NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Extreme Cold Weather Preparedness

Technical Rationale and Justification for EOP-012-1

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RELIABILITY | RESILIENCE | SECURITY




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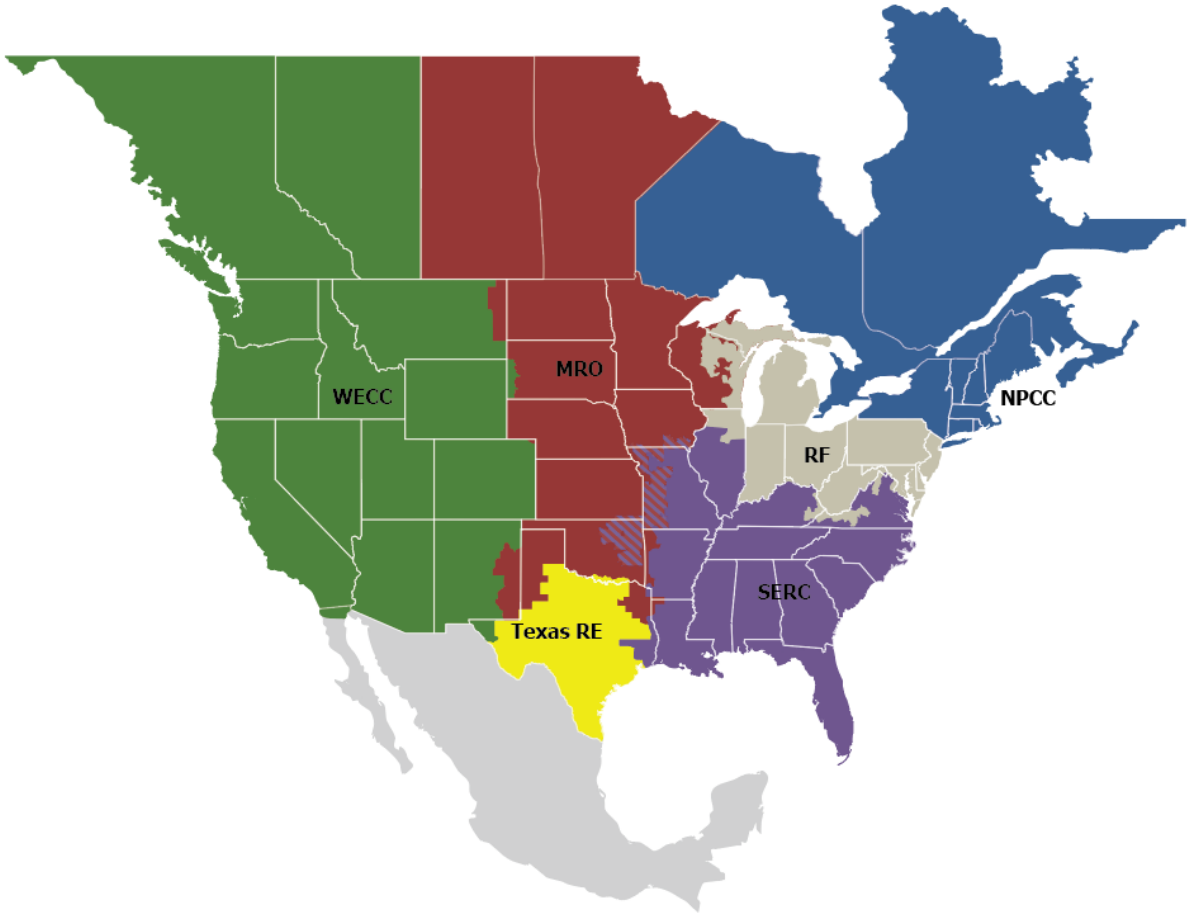
Table of Contents

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 Standard 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 Justification for EOP-012-1 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 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 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.

Facilities

For purposes of this standard, the term "generating unit" means those Bulk Electric System generators that plan to operate during the winter season. The winter season will be determined by the generating unit's applicable Balancing Authority. The term excludes those generators that do not operate during the winter season except when called upon by the Balancing Authority to be available during Capacity Emergencies or Energy Emergencies.

In the Joint Inquiry Report, Key Recommendation 1f includes support information, which states "consideration should be given to designing all new generation plants and designing modifications to existing plants (unless committed solely for summer peaking purposes) to be able to perform at the lowest recorded ambient temperature for the nearest city for which historical weather data is available …).[1] FERC staff from the Joint Inquiry Report team emphasized to the standard drafting team (SDT) that the reference to summer peaking units was intended to acknowledge that some units are not designed or planned to operate in winter conditions. The intent of the proposed standard as a reliability-focused standard is not to mandate that all generating units provide capacity in extreme cold weather, but instead to ensure that those units that plan to operate in the winter season be able to provide this capacity in a reliable fashion. This language ensures that this intent is captured for all requirements that follow.

Requirement R1 and R2

R1. *Each Generator Owner shall ensure generating units implement freeze protection measures based on the following minimum criteria: [Violation Risk Factor: Medium] [Time Horizon: Long-term Planning, Operations Planning]*

1.1. *Each generating unit shall be designed and maintained to be capable of continuous operations at the documented minimum hourly temperature experienced at its location since 1/1/1975 or a lesser period if reliable data is not available to 1975;*

1.2. *The generating unit design shall account for the cooling effect of wind;*

1.3. *The generating unit design shall account for the impacts on operations due to precipitation (e.g., sleet, snow, ice, and freezing rain); and*

1.4. *For each existing generating unit that requires either new freeze protection measures or modification of existing freeze protection measures, the Generator Owner shall develop and implement a Corrective Action Plan (CAP) which includes the following at a minimum:*

1.4.1. *An identification of corrective action (s) for the affected unit(s), including any necessary modifications to the Generator Owner's cold weather preparedness plan(s);*

1.4.2. *A timetable for implementing the corrective action(s) from Part 1.4.1 which considers any technical, commercial, or operational constraints, as defined by the Generator Owner;*

1.4.3. *An identification of any temporary operating limitations that would apply until execution of the corrective action(s) identified in the CAP; and*

1.4.4. *A declaration, where deemed appropriate by the Generator Owner based on the review of Parts 1.4.1 through 1.4.3, that no revisions to the cold weather preparedness plan(s) are required and that no further corrective actions will be taken. The Generator Owner shall document technical, commercial, or operational constraints as defined by the Generator Owner as support for such declaration.*

[1] See Report, page 189.

R2. *Each Generator Owner that is not able to implement freeze protection measures for new generating unit(s) as required by Requirement R1 due to technical, commercial, or operational constraints as defined by the Generator Owner shall: [Violation Risk Factor: Low] [Time Horizon: Long-term Planning]*

2.1. *Document its determination and the constraints on implementation; and*

2.2. *Review its determination every five calendar years to determine whether the documented constraints on implementation remain applicable.*

Key Recommendation 1f: To require Generator Owners to retrofit existing generating units, and when building new generating units, to design them, to operate to a specified ambient temperature and weather conditions (e.g., wind, freezing precipitation). The specified ambient temperature and weather conditions should be based on available extreme temperature and weather data for the generating unit's location.

General Considerations

As referenced in Key Recommendation 1f above, the specified ambient temperature and weather conditions should be based on available extreme temperature and weather data for the generating unit's location. FERC staff from the Joint Inquiry Report team clarified to the SDT that the reliability goal of the recommendation for existing generating units is to have the necessary freeze protection measures to be able to operate at extreme cold temperatures and weather for the generating unit's location. For example, those measures may consist of existing[2] or new, permanent and/or temporary measures[3] to maintain operation during extreme cold temperatures. Therefore, FERC staff clarified that the joint team's intent of the word retrofit is "to implement new, and/or make modifications to existing freeze protection measures for existing generating units."

In discussions with the Joint Inquiry Report team and in reading the Joint Inquiry Report itself, it is clearly stated that "consideration should be given to designing all new generation plants and designing modifications to existing plants (unless committed solely for summer peaking purposes) to be able to perform at the lowest recorded ambient temperature for the nearest city for which historical weather data is available …)". The Report went on to provide evidence that "Not only did generating units fail to perform at the lowest recorded ambient temperature for the nearest city, but many failed to perform at their own ambient design temperatures". The Joint Inquiry Report also notes that "Over 40 percent of the GOs/GOPs in the south central U.S. regions where "freezing issues" were identified as the predominant cause of unplanned generation outages, derates or failures to start stated that they did not incorporate specific generator-related recommendations from the 2011 Report or specific recommendations from the Guideline."

Based on the generating unit data contained in the Report, many generating units that operate in the winter season are not properly winterized to remain in reliable service during the most extreme cold weather conditions that they may reasonably be expected to experience at their locations. As the load on the grid is the most elevated at these extreme conditions, these are the periods when it is most critical that these generating units maintain their reliability. As such, Requirement 1 ensures that generating units are proactively taking steps to design and maintain their units to maintain their reliability during extreme cold weather.

Requirement R1 Part 1.1

The Joint Inquiry Report key recommendation 1f references recommendation 12 of the 2011 report suggesting that consideration should be given to designing all new generation plants and designing modifications to existing plants

[2] While the dictionary definition of the word retrofit includes to install (new or modified parts or equipment) in something previously manufactured or constructed, its origin suggests the need for replacing existing equipment with new technologies, which was not the intent of the joint team in this case. See Merriam-Webster definition.

[3] Some freeze protection measures may need to be removed for summer temperature operation.

(unless committed solely for summer peaking purposes) to be able to perform at the lowest recorded ambient temperature for the nearest city for which historical weather data is available. The Joint Inquiry Report states "The Standards Drafting Team can decide what additional specificity is desirable for this requirement, for example, specifying the number of years of weather data to be considered in establishing the required ambient temperature and weather conditions, and the source of the extreme temperature and weather data". The SDT considered several options of how many years back historical data should be analyzed (e.g., 10 years, 30 years, 50 years, 100 years). There is concern that some geographical areas may not have reliable data dating back 100 years. The SDT does not think 10 or 30 years of historical ambient temperature data is enough to support the intent of the recommendation. The SDT is also concerned if the lowest recorded coldest ambient temperature rolled off outside the historical parameter, it would give a new build generating unit a lesser cold weather criteria/standard to build to. Ultimately, the SDT decided to make 1975 the earliest historical date for the lowest recorded ambient temperature. Most would have historical data back to this date and the coldest temperature from 1975 would never roll off. This makes all new build and existing units to have to winterize to the same criteria in similar locations. Generator Owners should select a reliable source of data from a recording location near the plant. Examples would include National Weather Service or National Oceanographic and Atmospheric Administration weather stations, Federal Aviation Administration weather stations, etc. Generator Owners may use on-site weather stations if data, which reasonably matches reliable nearby off-site sources since 1975, is available.

Requirement R1 Parts 1.2 and 1.3

The key recommendation identifies wind and freezing precipitation as specific examples of weather conditions to consider during the design of new generating units and modifications to existing plants. Realizing the many differences in weather that generator sites face across the Regions, the 2021-07 SDT developed language to provide additional context and detail around these weather conditions, while allowing flexibility for site-specific circumstances. The key recommendation language was revised within the requirement language to be specific to the cooling effect of wind. Additionally, the 2021-07 SDT provided example precipitation types to prevent the focus being solely on one form, such as ice, and again, allowing flexibility for site-specific issues.

Requirement R1 Part 1.4

The SDT created a requirement to develop a Corrective Action Plan (CAP) for existing generating units that require either new freeze protection measures, or modification of existing freeze protection measures, to be capable of continuous operation under the conditions defined in Part 1.1. However, it is recognized that modifications or corrective actions may not be feasible under all circumstances due to technical, commercial, or operational constraints.

Additionally, the SDT considered the potential for unintended consequences, such as limiting winter participation or accelerating generator retirements, caused by requirements to develop and implement CAPs to be capable of continuous operations under the conditions defined in Part 1.1 in all circumstances. Thus, the SDT included Part 1.4.4, which allows the Generator Owner to make a declaration supporting why technical, commercial, or operational constraints result in a determination that no revisions to the cold weather preparedness plan are required and that no further corrective actions will be taken.

The SDT discussed setting a timeframe needed for the CAP to be completed during the drafting phase. While it is important that the CAP be completed, it would be difficult to set a definite timeframe due to the number of variables that could impact the completion of the CAP once the cause is determined. The SDT believes that it is more important to develop a CAP that identifies the solution and resolves the situation correctly regardless of time. Therefore, the team did not define a time when the CAP needs to be completed.

Requirement R2

The SDT has developed the new Extreme Cold Weather Preparedness and Operation standard with language that supports the ongoing consideration of new technologies when protecting against extreme cold weather. This five-

year review of the determination supports the desire for utilities to periodically vet these new technologies and consider whether the technical, commercial, or operational constraint is still applicable.

Requirement R5

R5. *Each Generator Owner in conjunction with its Generator Operator shall identify the entity responsible for providing the generating unit-specific training, and that identified entity shall provide annual training to its maintenance or operations personnel responsible for implementing cold weather preparedness plan(s) developed pursuant to Requirement R3. [Violation Risk Factor: Medium] [Time Horizon: Long-term Planning, Operations Planning]*

Key Recommendation 1e: To revise EOP-011-2, R8, to require Generator Owners and Generator Operators to conduct annual unit-specific cold weather preparedness plan training.

Project 2019-06 Cold Weather established the requirement that the Generator Owner, in conjunction with its Generator Operator, would provide generating unit-specific training for its personnel responsible for implementing cold weather preparedness plan(s) for its generating units. The Joint Inquiry Report recommended that EOP-011-2 R8 be revised to require the generating unit-specific training be provided on an "annual" basis. The report explains "Responses from the GOs/GOPs involved in the Event show that annual training is not yet universal in the Event Area." To address this recommendation, the SDT has utilized the existing language in EOP-011-2 and added the word "annual" to require the training on an annual basis. The requirement is deleted from EOP-011-3, and will be placed as a requirement in a new EOP Reliability Standard dedicated solely to extreme cold weather preparedness.

Requirement R6

R6. *Each Generator Owner that owns a generating unit that experiences an event resulting in a derate of more than 10% of the total capacity of the unit for longer than four hours in duration, a start-up failure where the unit fails to synchronize within a specified start-up time, or a Forced Outage for which (i) the apparent cause(s) of the event is due to freezing of the Generator Owner's equipment within the Generator Owner's control, and (ii) the ambient conditions at the site at the time of the event are at or above the temperature documented in Part 3.4.2 shall: [Violation Risk Factor: High] [Time Horizon: Long-term Planning]*

6.1. *No later than 150 days subsequent to the event or by July 1 that follows the event, whichever is earlier, develop a CAP.*

6.2. *The CAP shall contain at a minimum:*

6.2.1. *A summary of the identified cause(s) for the equipment freezing event where applicable and any relevant associated data;*

6.2.2. *A review of applicability to similar equipment at other generating units owned by the Generator Owner;*

6.2.3. *An identification of corrective action(s) for the affected unit(s) and identified similar units, including any necessary modifications to the Generator Owner's cold weather preparedness plan(s);*

6.2.4. *A timetable for implementing the identified corrective action(s) from Part 6.2.3 which considers any technical, commercial, or operational constraints as defined by the Generator Owner;*

6.2.5. *An identification of any temporary operating limitations that would apply until execution of the corrective action(s) identified in the CAP; and*

6.2.6. *A declaration, where deemed appropriate by the Generator Owner based on the review of Parts 6.2.1 through 6.2.5 that no revisions to the cold weather preparedness plan are required and that no further corrective actions will be taken. The Generator Owner shall document technical, commercial, or operational constraints as defined by the Generator Owner as support for such declaration.*

Key Recommendation 1d: To require Generator Owners that experience outages, failures to start, or derates due to freezing to review the generating unit's outage, failure to start, or derate and develop and implement a corrective action plan (CAP) for the identified equipment, and evaluate whether the CAP applies to similar equipment for its other generating units. Based on the evaluation, the Generator Owner will either revise its cold weather preparedness plan to apply the CAP to the similar equipment, or explain in a declaration (a) why no revisions to the cold weather preparedness plan are appropriate, and (b) that no further corrective actions will be taken. The standard drafting team should specify the specific timing for the CAP to be developed and implemented after the outage, derate, or failure to start, but the CAP should be developed as quickly as possible, and be completed by no later than the beginning of the next winter season.

The key recommendation from the report recommends requiring generator owners to develop a CAP for generators that experience outages, failures to starts, or derates due to freezing. The 2021-07 SDT developed language that defines the circumstances for which a CAP is required, as those when a freezing event effects the equipment within the control of the Generator Owner. The Report identifies that most of the outages and derates in the February 2021 event were due to freezing of instrumentation, transmitters, sensing lines, or wind turbine blades (p 166 in report). As such, the team followed the Report recommendation to require a CAP when the apparent cause of the event is freezing.

The CAP requirement applies to any forced outage due to freezing, regardless of duration. Derates, which are short-lived or of small capacity impact, are excluded from the CAP requirement, although nothing in this standard prevents a GO from taking its own corrective actions resulting from such events. Startup failures are defined using the GADS definition with the removal of "following an outage or reserve shutdown", since the definition of Reserve shutdown is different in GADS than it is in some of the RTO's.

R6 requires the GO to act within 150 days or by July 1 to develop the CAP or document that no corrective action is appropriate. This timeframe was chosen to allow GO's to review multiple events holistically following a winter season, and create one CAP for equipment with common failure causes. Requirement R6.2 define the requirements for a CAP and the requirements for a declaration when technical, commercial, or operational constraints are present.