RELIABILITY & SECURITY

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Workshop - Salt Lake City, UT

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Project 2021-07

Extreme Cold Weather Grid Operations, Preparedness, and Coordination

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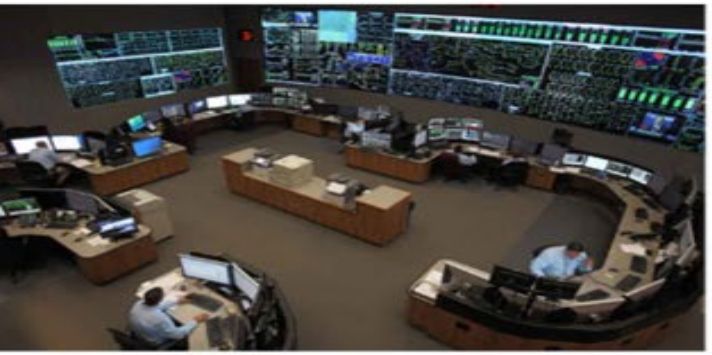



What You Will Learn and Why it Matters

- Learn about the background of Project 2021-07
- Review the three standards revised or created during the project
- Gain a deeper understanding of the standard revisions to assist in audit preparations

February 2021 Event

- During the week of February 14, 2021, for over two consecutive days, ERCOT averaged 34,000 megawatts (MW) of generation outages, nearly half of ERCOT's 2021 all-time winter peak load of 69,871 MW.
- Largest controlled firm load shed event in U.S. history (23,418 MW), third largest in quantity of outaged MW of load (August '03 and August '96 blackouts).
- Fourth event in the past 10 years, which jeopardized bulk-power system reliability due to unplanned generating unit outages which escalated due to cold weather.

Development Timeline

- Project was developed in three phases
- Phase 1
  - February 2022 – September 2022
  - Key Recommendations 1d, 1e, 1f and 1j
  - EOP-011-3 and EOP-012-1
- Phase 2
  - October 2022 – September 2023
  - Key Recommendations 1a, 1b, 1c, 1g, 1h and 1i
  - TOP-002-5 and EOP-011-4
- Phase 3
  - October 2022 – February 2024
  - FERC Order Directives
  - EOP-012-2

- Key Recommendations
  - 1j – TO, TOP and DP separation of circuits used for manual load shed
    - See Requirement R1 part 1.2.5, R2 part 2.2.9, R7 and R8
  - 1h – BAs operating plans prohibit use of demand response of critical natural gas infrastructure loads
    - See Requirement R2 part 2.2.8
  - 1i – to protect critical natural gas infrastructure loads from manual and automatic load shedding
    - See Requirement R1 part 1.2.5, R7 and R8

1.2.5. Operator-controlled manual Load shed, undervoltage load shed (UVLS), or underfrequency load shed (UFLS) 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, UVLS, or UFLS and circuits that serve designated critical loads which are essential to the reliability of the BES;

1.2.5.3. Provisions to minimize the overlap of circuits that are designated for manual Load shed and circuits that are utilized for UFLS or 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 which are essential to the reliability of the BES as defined by the Applicable Entity; and

Applicable to Balancing Authorities

2.2.8. Provisions for excluding critical natural gas infrastructure loads which are essential to the reliability of the BES, as defined by the Applicable Entity, as Interruptible Load, curtailable Load, and demand response during extreme cold weather periods within each Balancing Authority Area;

2.2.9. Provisions for Transmission Operators to implement operator-controlled manual Load shedding, undervoltage Load shedding, or underfrequency Load shedding in accordance with Requirement R1 Part 1.2.5; and

EOP-011-4 R7 and R8

- R7 - Each Transmission Operator shall annually identify and notify Distribution Providers, UFLS-Only Distribution Providers, and Transmission Owners that are required to assist with the mitigation of operating emergencies in its Transmission Operator Area through operator-controlled manual Load shedding or automatic Load shedding.

- R8 - Each Distribution Provider, UFLS-only Distribution Provider and Transmission Owner notified in R7 to assist shall have their own Load shedding plan to include provisions similar to Part 1.2.5. for the Transmission Operator

- Key Recommendation
  - 1g – provide specificity about roles of Generator Owner, Generator Operator, and Balancing Authority in determining the generating unit capacity that can be relied upon during “local forecasted cold weather”
    - See Requirement R8

TOP-002-5 R8

- New Balancing Authority extreme cold weather Operating Process unique from the BA operating Plan required in R4
  - Operating Process Definition per NERC Glossary of Terms: A document that identifies general steps for achieving a generic operating goal. An Operating Process includes steps with options that may be selected depending upon Real-time conditions.

TOP-002-5 R8

- Criteria for extreme cold weather Operating Process shall include but is not limited to:
  - Methodology for identifying an extreme cold weather period expected to affect Balancing Authority Area
  - Methodology that determines appropriate reserve margin during extreme cold weather period
  - Methodology to determine a five-day hourly forecast during the extreme cold weather period

- Current TOP-003 data specification requirement provides the mechanism for the BA to request necessary information from the GO

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: *[Violation Risk Factor: Medium] [Time Horizon: Operations Planning]*

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;

8.2.2 Fuel 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.

- Key Recommendations:
  - 1a – GO identification of cold-weather-critical components and systems
    - See Requirement R4 part 4.3., Generator Cold Weather Critical Component and Fixed Fuel Supply definitions
  - 1b – GO identification and implementation of freeze protection measures on each of the elements identified per 1a
    - See Requirement R4, R6 part 6.3, Generator Cold Weather Critical Component and Fixed Fuel Supply definitions
  - 1c – GO requirement to account for the effects of precipitation and wind
    - See Requirement R1 part 1.2.2 and R4 part 4.4

EOP-012-2

- Key Recommendations:
  - 1d – GO Corrective Action Plan
    - See Requirement R6, R7 and Generator Cold Weather Reliability Event definition
  - 1e – Revise GO training requirement to include annual periodicity completed
    - See Requirement R5
  - 1f – GO operation to specific ambient temperature and weather conditions
    - See Requirement R2, R3 and the Extreme Cold Weather Temperature definition

- Directives from the February 16, 2023 FERC order:
  - Applicability: Ensure the applicability section captures all BES generation resources needed for reliable operation and excludes only those generation resources not relied upon during freezing conditions.
    - See Facilities section and Requirement R1
  - Generator Constraints to Implementing Winterization Requirements: develop modifications related to generator-defined declarations of technical, commercial, or operational constraints that preclude a generator owner from implementing the appropriate freeze protection measures. Specifically, include auditable criteria on permissible constraints and to identify the appropriate entity that would receive the generator owners' constraint declarations.
    - See Requirement R8 and Generator Cold Weather Constraint definition

EOP-012-2

- Directives from the February 16, 2023 FERC order:
  - Generator Capability Requirements: modifications to ensure that generators that are technically incapable of operating for 12 continuous hours (e.g., solar facilities during winter months with less than 12 hours of sunlight) are not excluded from complying with the standard. Also, directed modifications to the one-hour continuous operations requirement to better align with the stated purpose of the standard.
    - See Requirement R2 and R3
  - Corrective Action Plan deadlines: include a deadline or maximum period for the completion of corrective action plan measures for any requirement requiring the development of a corrective action plan to address capability or cold weather performance issues.
    - See Requirement R7
  - Implementation Plan: Require a shorter implementation period than five years post approval.

Definitions

- **Extreme Cold Weather Temperature** – The temperature equal to the lowest 0.2 percentile of the hourly temperatures measured in December, January, and February from 1/1/2000 through the date the temperature is calculated.

Definitions

- **Generator Cold Weather Critical Component** – Any generating unit component or system, or associated Fixed Fuel Supply Component, that is under the Generator Owner's control, and is susceptible to freezing issues, the occurrence of which would likely lead to a Generator Cold Weather Reliability Event. This definition excludes any component or system or associated Fixed Fuel Supply Component located inside a permanent building with a heating source that regularly maintains the space at a temperature above 32 degrees Fahrenheit (0 degrees Celsius).

- **Fixed Fuel Supply Component** – Non-mobile equipment that supports the reliable delivery of fuel to the generating unit and under the control of the Generator Owner at a plant site. Gaseous, liquid, or solid fuel handling components that are installed on site as fixed parts of the fuel delivery system that are under the Generator Owner's control are included. Mobile equipment such as trains, bulldozers, or other equipment that are not fixed in one location are excluded.

Definitions

- **Generator Cold Weather Reliability Event** – One of the following events for which the apparent cause(s) is due to freezing of equipment or impacts of freezing precipitation (e.g., sleet, snow, ice, and freezing rain) on equipment within the Generator Owner's control, and the dry bulb temperature at the time of the event was at or above the Extreme Cold Weather Temperature:
  - (1) a forced derate of more than 10% of the total capacity of the unit, but not less than 20 MWs for longer than four hours in duration;
  - (2) a start-up failure where the unit fails to synchronize within a specified start-up time; or
  - (3) a Forced Outage.

Definitions

- **Generator Cold Weather Constraint** – Any condition that would preclude a Generator Owner from implementing freeze protection measures on one of more Generator Cold Weather Critical Components using the criteria below. Freeze protection measures are not intended to be limited to optimum practices, methods, or technologies, but are also intended to include acceptable practices, methods, or technologies generally implemented by the electric industry in areas that experience similar winter climate conditions.

  Criteria used to determine a constraint include practices, methods, or technologies which, given the exercise of reasonable judgment in light of the facts known at the time the decision to declare the constraint was made:

  - Were not broadly implemented at generating units for comparable unit types in regions that experience similar winter climate conditions to provide reasonable assurance of efficacy;
  - Could not have been expected to accomplish the desired result; or
  - Could not have been implemented at a reasonable cost consistent with good business practices, reliability, or safety. A cost may be deemed "unreasonable" when implementation of selected freeze protection measure(s) are uneconomical to the extent that they would require prohibitively expensive modifications or significant expenditures on equipment with minimal remaining life.

Applicability

- Functional Entities: Generator Owner and Generator Operator
- "Generating Unit" refers to
  - a BES resource identified in the BES definition, Inclusion I2 and I4
    - I2: Generating resource(s) including the generator terminals through the high-side of the step-up transformer(s) connected at a voltage of 100 kV or above with: a) Gross individual nameplate rating greater than 20 MVA. Or, b) Gross plant/facility aggregate nameplate rating greater than 75 MVA
    - I4: Dispersed power producing resources that aggregate to a total capacity greater than 75 MVA (gross nameplate rating), and that are connected through a system designed primarily for delivering such capacity to a common point of connection at a voltage of 100 kV or above
  - Blackstart Resource identified in the BES definition, Inclusion I3

EOP-012-2 R1

- Once every five calendar years for each generating unit:
  - Calculate the Extreme Cold Weather Temperature (ECWT)
    - Always use the lowest ECWT
    - Update the plan within 6 months if new corrective actions are needed
  - Identify generating cold weather data and unit minimums

EOP-012-2

1.2.1. Generating unit(s) operating limitations in cold weather to include:

1.2.1.1. Capability and availability;

1.2.1.2. Fuel supply and inventory concerns;

1.2.1.3. Start-up issues;

1.2.1.4. Fuel switching capabilities; and

1.2.1.5. Environmental constraints.

1.2.2. Generating unit(s) minimum:

- Design temperature, and if available, *the concurrent wind speed and precipitation;*
- Historical operating temperature at least one hour in duration, and if available, *the concurrent wind speed and precipitation*; or
- Current cold weather performance temperature determined by an engineering analysis, *which includes the concurrent wind speed and precipitation.*

TOP-003-5

2.3.1. Operating limitations based on:

2.3.1.1. capability and availability;

2.3.1.2. fuel supply and inventory concerns;

2.3.1.3. fuel switching capabilities; and

2.3.1.4. environmental constraints.

2.3.2. Generating unit(s) minimum:

2.3.2.1. design temperature; or

2.3.2.2. historical operating temperature; or

2.3.2.3. current cold weather performance temperature determined by an engineering analysis.

EOP-012-2 R2 and R3

- Generator Owners implement freeze protection measures on Generator Cold Weather Critical Components
  - To provide capability to operate at Extreme Cold Weather Temperature
  - Develop a CAP to add new or modify exiting to provide that capability

EOP-012-2 R2 and R3

- October 1, 2027
  - R2 applies to units with commercial operation on or after
  - R3 applies to units with commercial operation prior to

- Wind and Time Component
  - R2 – Temperature with sustained concurrent twenty (20) mph wind speed for (i) a period of not less than twelve (12) continuous hours
  - R3 – no specifics included in standard

EOP-012-2 R4

- Cold Weather Preparedness Plan documents:
  - Data calculated and documented in R1
  - Generator Cold Weather Critical Components (GCWCC)
  - Freeze protection measures implemented on the GCWCC
  - Annual inspection and maintenance of GCWCC

EOP-012-2 R5

- Moved from EOP-011-2 Requirement R8 to conduct training

i. 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~~7~~. *[Violation Risk Factor: Medium] [Time Horizon: Long-term Planning, Operations Planning]*

EOP-012-2 R6

- Corrective Action Plans shall be developed for a Generator Cold Weather Reliability Event when the following conditions are met:
  - The apparent cause(s) is due to freezing of equipment within the Generator Owner's control and the dry bulb temperature at the time of the event was at or above the Extreme Cold Weather Temperature.

- CAPs shall be developed:
  - no later than 150 days subsequent to the event OR
  - by July 1 that follows the event, whichever is earlier

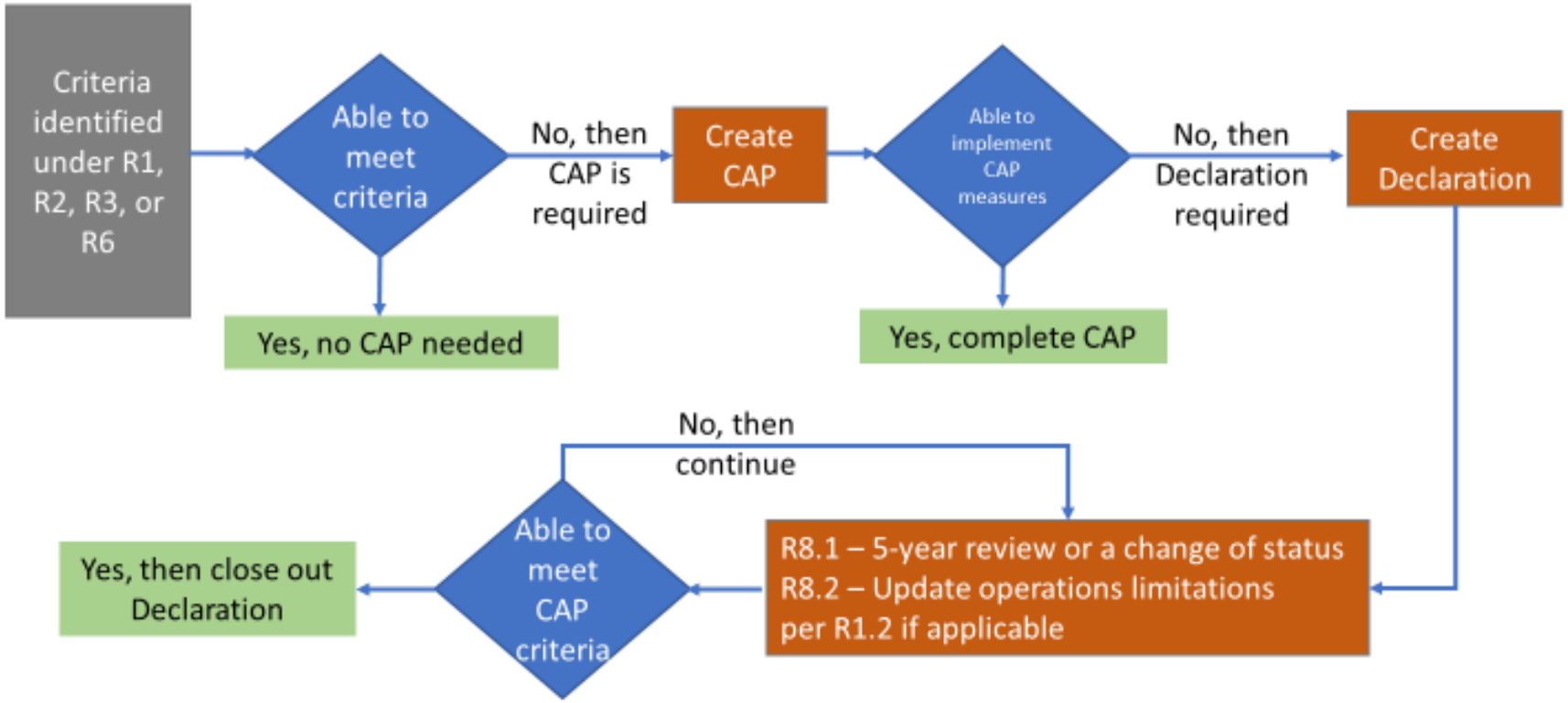
EOP-012-2 R7

- CAPs may be required by R1, R2, R3, or R6 to provide new or corrected freeze protection measures

- Part 7.1 requires CAP to have a timetable for execution.
  - Actions that address existing equipment or freeze protection measures must be completed within 24 months of development of the CAP.
  - Actions that require new equipment or freeze protection measures must be completed within 48 months of development of the CAP.

- Generator Owners may declare a Generator Cold Weather Constraint (see definition) if unable to implement actions in the CAP

Generator Cold Weather Constraint (GCWC) - Declaration Process (EOP-012-2)



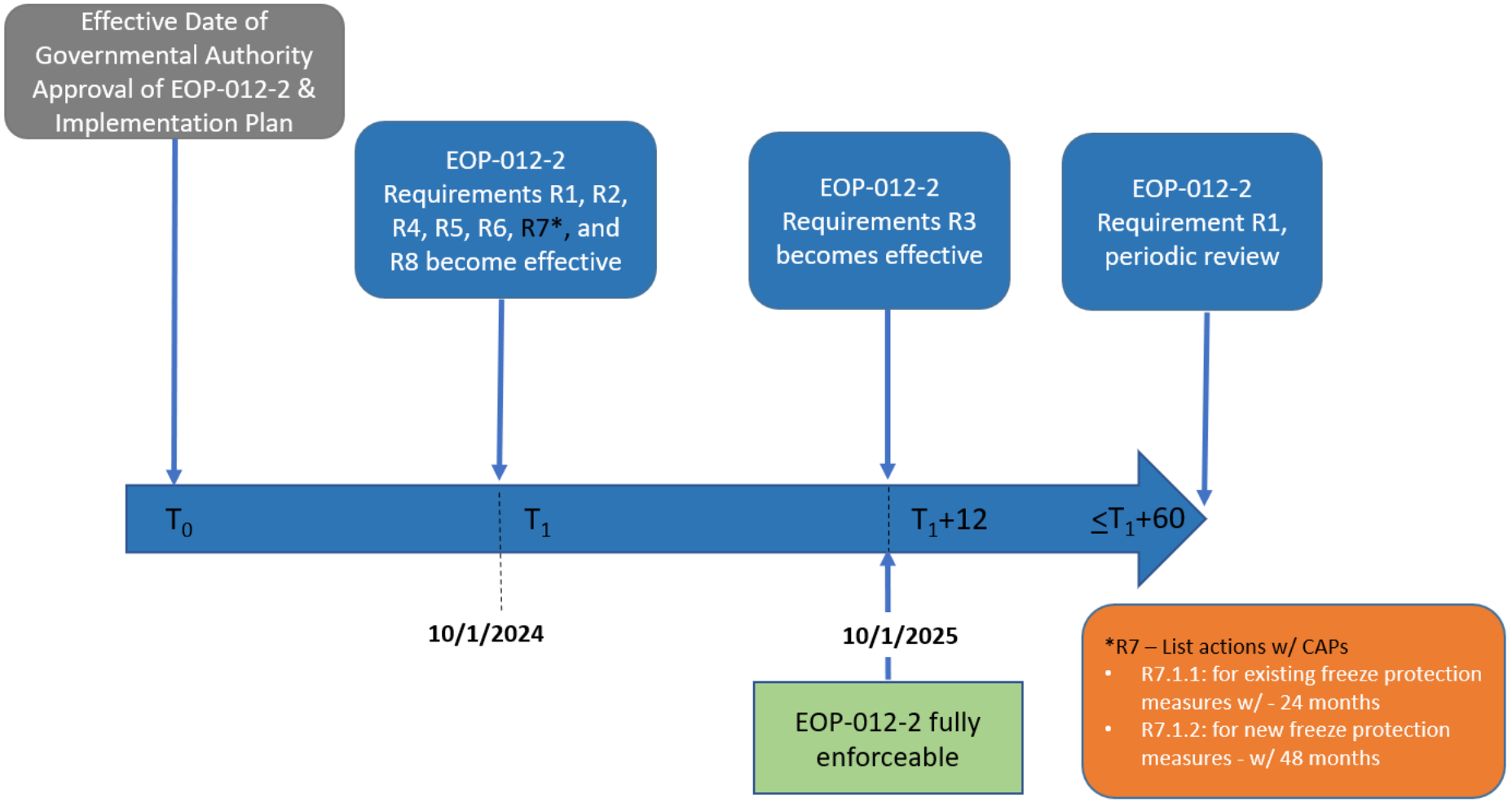
Where Are We Now?

- EOP-011-3
  - FERC deferred approving effective date of October 1, 2024
- EOP-011-4
  - FERC approved February 16, 2024
  - FERC deferred approving effective date until revised EOP-012-2 submitted
- TOP-002-5
  - Effective Date October 1, 2025
- EOP-012-1
  - Effective date, October 1, 2024
- EOP-012-2
  - Filed with FERC February 16, 2024

EOP-012-2 Implementation Plan

- Effective 10/1/2024
  - R1 – ECWT and unit cold weather information
  - R2 – Applicable to generating units with a commercial operation date on or after October 1, 2027
  - R4 – Cold Weather Preparedness Plan (CWPP)
  - R5 – Annual training on CWPP
  - R6 – If a Generator Cold Weather Reliability Event (GCWRE) occurs, develop a CAP w/in 150 days or July 1, whichever is earlier
  - R7 – Timelines for the completion of Corrective Action Plans
  - R8 – Generator Cold Weather Constraint declarations
- Effective 10/1/2025
  - R3 – Applicable to generating unit(s) in commercial operation prior to October 1, 2027

Implementation Plan



2024 Cold Weather Small Group Advisory Sessions

- NERC will again be hosting small group advisory sessions as well as a general session centered around cold weather preparedness in 2024.
  - Sessions will be held the week of May 6, 2024, all of which will be virtual
    - SGAS One-on-one Sessions
      - Closed discussions between registered entity personnel and ERO Enterprise staff to discuss any issues related to EOP-012-2 and any other cold weather-related compliance concerns. Entities will be requested to provide discussion topics prior to these sessions.
      - **Registration is free and is required by March 22, 2024**. Send SGAS registration requests to derek.kassimer@nerc.net.
    - General Session
      - ERO Enterprise staff will present general information on EOP-012-2 and other cold weather-related compliance issues. **Registration for a one-on-one session is not necessary to patriciate in this general session.**
      - Webinar announcement with registration information will be sent out at a later date.

Questions and Answers