

Introduction

The WECC Generator Operator Working Group (GOWG) supports Generator Operators (GOP) within the Western Interconnection (WI) in their work related to generator operation and the reliability of the Bulk Electric System (BES). GOWG members created this guideline in agreement with the GOWG Charter.

Generators located within WECC's footprint are in a wide range of climates and terrains and they consist of several generator varieties. Some generators experience severe cold weather annually while others in WECC's footprint experience extreme winter weather only occasionally. It is important for every generator to have an Extreme Cold Weather Preparedness Plan to be proactive and avoid complacency.

The purpose of this guideline is to provide best practices to WECC member organizations in the development of an Extreme Cold Weather Preparedness Plan. In turn, this guideline will help participating organizations with cold weather preparations of generation assets to ensure reliability of the Bulk Electric System (BES) under all conditions.

Extreme Cold Weather Preparedness Plan

An Extreme Cold Weather Preparedness Plan is not required but has been recognized as critical in maintaining the reliability of the BES. WECC recommends that Generator Owners (GO) and GOPs develop a plan that includes procedures, guidelines, checklists, and training to address generation, equipment, and personnel.

The plan should include specific actions performed to prepare for operating during extreme cold weather conditions. It should identify risks specific to each generator during cold weather operation, the capability of each facility during typical and extreme winter conditions, and specific actions performed for cold weather preparation and operation. Preparation items are best placed in a checklist. In addition to including plant specifics, GOs and GOPs who operate a large generating fleet may consider creating general guidelines for use at various plants. Creating these resources enable an organization to track the performance of vital activities, provide resources to the appropriate personnel to properly respond to events during cold weather, and aid in the development of training. The preparedness plan should identify the role and responsibilities of operating personnel, senior

management, and other compliance stakeholders. The rest of this document includes some recommendations and best practices for documentation, equipment, and personnel that GOs and GOPs can use as a guideline in developing their Extreme Cold Weather Preparation Plan.

Documentation

The cornerstone of a good Extreme Cold Weather Preparation Plan is documentation. Each organization should consider the complexity of its generation portfolio, the amount of activities performed in preparation for cold weather, and each plant with its associated equipment when creating a method for documentation. It is understood that procedures, guidelines, and checklists are not universally equal terms and may mean different things to each company. These are provided as examples for use in differentiating important plan information.

Use procedures, or their equivalent, to capture activities that occur in real-time. Extreme cold conditions may be sudden and unpredictable but having procedures to help with the operation of equipment will help expedite a proper response. Procedures should be specific to plants and include detailed actions. GOs and GOPs may consider requiring human performance tools, like circle/slash, in using a detailed procedure. Consider dividing the procedure into sections for reference, and sections for step-by-step or continuous action. To keep procedures manageable in size, consider moving information not required for equipment operation or maintenance into a guideline.

Include general information in guidelines or their equivalent. These may apply to all personnel regardless of the generator. This is a good place to identify roles in cold weather preparation and operation across an organization.

Checklists are a simple way of summarizing weather preparation activities. Complete and save checklists when preparing for winter weather to ensure all lessons learned from previous years are captured, problem areas are addressed, and all equipment is properly protected. Documenting the actions taken to prepare for winter weather eliminates factors of human error. Use checklists for various inspections and verifications on generator equipment. You can also use checklists to procure winter weather supplies like heaters or emergency kits. Checklists may also be valuable in a post-event investigation by management or regulatory authorities. You can see a sample checklist used for a typical generator in Annexes B and C.

Equipment

Outages

GOs and GOPs maintaining enough supply of generation is essential to BES stability during winter months. It is the GOP's role to prepare its facilities' equipment and fuel supply for winter months. GOPs should do their best to limit planned outages and maintenance of generation facilities during the



months of cold weather for a generation facility, proactively postpone planned outages during winter events, and consider peak load and fuel supply when scheduling generation outages. If an outage is inevitable, monitor weather conditions daily and, whenever possible, return critical equipment that is essential to generating back to service before an extreme weather event. GOPs should do their best to keep Transmission Operators (TOP) informed of anticipated power delivery capabilities.

In addition, consider including an annual review of Computerized Maintenance Management Systems (CMMS) to ensure adequate preventative maintenance is scheduled on critical systems, equipment, and components for maximum freeze protection and winter preparedness. Also, it is best to review new work orders often for freeze-related issues and promptly correct the deficiency. It is also best practice to buy and inventory freeze-protection equipment and supplies for the entire winter to ensure winter weather readiness.

Capacity Limitations & Equipment

Each generator is designed to operate in certain conditions, including winter weather. Ambient temperatures will affect the capability design of generation and can ultimately limit the nameplate capacity of a facility. You should know the capacity limitations of your facility during the winter months and have your facility modeled properly. These practices help the Western Interconnection to maintain reliability during severe winter events. Certain types of generators, like wind, can buy cold weather packages that allow the generators to stay online for periods of cold weather that are routine for their location. It is also best practice to review plant and system cold weather design parameters and implement action plans as necessary for systems, equipment, and components that are vulnerable to cold weather conditions.

Generators that have fuel switching capabilities should know their overall capacity while operating on alternate fuel. Monitor the availability of fuel supply, including alternate fuel.

Balance of Plant Equipment

Not only do generating facilities need to ensure they properly prepare for winter events and severe cold weather, but substation equipment also needs to be properly maintained. Failure to properly prepare may affect the ability to deliver power.

- SF6 circuit breakers—ensure pressure and temperatures are in range to operate safely during severe cold weather. Perform annual maintenance that tests SF6 circuit breaker heaters and supporting circuitry to ensure they are functional. Consider inspecting breaker attributes daily or weekly.
- Transformers—check heaters in control cabinets and verify that main tank oil levels are proper for the actual oil temperature; check the bushing oil levels and the nitrogen pressure if necessary.



Personnel

Operations

GOPs should consider staffing in generation availability. For facilities in remote locations, it is not always the unavailability of the resource that causes a forced outage, but instead, plant staff cannot arrive on site due to icy roads or heavy snow conditions.

Consider shift schedules and operations personnel turnover during the winter months to account for the changes to load profiles. For example, maintaining a shift schedule with shift turnover that occurs before or after the morning peak helps ensure operational efficiency. Consider the need for more coverage for when ambient conditions are below 32° F with high winds and freezing rain where ice accumulation is possible.

It is beneficial for personnel to look for potential problem areas that may be vulnerable to winter weather operational issues. Once personnel find those areas, develop a list of critical, site-specific problem areas to mitigate risks that could cause a generator to trip or de-rate, impact generator start-up, cause damage to the unit, or create a safety hazard related to winter weather. Specific examples of problem areas are—

- Heat trace systems failed or inadequate;
- Wind breaks missing or inadequate;
- Insulation removed, damaged, or inadequate;
- Instrument cabinet or enclosure heating elements failed or inadequate; and
- Freeze protection support equipment not available.

Training

Training on the Extreme Cold Weather Preparation Plan is important to ensure all operating personnel are aware of circumstances that could occur during winter events. Plant personnel should know their role and responsibilities in preparing generating facilities for winter weather. Employ methods like an annual meeting with generator personnel to review winter readiness plans before the winter season begins. This will ensure processes and procedures are accurate and that scheduling for the upcoming winter season is derived. It is recommended that you annually train all affected generator personnel on the winter readiness plan before the winter season.

Training can occur in several forms: staff readiness meetings, drills, exercises, and presentations, among others. Training topics should cover communication guidelines or procedures. Personnel must know how to communicate changing resource conditions to senior management and to appropriate reliability entities like the Reliability Coordinator (RC), Balancing Authority (BA), and TOP. GOPs should train on the use of backup communication systems.



Winter Generator Preparation Guideline

Consider topics for further training, such as emergency response scenarios, response to freeze protection alarms, and lessons learned from past winter events for a particular generator or even the lessons learned¹ experienced by the industry. NERC posts past winter events. NERC and the other regions hold various winter readiness workshops in person and by webinar. It is important to keep training topics and a list of attendees on record.

Safety

The goal is to ensure adequate generation is available during severe winter events, however, safety of personnel is considered top priority, and actions to maintain optimal safety should be implemented accordingly. Plan safety briefings during extreme cold weather and consider assigning a partner for each person on site to gain assurance of personnel safety. A GOP may consider issuing personal protective equipment for working activities during winter weather events. This can include slip-resistant shoes and winter gloves. In addition, consider staging space heaters. Most importantly, GOs and GOPs need to ensure that facilities are set up to accommodate needs in a safe way and that precautions are taken during non-normal or emergency operations.

Shelter in Place

During extreme cold weather, operations staff may assess conditions of a facility and decide it is safest to remain in place to ride through a storm. Keep an accurate inventory of supplies and equipment for surviving a winter event on site should personnel be have to stay on site for an extended period. Items may include food, cots, blankets, portable heaters and generators, ice and snow removal equipment, and properly stocked vehicles.

¹ NERC published lessons learned: <https://www.nerc.com/pa/rrm/ea/Pages/Lessons-Learned.aspx>



Annex A

References

[NERC Reliability Guideline: Generating Unit Winter Weather Readiness – Current Industry Practices](#)

[NERC Lessons Learned page](#)

[PJM Manual 14D: Generator Operational Requirements](#)

[NERC's Polar Vortex Review](#)

[FERC/NERC Staff Report on the 2011 Southwest Cold Weather Event](#)

[ERCOT and Texas RE Generator Winter Weatherization Workshop](#)



Annex B

Sample Generator Winter Preparation Checklist

UNIT

Verify Heating is on in all buildings

- Switch-gear Room (EHU-1, EHU-2, breakers 1, 3, 5 & 25, 27, 29).
- Fire Protection Valve Enclosure Building Aux. Transformer.
- Electrical Building Just West of Cooling Tower Chemical Building.
- Cooling Tower Chemical Building (Unit Heaters EUH 19 & 19).
- Fire Protection Valve Enclosure building Just South of Cooling Tower.
- CEMS Shack.
- Boiler Feed Pump Building (Unit Heaters EUH 20 & 21).
- Turbine Building (Unit Heaters EUH 1 - 15) (7 removed, power routed out to spare transformer pad).
- Penthouse (Unit Heaters EUH 16 & 17) NE corner upstairs and downstairs.
GSU Transformer Heater In /Auto (Locally @ 8-6 heater circuit on).
- Verify heater in Serveron UPS cabinet in service.
- Water Wash Building.
- CTG Accessory Compartment.
- LCI Control Building.
- CTG PEEC.
- Heat Trace on Storm Pond Pumps.
- HRSG service water & air lines isolated inside & lines drained outside.
- Spare transformer heater (Powered from old Unit heater #7, disconnect).

Verify all heat trace circuits on/not tripped

- Plant-XX-L-24 Boiler Feed Pump Building.
- Plant -XX-L-25 Boiler Feed Pump Building.
- Plant-XX-L-26 Penthouse (verify all circuits on/not tripped).
- Plant-XX-L-27 Cooling Tower Chemical Feed Building.

Common Items/Supplies

Heaters and fuel

- Check to ensure adequate quantity (minimum 5), type, and condition of portable heaters.
- Check to ensure adequate supply of usable fuel containers.



Winter Generator Preparation Guideline

- Check to ensure adequate supply of good-quality tarps and tie down ropes.
- Thermostats: At least 60.

Ice Melt

- 10 Bags or Buckets on site.

Any Unit shutdown with auxiliary boiler in-service

HRSG and Cooling Tower

- Stack damper shut.
- HRSG (HP, IP, LP, FWH sections).
- Cooling Tower bypassed.

HP steam

- All 3 sets of double valve drains at station are open.
- Station bypass valve is open (to allow leg from BFP's to drain).
- IP Feed Water Header double drain open (just downstream of BF-FE-411).

Manual Drum Blowdown Lines to Blowdown Tank

- Drains on HP legs cracked open.
- Drains on IP legs cracked open (2).
- Drains on LP legs cracked open (2).

Technician: _____

Date/Time: _____

Remarks:



Annex C

Generator Winter Preparation Checklist for Wind Facilities

Site: _____ Name: _____

Date: _____ Title: _____

	Yes	No	N/A
Reviewed previous winter event issues and applied any applicable lessons learned?			
List any lessons learned from previous winter experienced at site or applicable lessons learned posted by NERC from previous year (link):			
Are there any exposed components on site that need additional insulation?			
If yes, please list components and verify that insulation was added as needed:			

	Yes	No	N/A
Have the oil hydraulic heaters for each turbine been plugged in (if applicable)?			
Date verified:			
Have all the heaters inside the turbine been verified for operation?			
Date verified:			
Have transformer oil levels been checked and refilled if necessary?			
Date verified and refilled:			
Does the site have a backup generator?			
If yes, has it been tested for functionality? Date of test:			
Does the site have a proper stock of food and emergency supplies in the O&M building?			



Winter Generator Preparation Guideline

Do site personnel have the proper supplies needed in their vehicles to be able to travel winter roads?			
If temporary lodging should be required for personnel during a winter storm event, is there a plan in place to arrange for it? (e.g., cots, blankets, etc.)			
If yes, please describe plan:			

