Winter Weather Readiness

September 10, 2024

Curtis Holland Senior Reliability Specialist WECC



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AESO – January 2024 Winter Extreme Weather

September 10, 2024

Lane Belsher Manager, Real-Time Operations - Markets AESO



AESO – January 2024 Winter Extreme Weather



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Source: AESO Annual Market Statistics Datafile (data as of Dec 31, 2023) *Renewables include wind, solar and hydro.

Source: Monthly Sales History 2022 (www.auc.ab.ca/annual-electricity data/)





3 Interconnections



> 800 MW AC tie west to BC

> 300 MW AC tie south to Montana

153 MW DC tie east to Saskatchewan





Thursday Jan 11

- All-Time Winter Peak 12,384MW
- No Energy Emergency Alert (EEA)
- Large gas-steam turbine scheduled maintenance;
 Combined-cycle on forced derating due to icing

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- Commercial import available
- Wind reduced to < 200MW

- Net Imports
- Storage
- Wind
- Solar
- Hydro
- Dispatchable Gas



~800 MW of wind

Friday Jan 12



- EEA3 @ 16:15
- Combined cycle on forced outage
- No wind
 - Used Energy storage to increase Path 1 import

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- Commercial and emergency import
- EEA0 @ 21:12







Emergency import

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Sat Jan 13 WECC

- External:
 - High demand in US Pacific NW and BC
 - Planned intertie outage between California and Pacific NW
 - Idaho declared EEA3 AM (and 4 others)
 - Prairie Jackson Gas storage forced outage
 - Mid-C spot price > CDN 1,300\$
 - Priced out = No commercial offers input







- EEA3 15:30
 - Gas steam turbine derate and recovered
 - 150 MW from Western Power Pool (WPP) for 1 hour
 - Consumed Energy Storage for reserves
- Emergency Alert sent at 18:44
 - Exhausting Energy Storage and WPP emergency sharing
 - 170 MW of load drop within 3 mins and further 100 MW in 10 mins
 - Combined cycle tripped due to line outage



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Sunday Jan 14

- Additional generation outages
- Gas-steam turbine derated and recovered
- Slightly higher wind and more import available
- Prolonged load evening down-ramp

Net Imports
Storage
Wind
Solar
Hydro
Dispatchable Gas

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- Continuation of Sunday's conditions
 - No import
- Tight supply until wind & solar generation ramp up

Net Imports
 Storage
 Wind
 Solar
 Hydro
 Dispatchable Gas





Thank You



Extreme Natural Events

September 10, 2024

Steve Ashbaker Reliability Initiatives Director WECC



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RRC ENE Task

- Identify strategic initiatives for extreme natural events:
 - 1) Identify specific risk areas within the broader topic of "extreme natural events" that pose unique risks to the reliability of the Western Interconnection Bulk Power System (BPS) that, if addressed, would be most valuable to stakeholders. Determine the best way to collaborate with the RAC on this initiative.
 - 2) Determine whether and how these specific risk areas are being addressed in the industry and determine how to share these lessons most effectively with stakeholders.
 - 3) Based on this research, determine one or more specific risks the RRC should address via the RRC Risk Management Process.
 - 4) Develop a strike team by February 2023, followed by developing a plan to identify specific tasks that can be completed within 12 months.

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Extreme Natural Events

Factors to consider

- 1. What reliability impacts of extreme natural events exist for system operations?
- 2. What best practices already exist or are needed to address extreme natural events?
- 3. What types of system characteristics and conditions expose the interconnection to the greatest risk from natural events?



Extreme Natural Events

- Category A—Events Related to Changing Climate
 - Extreme temperatures—heat domes/waves and cold snaps
 - Haboobs/extreme dust storms
 - Wildfire events
 - Drought/aridification (climate change causing higher average temperature)
 - Atmospheric rivers and flooding
 - Rising oceans and coastal erosion
 - Extreme winds

Extreme Natural Events

- Category B—Physical Forces in Earth and Space Causing Disruptions
 - Earthquakes
 - Tsunamis
 - Volcanic eruptions
 - Geomagnetic disturbances



ENE Analysis Objective

- Extreme Natural Events description.
- Identified associated risks affecting BPS reliability.
 - Risk description and characteristics.
- Mitigation Activities.
 - What is currently being done (nationally, WECC, etc.)?
 - What should WECC/Western Interconnection be doing?
- <u>RRST Extreme Natural Events white paper</u>.



Extreme Cold Weather Event Risk Mitigation

- NERC Alerts Level III
 - Eight Essential Actions Cold Weather Preparedness
- NERC Alert Level II Cold Weather Preparations for Extreme Weather Events
 - Eight Recommendations for winter weather preparedness
- EOP-011-4 (10/1/2024), EOP-012-2 (FERC Filing, 2/16/2024)
- TPL-008, BAL-008, BAL-007 new standards in process
- Reliability Risk Register
- ENE Mitigation Plan Advisory Group

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Power Plant Winterization Measures

September 10, 2024

David Lemmons Co-Founder Greybeard Compliance Services



Power Plant Winterization Measures

Prepare for Winter and Winter Storms September 10, 2024

Winterization



Merriam-Webster definition: to make ready for winter or winter use and especially resistant or proof against winter weather







- New standard requires a plan to ensure power plants are ready for winter.
- Expectation is that your plant can continue to generate down to your Extreme Cold Weather Temperature.
 - Hope is that you can withstand any temperature you encounter.
- What is needed to be prepared?
 - Standard requires at least a seasonal plan for the winter season
 - Are multiple processes, one for pre-winter and one or more depending on expected weather, better for your plant?



- Consider the temperature swings at your location.
 - 73° at 5:00 p.m. on the 20th, 23° at 9:00 a.m. on the 25th
 - 38° at 8:00 a.m. on the 28th, -20° at 7:00 a.m. on the 30th
- Extreme Weather is not new
 - Denver Record Daily Temperature change is from January 1872
 - 66° drop from 46° to -20°
 - Second-largest change is from -2° to 62° in January 1888

Generator Cold Weather Reliability Event



Generator Cold Weather Reliability Event Areas

Generators have two areas where a Generator Cold Weather Reliability Event can occur.

Common Freeze Protection Measures

- Heat trace for pipes and sensors
- Heaters of all types
 - Inside control cabinets
 - Portable heaters
 - Heated enclosures/O'Brien boxes
- Temporary shelters/wind breaks







• Fuel Delivery

- Are coal conveyor belts open to the elements and therefore susceptible to the effects of blowing snow?
- Is your gas delivery path protected from the weather?

• Operating versus Off-line

- What areas of the plant are more susceptible to freezing if the plant is not operating as temperatures drop?
- Is there a limitation on the ability to start?
 - Will it take more time to start if the outside temperature is very cold?



- Not a lot of water used, so what needs to be winterized?
 - Are all heaters working in the substation, met towers, base of towers and the hubs/nacelles?
 - Are these heaters remotely monitored?
 - If monitored, does it provide status of the heater, the temperature in the compartment other information?
 - Liquid-cooled invertors
 - Can lubricants meet the ECWT without heaters?
 - Are breakers a potential cold weather limitation for start-up?

Generator Issues in Winter Storm Elliot

- Electrical/Mechanical Failures 41%
 - Correlation between cold temperatures and high levels of failures
- "Freezing" Issues 31%
 - Blade Icing
 - Freezing Instrumentation
 - Blocked Inlets, etc.
- Natural Gas Issues 20%
 - Transportation Issues



- Gas Market Timing versus Electric Market Timing
- Retail/End Use Customers given priority over Generation

• Doors and Windows

- Seasonally
 - Check doors for proper operation and seal
 - This includes overhead doors and entry doors
 - Are windows broken or missing
- Before Forecast Cold Weather
 - Verify doors and windows are closed
- Air Vents
 - Do you have vents that need to be covered before cold weather, but not for the entire winter season?
- Other areas to consider?







David Lemmons Greybeard Compliance Services DavidL@GreybeardCS.com

Break





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Extreme Weather CMEP Efforts

September 10, 2024

Derek Kassimer Senior Engineer NERC

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History



During the week of February 14, 2021, for over two consecutive days, ERCOT averaged 34,000 MW of generation outages, nearly half of ERCOT's 2021 all-time winter peak load of 69,871 MW.



Project 2021-07

- <u>Project 2021-07 Extreme Cold Weather Grid Operations, Preparedness, and Coordination</u>
- Key recommendations from <u>Report</u>
- Phase 1
 - February 2022 September 2022
 - EOP-011-3 and EOP-012-1
- Phase 2
 - October 2022 September 2023
 - EOP-011-4 and TOP-002-5
- Phase 3

ECC

- October 2022 February 2024
- EOP-012-2

Project 2021-07

- <u>FERC Order June 27, 2024</u>
 - Approved EOP-012-2
 - Approved EOP-012-2 Implementation Plan
 - Approved Generator Cold Weather (GCW) Constraint, GCW Critical Component, GCW Reliability Event, Fixed Fuel Supply Component, (Extreme Cold Weather Temperature (ECWT) previously approved with EOP-012-1)
 - Approved retirement of EOP-012-1
 - Approved EOP-011-4 Implementation Plan
 - Approved retirement of EOP-011-2 and EOP-011-3
- However...



Project 2021-07

- FERC directed modifications to EOP-012-2:
 - Clarify GCW Constraint to be objective and sufficiently detailed AND to remove all references to "reasonable cost," "unreasonable cost," "cost," and "good business practices" (replace with objective, unambiguous, and auditable terms)
 - NERC process for GCW Constraint (receive, review, evaluate, and confirm the validity in a timely way
 - Shorten and clarify Corrective Action Plan implementation timelines and deadlines
 - Ensure extension of CAP implementation deadline beyond the maximum implementation time frame required is pre-approved by NERC AND ensure operating limitations are provided during the period of extension
 - Implement more frequent reviews of GCW Constraint declarations to verify that the declaration remains valid



Implementation Plan

- EOP-012-2: October 1, 2024 (*EOP-012-1 superseded*)
- EOP-011-4: October 1, 2024 (EOP-011-3 superseded), with compliance dates:
 - R1 Part 1.2.5: (new/revised portions applicable to UVLS, UFLS, critical natural gas infrastructure loads): April 1, 2027
 - R2 Parts 2.2.8-2.2.9 (new/revised portions applicable to UVLS, UFLS, critical natural gas infrastructure loads): April 1, 2027
 - R8: April 1, 2027, or 30 months past notification by a TOP to assist with mitigation of operating Emergencies
- TOP-002-5: October 1, 2025 (already approved/announced in February 2024, no change)

EOP-011-4 Implementation Plan

Effective October 1, 2024

- **1.2.5.** Operator-controlled manual 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); and
 - **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.
- 1.2.6. Provisions to determine reliability impacts of:
 - 1.2.6.1. cold weather conditions; and
 - 1.2.6.2. extreme weather conditions.

Redline Language Effective April 1, 2027

- **1.2.5.** Operator-controlled manual Load shedding <u>or automatic Load shedding</u> during an Emergency that accounts for each of the following:
 - 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 <u>or automatic</u> Load shed and circuits that serve designated critical loads <u>which are essential to the reliability of the BES</u>;
 - 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_ <u>shed (UVLS);</u>

shed (UVLS); and

- 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_{*2}
- 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; and
- 1.2.6. Provisions to determine reliability impacts of:
 - 1.2.6.1. coldCold weather conditions; and
 - 1.2.6.2. extremeExtreme weather conditions.



EOP-011-4

- Introduced "designated critical natural gas infrastructure loads"
- Established TO, DP, DP UVLS obligations for Load Shedding Plan
 - Plan for operator-controlled manual Load Shedding, UVLS, and UFLS during an Emergency, including:
 - Adequacy of implementation time frame
 - Minimizing overlap of designated for manual/UVLS/UFLS and critical loads
 - Minimize overlap of manual and UFLS/UVLS
 - Limiting utilization of UFLS/UVLS circuits in manual load shed (system condition dependent)
 - Identify and prioritize designated critical natural gas infrastructure loads

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EOP-011-4





EOP-012-2

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EOP-012-2

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EOP-012-2

- R1—Calculate ECWT, provide cold weather data (limitations and minimum temp)
- R2(new)/R3(old)—Identify GCWCC and implement freeze protection measures; NEW: 20 mph/12 hours operate at ECWT; OLD—operate at ECWT
- R4—CW Preparedness Plan
- R5—Training
- R6—Develop CAP if GCWRE occurs
- R7—CAP timetable/actions/deadlines declare GCW constraint
- R8—Review constraint/update limitations

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Process



SGAS

- EROE Team—19 people
- General session—Close to 500 attendees
- One-on-one sessions—started with 40+ companies (60+ NCRs) registering ended up with approx. 25
- Over 140+ draft questions
- FAQ posted





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Cold Weather Efforts in the West

September 10, 2024

James Hanson Manager, Operations Analysis WECC

Winter Storm Elliott-Recommendation 1b

Recommendation 1(b): Findings from the Report support the need for robust monitoring by NERC and the Regional Entities of compliance with the currently effective and approved generator cold weather Reliability Standards, to determine if reliability gaps exist. NERC should identify the generating units that are at the highest risk during extreme cold weather and work with the Regional Entities (and Balancing Authorities, if applicable) to perform cold weather verifications of those generating units until all of the extreme cold weather Standards proposed by the 2021 Report are approved and effective. (Verify highest risk units by Q4, 2023; implement by Q3, 2024)



Determining Potential Generators Posing Risk

- NERC dependent on assistance from Regional Entities
- Data Sources Used
 - NERC—Alert Cold Weather Preparations for Extreme Weather Events
 - Generation Type and Location
 - GADS Outage Data



Cross Departmental Team

- Curtis Crews—Senior Technical Advisor, Entity Monitoring
- Greg Park—Senior Risk Analysis Specialist, Risk Analysis and Data Services
- Curtis Holland Senior Reliability Specialist, Operations Analysis
- Fahad Ansari—Senior Technical Advisor, Oversight Planning
- Dave Grover—Senior Reliability Engineer, Operations Analysis
- James Hanson Manager, Operations Analysis



Additional Information Requested

- Questions were developed on:
 - Incomplete essential actions tied to NERC Alert
 - Cold weather readiness processes and procedures
 - Cold weather maintenance and training
 - Units involved in cold weather events—what was learned
 - Freeze protection measures for units with ECWT above 32° F
 - How freeze protection measures are monitored



Contact with Selected Entities

- Held webinars with entities explaining the effort
 - Why
 - Selection Process
 - Review of Questions
- Offered help throughout the response period



Responses Received

- Internal team reviewed responses
 - Identified where follow-up was necessary to understand approach
 - Identified responses exhibiting stand-out practices
 - Identified responses where improvements could be made
- Held follow-up calls with entities to address questions from initial responses
- Identified generating stations to perform on-site verifications



Feedback from Effort

- Individual feedback to selected entities
 - Observation sheet
 - Areas of strength
 - Opportunities for improvement
- General audience
 - Provide observations to NERC for ERO-wide presentation
 - Regional presentations



Continued Efforts—Recommendation 1c

1(c) Generator Owners/Operators should assess their own freeze protection measure vulnerability, and NERC or the Regional Entities should perform targeted cold weather verifications pursuant to a riskbased approach.



Generator Readiness Program

- Looking to start a program that will periodically select generation sites to perform readiness reviews
- Look beyond cold weather readiness
- Focused on identifying good practices with industry



Recommendation 3

A NERC–Regional Entity team, working with FERC staff, should study the overall availability and readiness of blackstart units to operate during cold weather conditions



Recommendation 3

- Plants have been selected
- RFIs have been sent and waiting responses
- Responses will be reviewed
- Findings will be shared with industry late Q4 2024/early Q1 2025



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Resources

- NERC Information on Cold Weather Preparation and BPS Impacts
- <u>NERC Major Event Reports</u>





www.wecc.org