtain natural gas commodity and transportation for generating units," each Generator Owner/Generator Operator should be required to provide the Balancing Authority with data on the percentage of the generating unit's capacity that the Generator Owner/Generator Operator reasonably believes the Balancing Authority can rely upon during the "local forecasted cold weather".

-Each Balancing Authority should be required to use the data provided by the Generator Owner/Generator Operator, combined with its evaluation, based on experience, to calculate the percentage of total generating capacity that it can rely upon during the "local forecasted cold weather," and share its calculation with the Reliability Coordinator.

-Each Balancing Authority should be required to use its calculation of the percentage of total generating capacity that it can rely upon to "prepare its analysis functions and Real-time monitoring," and to "manag[e] generating resources in its Balancing Authority Area to address . . . fuel supply and inventory concerns" as part of its Capacity and Energy Emergency Operating Plans.

General Considerations

There have been several past events during extreme cold weather where load and resource balancing issues have occurred, due to both unexpected generator trips and higher loads than forecasted. A proactive Operating Process required prior to the onset of extreme cold weather events would formalize the Balancing Authority's extreme cold weather preparations for those periods, including forecasting load needs and adequate reserve requirements. Initial drafts to incorporate the Operating Process tied the process to the Operating Plan described in Requirement R4. To remove any ambiguity whether a cold weather Operating Process must be developed for all Operating Plans during all seasons, the standard drafting team (SDT) structured Requirement R8 to be stand-alone. Therefore, the Operating Process contained in Requirement R8 will address preparations and operations for extreme cold weather periods and is not required for other seasonal conditions. The Operating Process is specific to extreme cold weather operations to formalize the process to review and respond to oncoming conditions that may affect generation availability and capability, forecasted load, and determining whether additional capability/reserves should be ready to serve loads during extreme cold weather. The content of Requirement R8 is similar to what is required in the Operating Plan in Requirement in R4 with the exception of Interchange Scheduling which is not required here because this function is typically done in real time on an hourly basis. The need for the Balancing Authority to proactively look ahead and forecast their ability to import power from neighboring Control Areas is captured under Parts 8.3.1 and 8.3.3.

The Project 2021-07 SDT does not believe that prescriptive processes must be used for every Balancing Authority to develop their methodology. This is based in part on the differences in the size of Balancing Authorities (for reference, in 2020, 14 Balancing Authorities had peak loads of less than 200 MWs, while two had peak loads of more than 100,000 MWs[1]). The differences between Balancing Authority footprints, loads, and market structures or lack thereof, make a single consistent methodology inappropriate. Requirement R8, Parts R8.2 and R8.3 contain criteria, including data requirements, the Balancing Authority will use as part of its methodologies. Due to the criteria being the minimum required, the SDT team has included "but not limited to" language to allow the Balancing Authority that flexibility in needed information and process that is vital to ensure the methodologies can effectively accomplish the reliability need, and reflect the intent of the standard to require inclusion of the various listed items but not exclude other items that the Balancing Authority may consider valuable and germane to include in its methodologies. The SDT spent considerable time discussing the appropriate look ahead time frame for the Operating Process with suggestions ranging from seven days to three days. It was determined that seven days was too long of a period as weather forecasts are typically not reliable for this longer duration and three days was too short of a period as this would not allow for the forecast to span a longer holiday weekend. Furthermore, the SDT determined that five days would provide sufficient visibility into projected reserve margin requirements.

The SDT developed the proposed requirement to ensure that the Balancing Authorities address the increased uncertainty related to these extreme weather events in a manner appropriate and adequate for their Balancing Authority Area. Each Balancing Authority can develop a methodology consistent with the Requirement they feel provides the best solutions to sustain an adequate level of reliability during an upcoming extreme cold weather event.

[1]Source: OY 2022 BAL-003 Frequency Bias Settings 01 Jun 2022
https://www.nerc.com/comm/OC/RS%20Landing%20Page%20DL/Frequency%20Response%20Standard%20Resources/OY_2022_Frequency_Bias_Annual_Calculations_REVISION_4.26.22.pdf

Technical Rationale from TOP-002-4

This section contains a "cut and paste" of the Technical Rationale components of the former Guidelines and Technical Basis (GTB) as-is from TOP-002-4 standard to preserve any historical references.

Rationale for Definitions:
Changes made to the proposed definitions were made in order to respond to issues raised in NOPR paragraphs 55, 73, and 74 dealing with analysis of SOLs in all time horizons, questions on Protection Systems and Special Protection Systems in NOPR paragraph 78, and recommendations on phase angles from the SW Outage Report (recommendation 27). The intent of such changes is to ensure that Real-time Assessments contain sufficient details to result in an appropriate level of situational awareness. Some examples include: 1) analyzing phase angles which may result in the implementation of an Operating Plan to adjust generation or curtail transactions so that a Transmission facility may be returned to service, or 2) evaluating the impact of a modified Contingency resulting from the status change of a Special Protection Scheme from enabled/in-service to disabled/out-of-service.

Rationale for R1:
Terms deleted in Requirement R1 as they are now contained in the revised definition of Operational Planning Analysis

Rationale for R2:
The change to Requirement R2 is in response to NOPR paragraph 42 and in concert with proposed changes made to proposed TOP-001-4

Rationale for R3:
Changes in response to IERP recommendation

Rationale for R4 and R5:
These Requirements were added to address IERP recommendations

Rationale for R6 and R7:
Added in response to SW Outage Report recommendation 1

This section contains a "cut and paste" of the "Associated Documents" section as is in TOP-002-4 Standard to preserve any historical references:
Operating Plan - An Operating Plan includes general Operating Processes and specific Operating Procedures. It may be an overview document which provides a prescription for an Operating Plan for the next day, or it may be a specific plan to address a specific SOL or IROL exceedance identified in the Operational Planning Analysis (OPA). Consistent with the NERC definition, Operating Plans can be general in nature, or they can be specific plans to address specific reliability issues. The use of the term Operating Plan in the revised TOP/IRO standards allows room for both. An Operating Plan references processes and procedures which are available to the System Operator on a daily basis to allow the operator to reliably address conditions which may arise throughout the day. It is valid for tomorrow, the day after, and the day after that. Operating Plans should be augmented by temporary operating guides which outline prevention/mitigation plans for specific situations which are identified day-to-day in an OPA or a Real-time Assessment (RTA). As the definition in the Glossary of Terms states, a restoration plan is an example of an Operating Plan. It contains all the overarching principles that the System Operator needs to work his/her way through the restoration process. It is not a specific document written for a specific blackout scenario, but rather a collection of tools consisting of processes, procedures, and automated software systems that are available to the operator to use in restoring the system. An Operating Plan can in turn be looked upon in a similar manner. It does not contain a prescription for the specific set-up for tomorrow, but contains a treatment of all the processes, procedures, and automated software systems that are at the operator's disposal. The existence of an Operating Plan, however, does not preclude the need for creating specific action plans for specific SOL or IROL exceedances identified in the OPA.

When a Reliability Coordinator performs an OPA, the analysis may reveal instances of possible SOL or IROL exceedances for pre- or post-Contingency conditions. In these instances, Reliability Coordinators are expected to ensure that there are plans in place to prevent or mitigate those SOLs or IROLs, should those operating conditions be encountered the next day. The Operating Plan may contain a description of the process by which specific prevention or mitigation plans for day-to-day SOL or IROL exceedances identified in the OPA are handled and communicated. This approach could alleviate any potential administrative burden associated with perceived requirements for continual day-to-day updating of "the Operating Plan document" for compliance purposes.