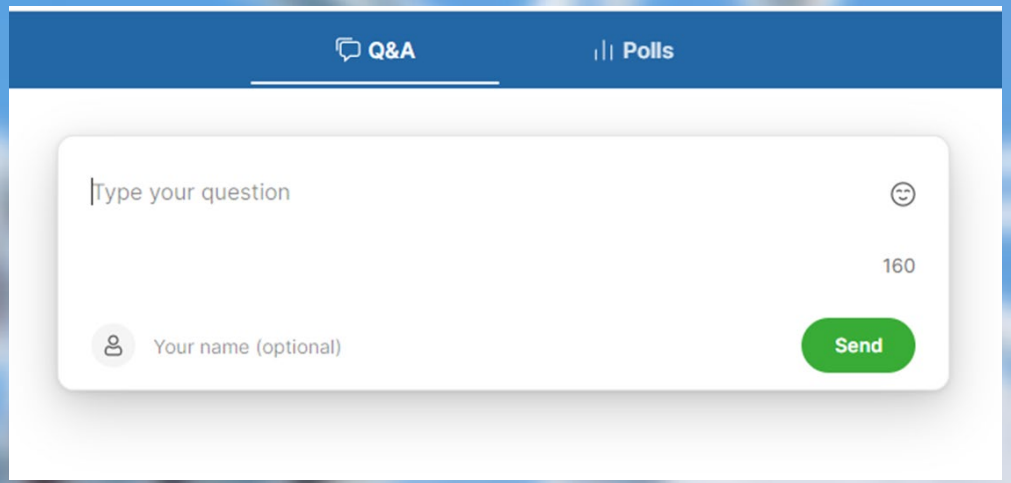
Winter Weatherization Workshop

Begins at 9:00 a.m. Central

- Executive Welcome
- Updates Since Uri
- Inquiries and Alerts
- ERCOT Weatherization Activities Update
- Weatherization Standards
- PUCT Winterization Activities Update
- RRC Winterization Activities Update
- 2023-24 Winter Weather Forecast and Review of Historical Winter Extremes
- Winter Weather Prep and Lessons Learned
- NERC Winterization Activities Update
- Entity Inspection Program

To submit questions during the workshop, please visit **slido.com** and enter today's participant code: **TXRE**



Welcome and Instructions

Matthew Barbour– Texas RE
Manager, Communications and Training

Antitrust Admonition

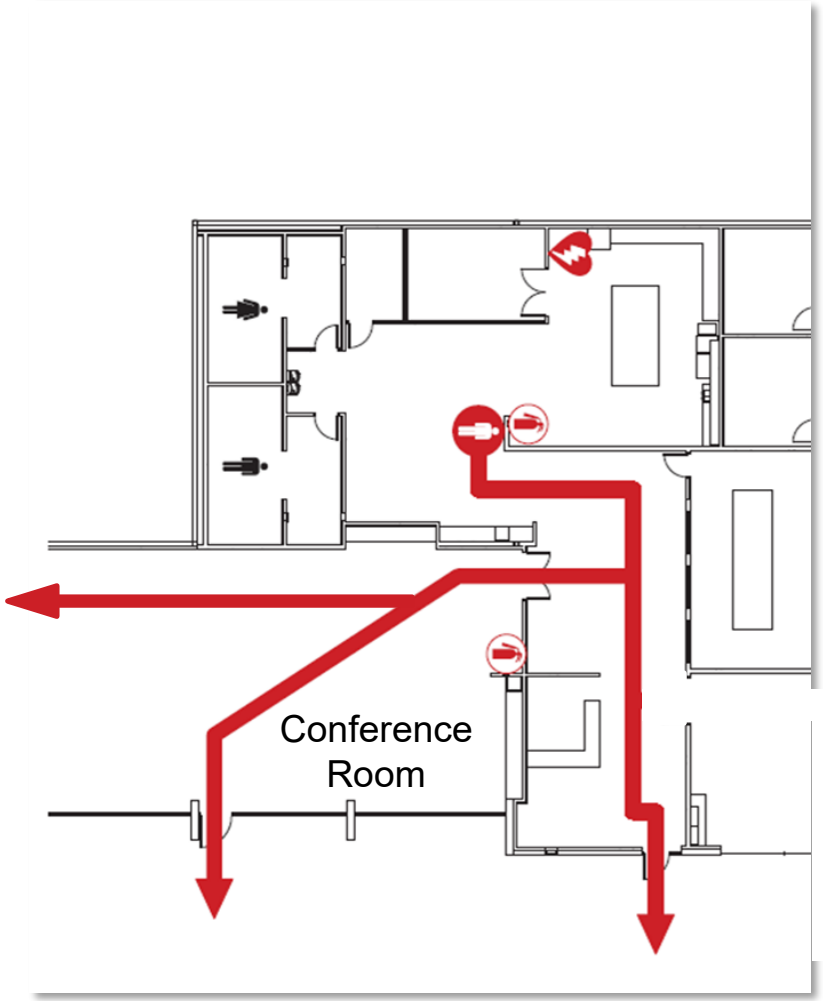
Texas Reliability Entity, Inc. (Texas RE) strictly prohibits persons participating in Texas RE activities from using their participation as a forum for engaging in practices or communications that violate antitrust laws. Texas RE has approved antitrust guidelines available on its website. If you believe that antitrust laws have been violated at a Texas RE meeting, or if you have any questions about the antitrust guidelines, please contact the Texas RE General Counsel.

Notice of this meeting was posted on the Texas RE website and this meeting is being held in public. Participants should keep in mind that the listening audience may include members of the press, representatives from various governmental authorities, and industry stakeholders.

Safety Moment

In case of emergency, evacuate through the nearest door

Rally point is in the front parking lot



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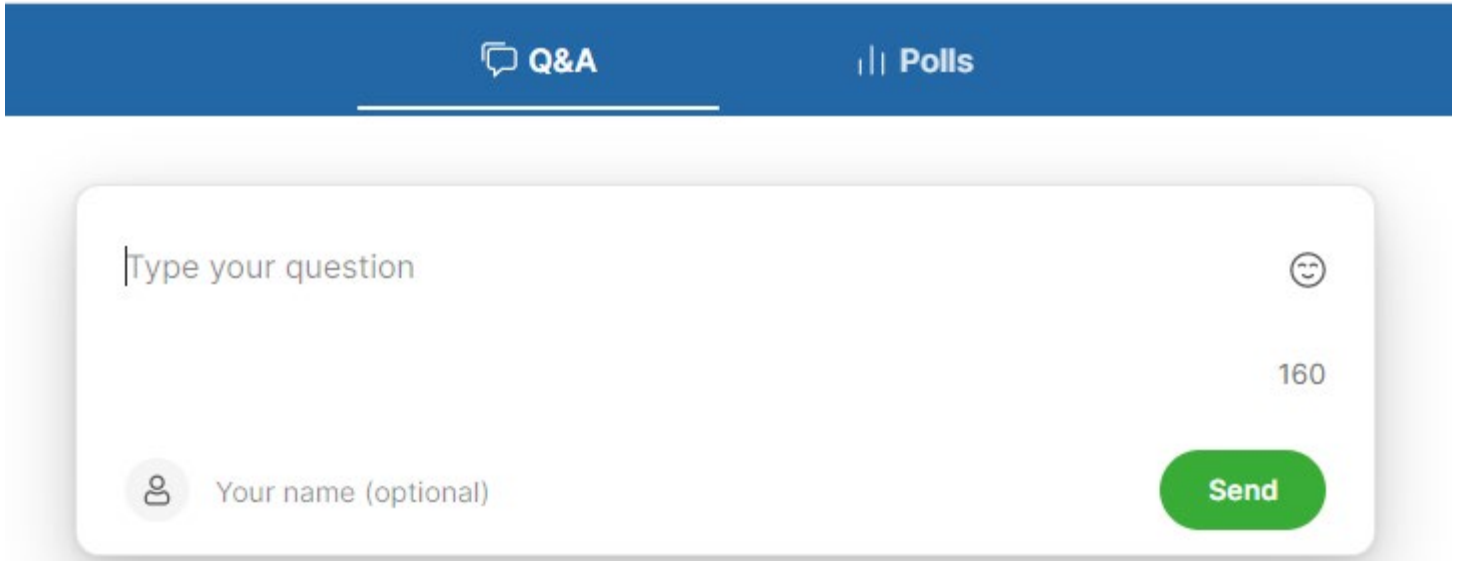

Agenda & Speaker Bios

Agenda

Speaker Bios

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TEXAS RE
Ensuring electric reliability for Texans

COMPLIANCE ENFORCEMENT REGISTRATION RELIABILITY SERVICES STANDARDS

Winter Weatherization Workshop
September 13, 2023

Texas RE's 2023 Winter Weatherization Workshop will be held on September 13, 2023, beginning at 9:00 a.m. Central. This workshop is intended for all stakeholders in the Texas Interconnection and will feature speakers from Texas RE and external entities.

Register

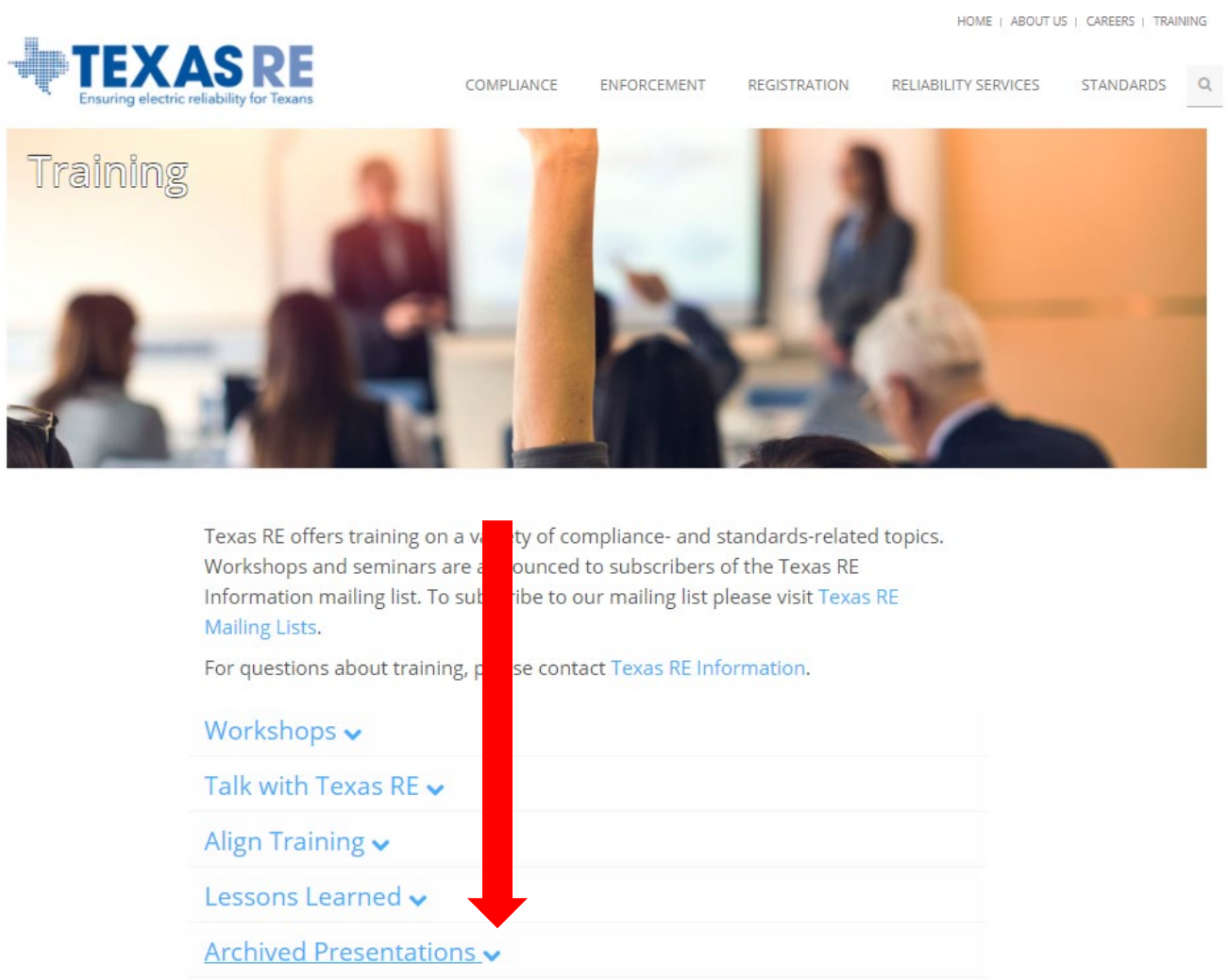
Agenda

2023 Winter Weatherization Workshop Agenda

Topic	Speaker
Executive Welcome	Jim Albright (Texas RE)
Updates Since Uri	Michael Jewell (Michael Jewell and Associates)
Inquiries and Alerts	Mark Henry (Texas RE)
ERCOT Winterization Activities Update	David Kezell (ERCOT)
Weatherization Standards	Rachel Coyne (Texas RE) & Venona Greaff (Project 2021-07 SDT)
PUCT Winterization Activities Update	Thomas Gleeson (PUCT)
RRC Winterization Activities Update	Mysti Doshier (RRC)
2023-24 Winter Weather Forecast and Review of Historical Winter Extremes	Chris Coleman (ERCOT)
Winter Weather Prep and Lessons Learned	Brock Carter (Austin Energy)
NERC Winterization Activities Update	Kiel Lyons (NERC)
Entity Inspection Program	Jake Bernhagen (MRO)

Speaker Bios

Training Page



Social Media

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TEXAS RE
Ensuring electric reliability for Texans

WINTER WEATHERIZATION WORKSHOP

Jim Albright– Texas RE
President & CEO

Texas RE Winter Weatherization Workshop: Updates Since Winter Storm Uri

Michael J. Jewell
Jewell & Associates, PLLC
September 13, 2023

Winter Storm Uri

What Happened: Overview of Winter Storm Uri

- On Saturday, February 13th, a polar vortex swept across Texas causing severe winter storms and record-setting low temperatures throughout the week that led to record electric demand, natural gas supply constraints, and generator equipment failures

- Power and natural gas prices were severely impacted during the polar vortex event
  - System-wide power prices averaged over $6,500/MWh(1), compared ~$18/MWh in February 2020
  - Real-time prices hit $9,000/MWh cap for 31 hours
  - Natural gas prices reached over $300/MMBtu, with reports as high as $500+/MMBtu (if gas could even be sourced)
- On Monday 2/15 ERCOT implemented rotating outages of up to 20 GW to address emergency supply/demand imbalance and prevent a prolonged statewide blackout
  - Estimated peak load (without load shed) was 76.8 GW for Tuesday 2/16, higher than ERCOT's all-time summer peak
  - In response to the electric crisis, the PUCT has issued several orders to ERCOT and the Texas electric utilities(2) (see lower left), and the Railroad Commission of Texas issued an order to prioritize gas deliveries to electric generators over industrial demand

Key PUCT Orders

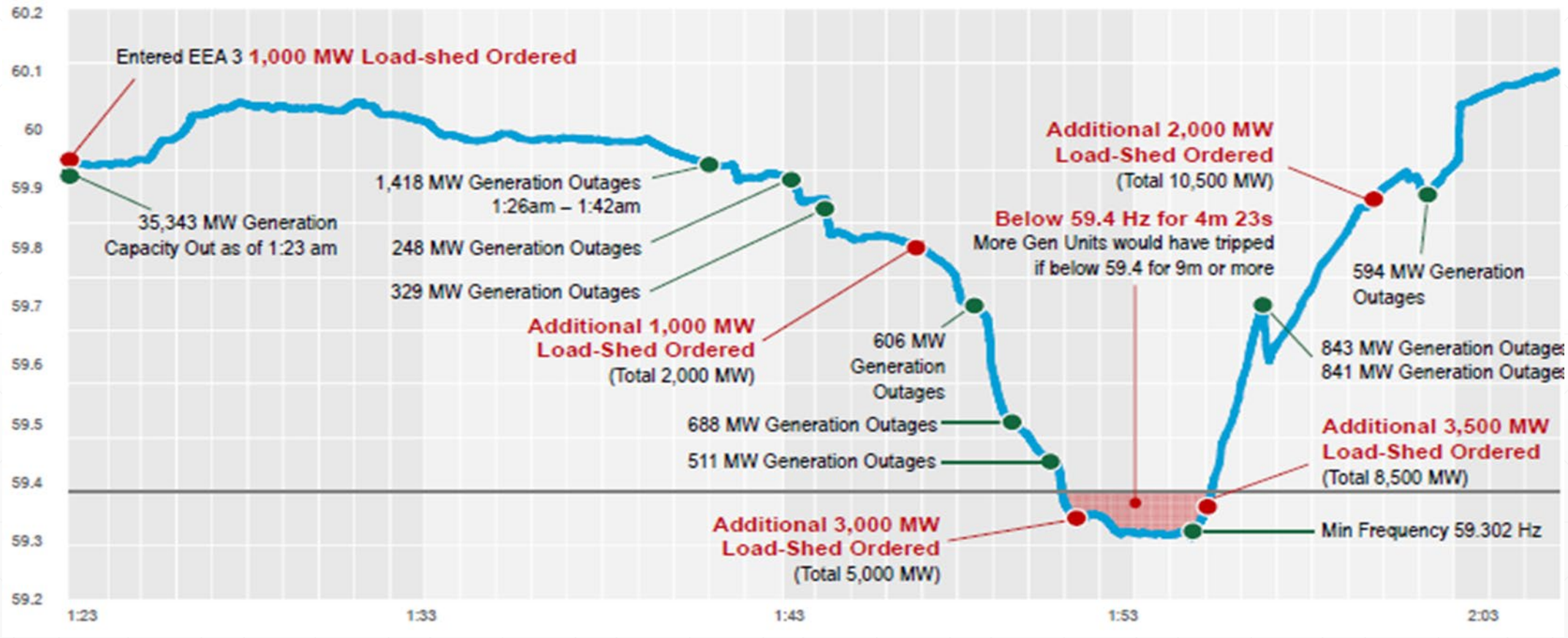
1. Direct ERCOT to adjust prices such that shed load is accounted for in prices (i.e. raise to $9,000/MWh cap)
2. Suspension of "alternative" price cap that would have taken effect after the peaker net margin threshold was achieved on 2/16(5),(6)
3. Grant ERCOT authority to use its sole discretion to resolve financial obligations of market participants (i.e. authority to change timing/deadlines, utilize CRR funds, relax credit requirements, etc.)
4. Suspension of customer disconnection for non-payment and extension of required offers for deferred payment plans

Unprecedented Energy Supply / Demand Dynamics

Record Winter Peak	69.2 GW
Record NG Demand for Power	2.3 Bcf/d
Max Capacity Forced Outage	52.3 GW or 48.6% total MWs(3)
Gas-Fired Capacity Derates	*~9 GW*
Frozen Wind / Solar	*~20 GW*
Frozen Thermal	*~22 GW(4)*
Grid Frequency Instability Event	▪ Potentially tripped 10-20 GW
Natural Gas Supply Disruption	▪ Delivery priority for home/business heating under emergency orders ▪ Low pipeline pressure from frozen equipment and compressor outages due to rolling black outs ▪ >50% decline in Texas natural gas production due to freeze-offs

Sources: ERCOT, SNL Energy and industry publications
DA = Day-Ahead; RT = Real-Time; PUCT = Public Utility Commission of Texas;
(1) Average DA and RT pricing for "ERCOT Hub Average" price point from 2/14 to 2/19
(2) PUCT jurisdiction does not extend to municipal utilities or electric cooperatives
(3) Offline capacity high point occurred on Tue. 2/16 and total installed capacity equal to 107.5 GW
(4) Equal ~31 GW of total thermal capacity offline less ~9 GW attributable to gas-fired derates
(5) Alternative cap (the "LCAP") is equal to the greater of $2,000/MWh or 50 x natural gas price index
(6) Peaker net margin ("PNM") threshold set at $315,000/kW-year

Rapid Decrease in Generation Causes Frequency Drop



Source: Magness, Review of February 2021 Extreme Cold Weather Event – ERCOT Presentation to Board of Directors (Feb. 24, 2021) at 12.

What Happened Next?

- Multiple Days of Legislative Hearings in 2021 & Interim Hearings thereafter; 2023 Session
- Resignations of ERCOT Independent Board Members, ERCOT CEO, & PUCT Commissioners
- Hundreds of bills on Electric Industry in ERCOT in 2021 (and 2023) – with many enacted
- Numerous PUCT rulemakings
- Multiple lawsuits and appeals

Overhaul of PUCT and ERCOT & Securitization

- Legislature increased Commission membership from 3 to 5 members.
- Legislature eliminated stakeholder members of ERCOT Board of Directors and established new process for selecting Members of Board of Directors.
- Members of PUCT and ERCOT Board must be Texas residents.
- PUCT must approve ERCOT Protocol revisions.
  - New process for Commission issuing directives to ERCOT (Project 52301).
- Implemented process to finance $800 million for default balance and securitize $2.1 billion of ancillary service costs.

New Weatherization Requirements

- Weatherization of Electric Facilities:
  - Phase 1: Implement recommendations following 2011 Winter Storm (Project No. 51840) (16 TAC §25.55; adopted 10/26/21)
  - Phase 2: Implement additional requirements based on historical weather study (Project No. 53401) (16 TAC §25.55; adopted 9/30/22)
- Weatherization of Natural Gas Facilities:
  - 16 TAC §3.66 – RRC – Weather Emergency Preparedness Standards (adopted 8/30/22)

Identification of Critical Supply Chain Facilities & Improved Communication and Coordination

- Identification of Critical Natural Gas Facilities or Critical Customers (Project No. 52345)
- Designation of Critical Natural Gas Suppliers or Critical Customers (16 TAC §3.65 adopted 11-30-21).
- Texas Electricity Supply Chain Security and Mapping Committee
  - Minutes of Committee Meetings (Project 52404)
  - First Map “Released” April 1, 2022
- Texas Energy Reliability Council: “Foster communication and planning to ensure preparedness for making available and delivering energy and electricity in this state to ensure that high priority human needs are met and critical infrastructure needs are addressed.”
- Requirement for Stakeholders to File Emergency Operations Plans - 16 TAC §25.53 (Project Nos. 51841 & 53385).

Initial Electric Market Design Changes

- Implemented “Conservative Operations”
- Modifications to ERCOT Pricing:
  - Modifying Low Price Cap – Eliminate connection to price of natural gas (Project No. 51871).
  - Reducing High Price Cap - Lower ERCOT Market High Price Cap from $9,000/MWh to $5,000/MWh (Project No. 52631).
  - De-couple Value of Lost Load from High Price Cap (Project No. 53191).
- Modification to Operating Reserve Demand Curve (ORDC) (Project No. 52373).
  - Minimum Contingency Level increased to 3,000 MW; HCAP and VOLL set to $5,000/MWh.
- Emergency Response Service (ERS)
  - PUC ordered ERCOT to deploy ERS at Minimum Contingency Level (3000 MW) (before EEA 1) (Project No. 52373).
  - Allow ERCOT to contract for longer deployment time for ERS and increase budget from $50 million/year to $75 million/year plus option for additional $25 million for contract extensions (Project No. 53493).

Initial Market Design Changes cont.

- Ancillary Service Modifications:
  - Fast Frequency Response Service (FFRS) (Project No. 52373)
  - Non-Spin Reserve Service (NSRS) – Allow Load Participation (Project No. 52373)
  - ERCOT Contingency Reserve Service (ECRS) (Project 52373)
  - Firm Fuel Supply Service (FFSS) (Project Nos. 52373 and 52798)
  - Voltage Support Compensation (Project Nos. 52373 and 53298) (underway)
  - Dispatchable Reliability Reserve Service (DRRS) (underway)
- Demand Response:
  - Change pricing for Load Resources from Zonal to Nodal (Project 52373; NPRR 1188)
  - Enable Virtual Power Plants (VPPS) – Pilot Project (Project No. 53911)
  - New Utility Load Winter Load Management Programs (Project No. 52689).
- Faster Disclosure of Generator Outages – from 60 to 3 days (Project No. 52266).
- Transmission Certification Criteria (Project No. 53403)

Initial Market Design Changes cont.

- Distributed Generation Interconnection and Cost Recovery (Project Nos. 51603, 54224, and 54233) (underway).
- Changes to ERCOT Capacity Demand and Reserves (CRD) Report and Seasonal Assessment of Resource Adequacy (SARA) (Project No. 52373).
- Investigation into Use of Dynamic Line Ratings for Transmission Lines in Texas (Project No. 52771) (pending).

Broader Market Design Changes

- Initial Proposals (Project No. 52373)
  - Load-Serving Entity (LSE) Obligation
  - Dispatchable Energy Credits Mechanism
  - Strategic Reserve Service / Backstop Reliability Service
- PUC Recommendation to Legislature: Performance Credit Mechanism (Project Nos. 52373, 53298, and 54335)
  - ERCOT Bridge Mechanism: Multi-step ORDC price adders (Project Nos. 53298 and 55156)
  - Define Reliability Standard (Project Nos. 53298 and 54584)
    - Study Value of Lost Load (VOLL)
    - Study Cost of New Entry (CONE)
- Low Interest Loans and Grants (SB 2627 & SJR 93)
- Ad Valorem Tax Abatements (HB 5)
- Real Time Co-optimization + Batteries (RTC+B)

Questions?

Michael J. Jewell
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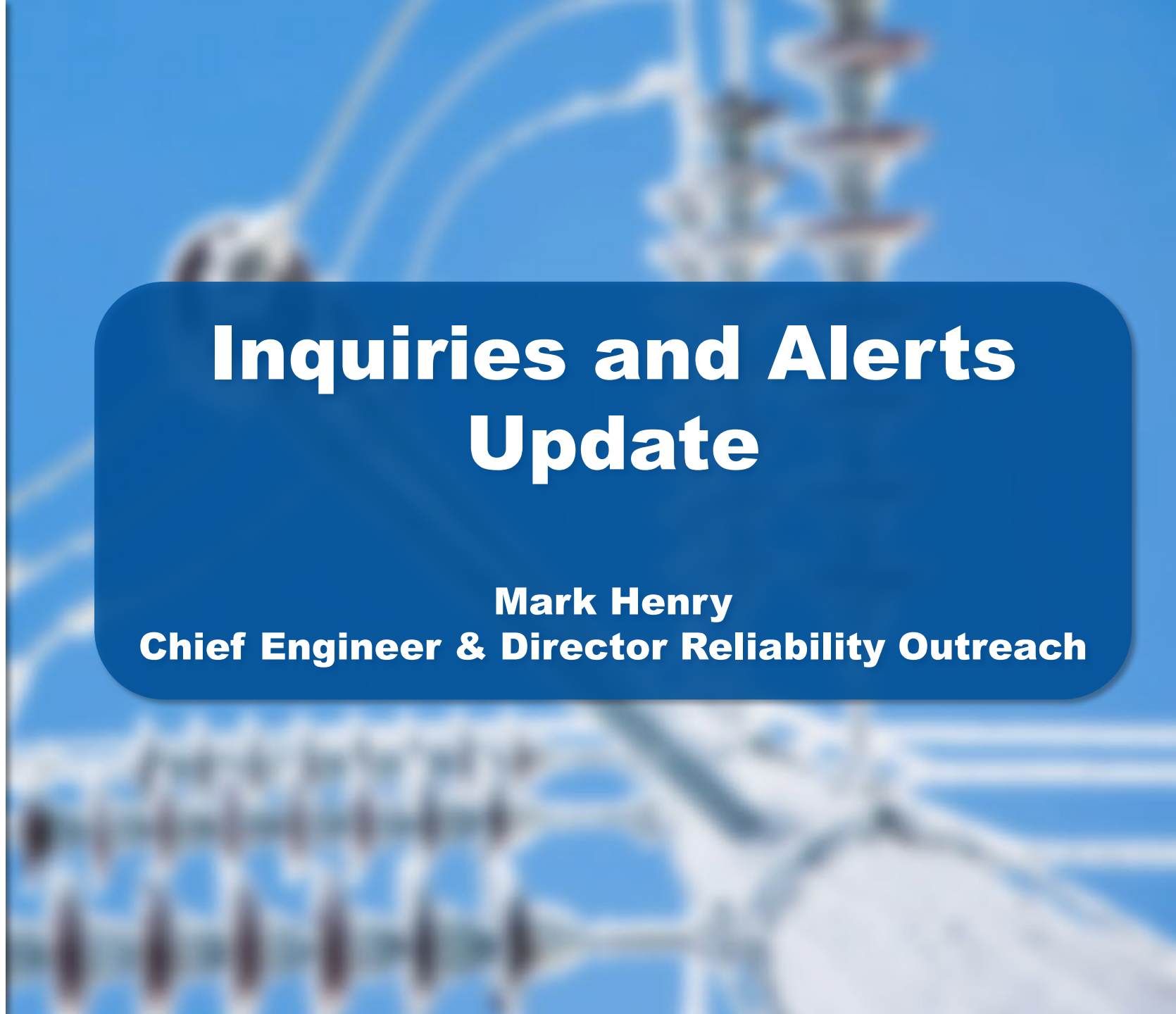
512.423.4065



Inquiries and Alerts Update

Mark Henry
Chief Engineer & Director Reliability Outreach

Overview

- Uri Recommendation Updates
- Elliot Inquiry
- Winter Guideline Revisions
- Failure Modes and Mechanisms Task Force Work on Winter Issues
- NERC Essential Action Alert

February 2021 Event Joint Inquiry Report

28 Recommendations (not all applicable to NERC and Regions)

- Nine key recommendations, including Reliability Standards changes
- Five recommendations for further study
- Completion target - before Winter 2023/2024

Many improvements and actions by ERCOT, entities, PUCT, and RRC

Recent activity

- Standards for generator winterization, Phase 2
- NAESB Gas-Electric Harmonization Forum Report and Recommendations
- Blackstart Unit Availability Study

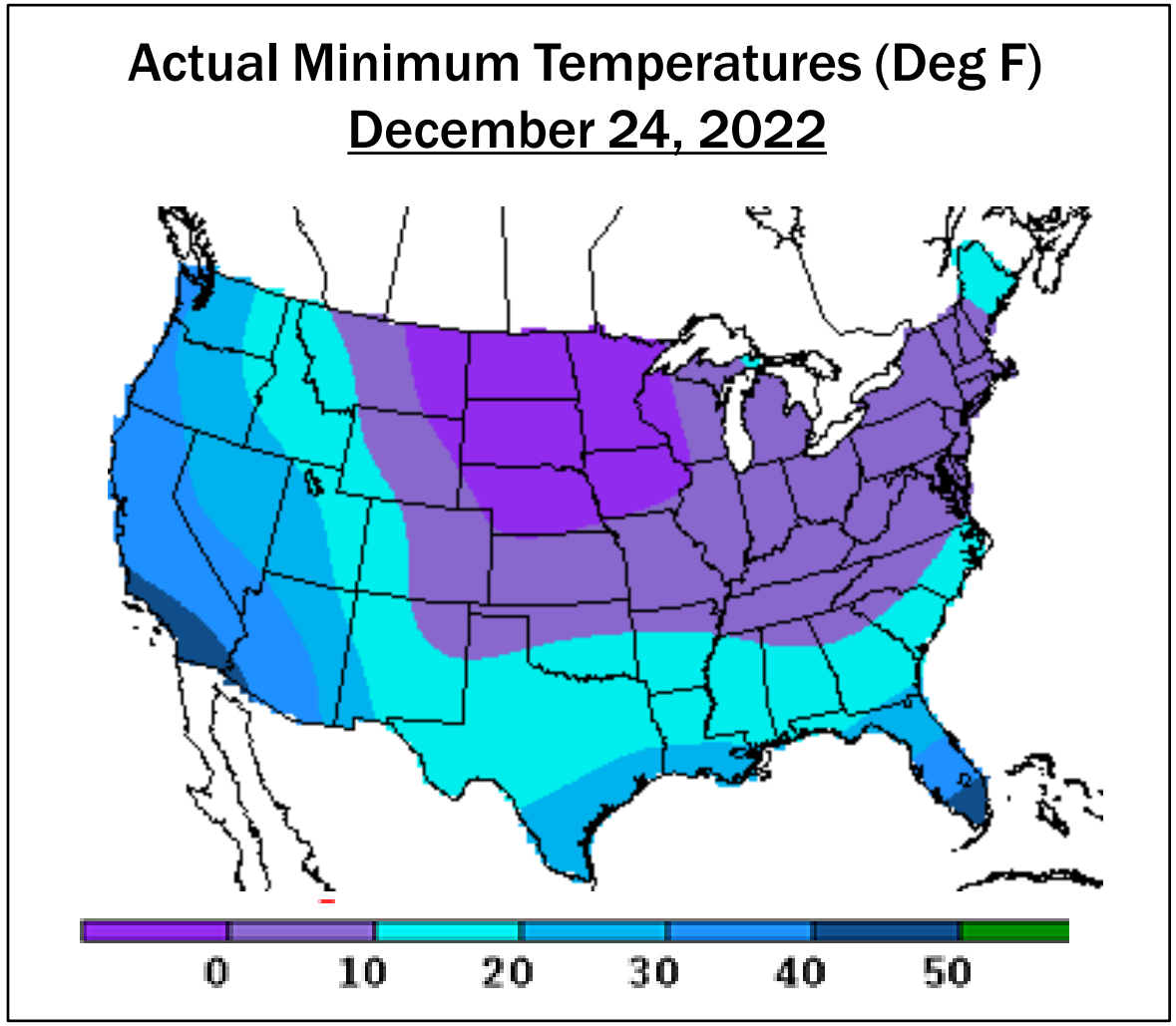
Full Report

Winter Storm Elliott's Effects on the Bulk-Power System*

December 21-26, 2022: Frigid arctic air with strong winds arrived over the eastern half of the country

Peak winter electricity demands, coupled with significant unplanned electric generation supply losses exceeding 70,000 MW, occurred during the coldest weather across the Southeastern, Mid-Atlantic, Midwest, and Northeastern U.S.

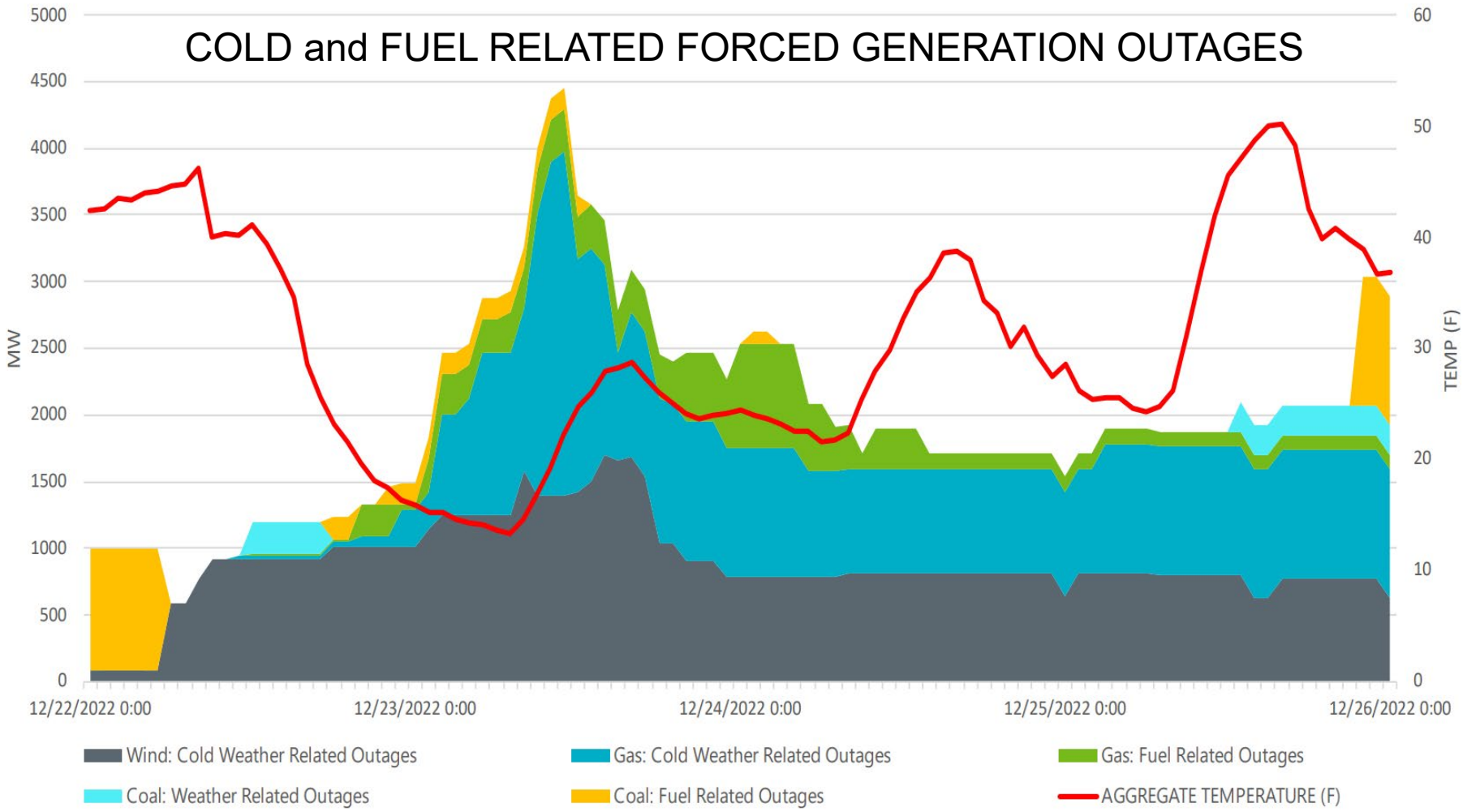
Several southeastern U.S. Balancing Authorities (BAs) ordered firm load shed on December 24, 2022, in total exceeding 5,000 MW



(Source: NOAA)

** Results are preliminary findings and do not necessarily reflect the views of FERC.*

Winter Storm Elliott in ERCOT



Conservative operations

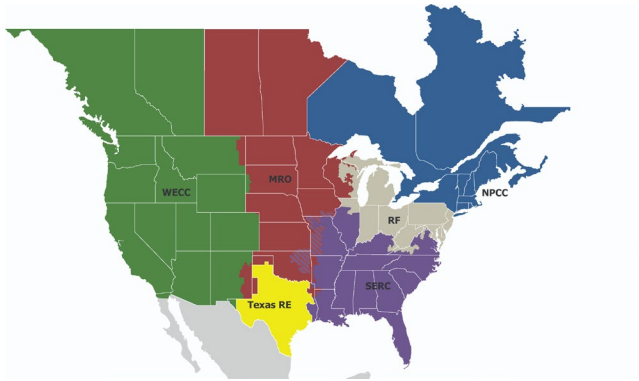
Two new all-time winter peaks

Firm fuel service beneficial to offset some natural gas supply shortfalls

Dan Woodfin, ERCOT, Board Meeting, Feb 28, 2023

Inquiry Overview

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION



- On December 28, 2022, FERC, NERC, and NERC's Regional Entities announced a joint inquiry into operations of the bulk-power system during Winter Storm Elliott.
- Status update provided on June 15, 2023
- Presentation of recommendations set for FERC Open Meeting, September 21, 2023
- Full report to be issued in November 2023
- ERCOT operations will not be included in the report

Similarities to Past Extreme Cold Weather Events

	2011 Event	2014 Event	2018 Event	2021 Event	2022 Event
Significant levels of incremental unplanned electric generating unit losses with top causes found to be mechanical/electrical, freezing, and fuel issues.	✓	✓	✓	✓	✓
Significant natural gas production decreases occurred, with some areas of the country more severely affected.	✓			✓	✓
Short-range forecasts of peak electricity demands were less than actual demands for some BAs in event area.	✓		✓	✓	✓

** Results are preliminary findings and do not necessarily reflect the views of FERC.*

Generating Unit Loss Causes – Early Observations*

The major categories of causes identified from early review (final rankings to be determined) are:

- freezing Issues,
- mechanical/electrical Issues, and
- fuel Issues.

Combined, these causes represent the majority of the generating unit outages, derates and failures to start.

** Results are preliminary findings and do not necessarily reflect the views of FERC.*

Generation Cold Weather Preparedness Initial Observations*

Early Observations Reinforce Past Report Recommendations

- Add/modify Reliability Standards regarding generating unit freeze protection measures (2021 “Uri” Report, Key Rec. 1a-1f)
- Utilize pre-operational warming prior to severe cold weather (2011 Report, Rec. 5)
- Review and update generating unit weatherization based on lessons learned, and conduct reviews of generating unit winter readiness (2014 Polar Vortex Report, Recs. 2, 3)
- Perform adequate/timely inspection of generating unit freeze protection measures; inspect/maintain heat trace and insulation (2011 Report, Recs. 14-16)
- Ensure winterization supplies/equipment are in place, and ensure adequate staffing for cold weather events (2011 Report Rec. 19)

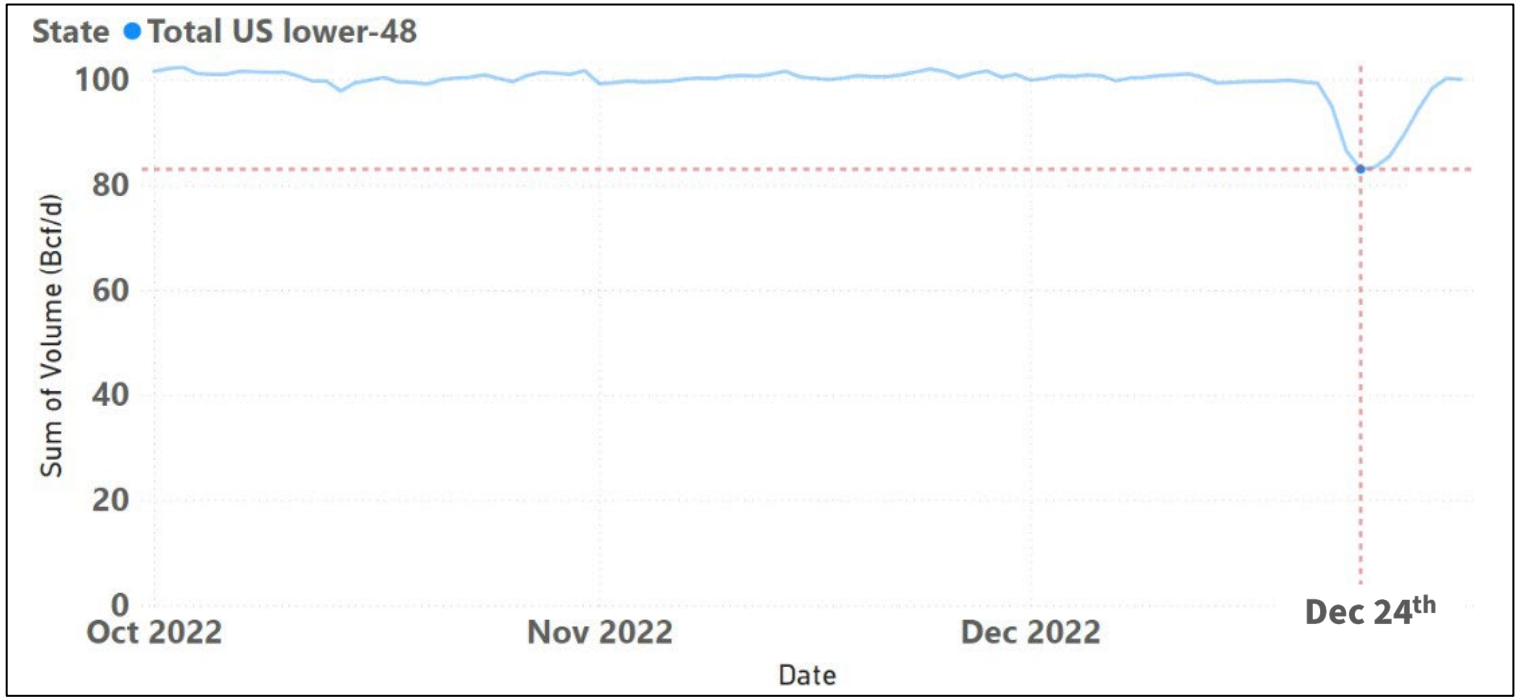
** Results are preliminary findings and do not necessarily reflect the views of FERC.*

Effects on Natural Gas System*

"Dry natural gas production in the Lower 48 states dropped to a low of 82.5 Bcf on December 24, a 16 percent decrease (16.1 Bcf/d) from December 21...." (EIA)

The Marcellus and Utica Shale regions experienced the greatest declines in gas production during the period (22-54%). (S&P)

Total US lower-48 Production (Bcf/d)



** Results are preliminary findings and do not necessarily reflect the views of FERC.*

Gas–Electric Preparedness Initial Observations*

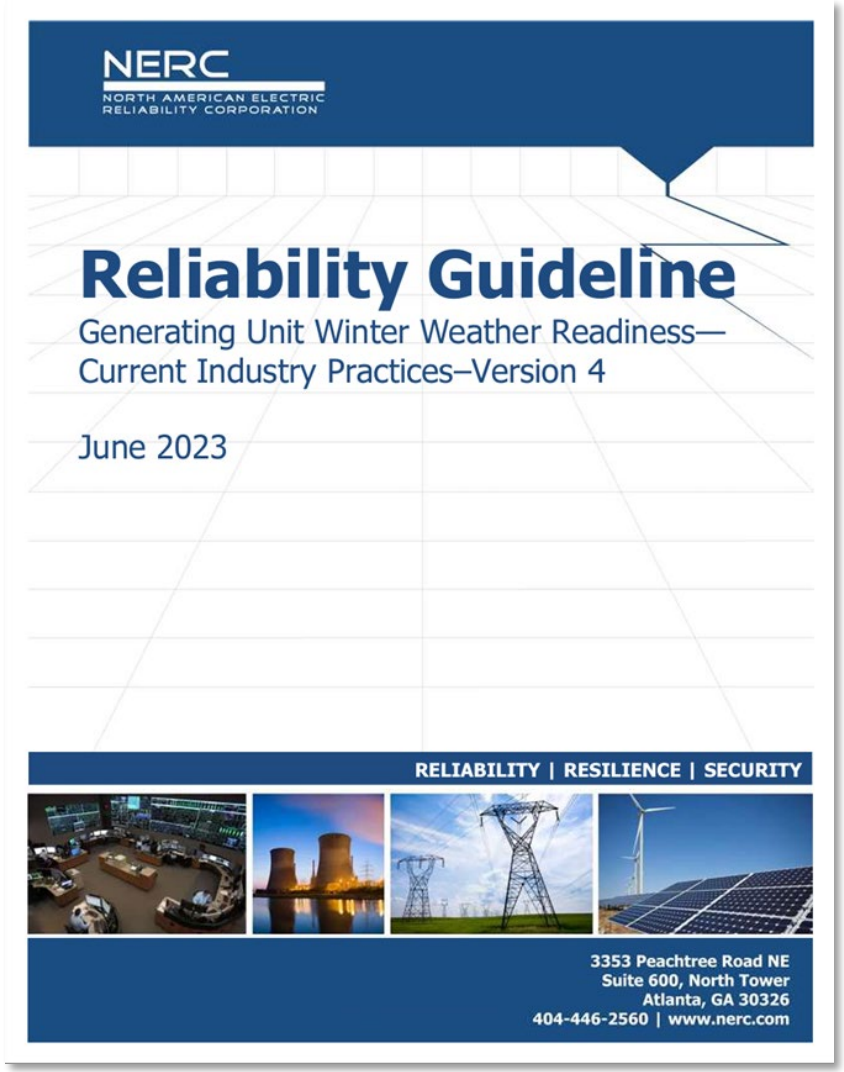
Early Observations Reinforce Past Report Recommendations

- Require natural gas facilities to implement cold weather preparedness plans; implement measures to protect natural gas infrastructure from freezing; adopt minimum uniform standards for winterization of natural gas production and processing facilities (2021 "Uri" Report, Key Recs. 5, 6; 2011 Report, Natural Gas Rec. 1)
- Establish a forum to improve reliability of natural gas infrastructure to support the Bulk Electric System (2021 "Uri" Report, Key Rec. 7)
- Protect critical natural gas infrastructure loads from demand response and load shedding (2021 "Uri" Report, Key Recs. 1h – 1i)

** Results are preliminary findings and do not necessarily reflect the views of FERC.*

Revised Generator Winter Readiness Guideline Highlights

- **General framework for developing an effective winter weather readiness program for generating units throughout North America.**
- **Collection of recommended industry practices compiled by NERC. Incorporation of these practices is strictly voluntary.**
- **Recommendations to Generator Owners and Generator Operators.**
  - Recommendations include Generator Owner's communications with their Balancing Authorities, Transmission Operators, and Reliability Coordinators (Reliability Entities)
  - Identifies critical components to focus on for both conventional and inverter-based resources.
  - Identifies additional responsibilities of Plant management and corporate management.
  - Provides Key elements of good Cold weather preparation procedure in Appendix C.
- **Does not provide guidance on identifying Extreme cold weather**



New Recommendations in Revised Guideline

Review plant design and configuration, identify areas where critical components' potential exposure to the elements, ambient temperatures, or both might cause issues and tailor their plans to address them accordingly

Ensure cold weather preparation and testing of infrequently used equipment and systems where applicable, such as startup of emergency generators, operation on secondary fuels, fire pumps, and auxiliary boilers.

Before and during a severe winter weather event, affected entities should keep their BA up to date on changes to plant availability, capacity, low temperature cut-offs, or other operating limitations.

Operations personnel should review cold weather scenarios affecting instrumentation readings, alarms, and other indications on plant control systems.

Maintain the correct coding for NERC Generation Availability Data Systems on unit derates or trips as a result of severe winter weather events to promote lessons learned, knowledge retention, and consistency. Examples may include NERC GADS code 9036 "Storms (ice, snow, etc.)" or code 9040 "Other Catastrophe."

New Recommendations in Revised Guideline (cont.)

Each entity will need to make its own determination for what constitutes normal winter weather and what is extreme for each of its own locations

After identifying issues related to derates, outages, or other operational issues, Generator Owners should communicate with their Balancing Authorities, Transmission Operators, and Reliability Coordinators (Reliability Entities) as soon possible

Consider a fleet-wide annual winter preparation meeting, training exercise, or both to share best practices and lessons learned

Following each winter, conduct an evaluation of the effectiveness of the winter weather preparation procedure and incorporate lessons learned

After a generating plant trip, derate, or failure to start due to severe winter weather, plant management should conduct an analysis, develop lessons learned and appropriate corrective actions

Inverter-Based Resources Recommendations in Guideline

Check Adequacy of tracking systems' lube oil for expected temperature during cold weather

Ensure winterization measures for battery systems and liquid-cooled inverters

Check Accessibility of roads throughout the facility

Ensure Anemometer functionality

Ensure blade de-icing capabilities are known

Ensure have freeze protection measures, such as anti-freeze or heaters, to address expected temperatures for that location

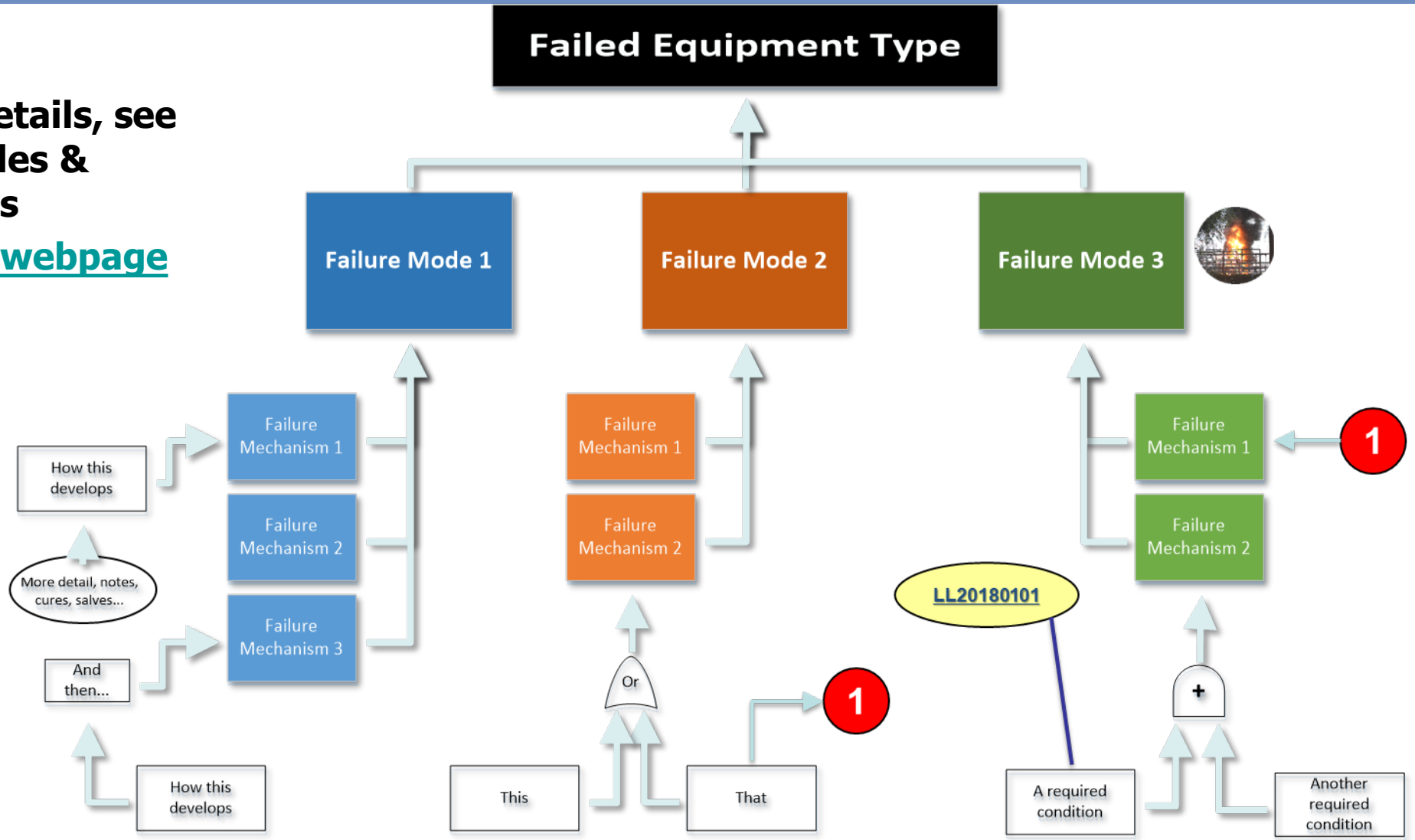
Failure Modes and Mechanisms–NERC Event Analysis Subcommittee

- **Failure Modes** are what gets your attention
- **Failure Mechanisms** are how the equipment gets going on the path to a failure
  - Equipment Failures have logical cause-and-effect relationships behind them
  - Physical Evidence Examination and Root Cause Analysis can reveal what Failure Mechanisms were involved
  - Aging is not a 'cause,' It is just a catch-all term for slow moving Failure Mechanisms
  - Failure Mechanisms are detectable. Many can be stopped, or at least slowed down so they can be corrected before causing a failure

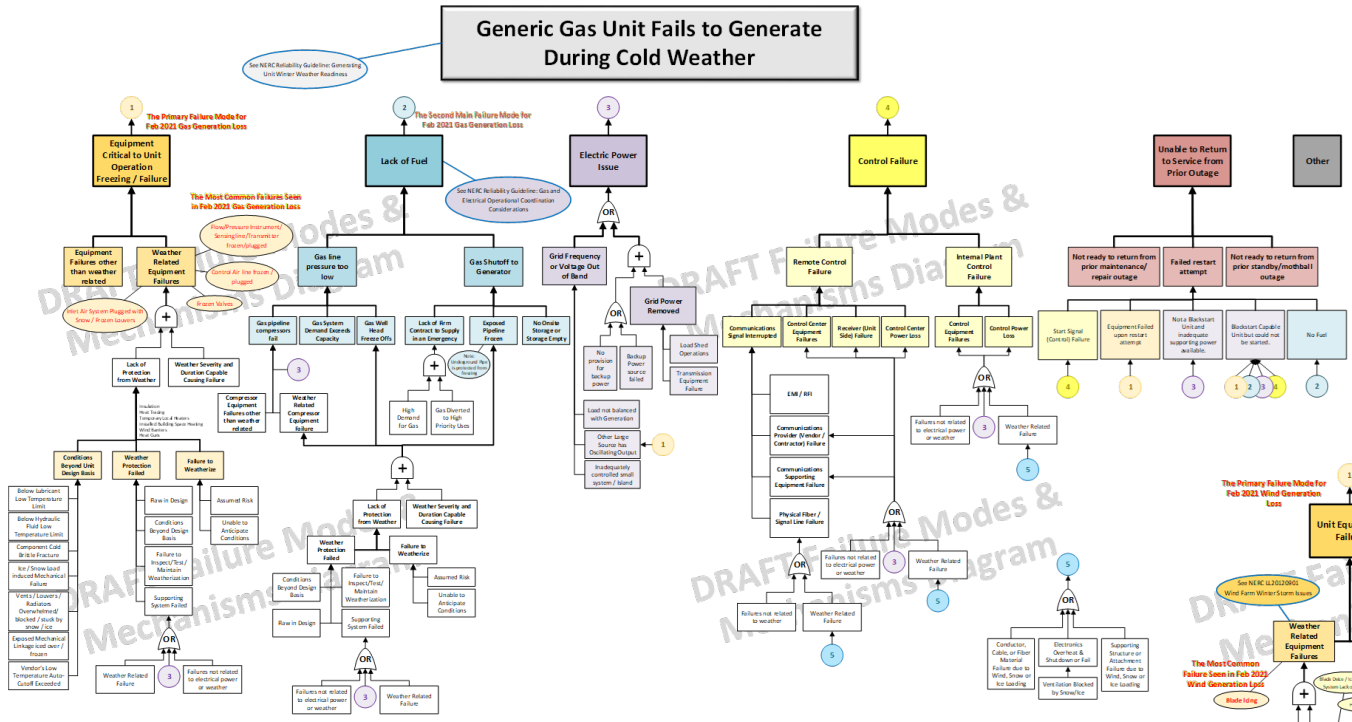
Generic Failure Modes and Mechanisms Layout

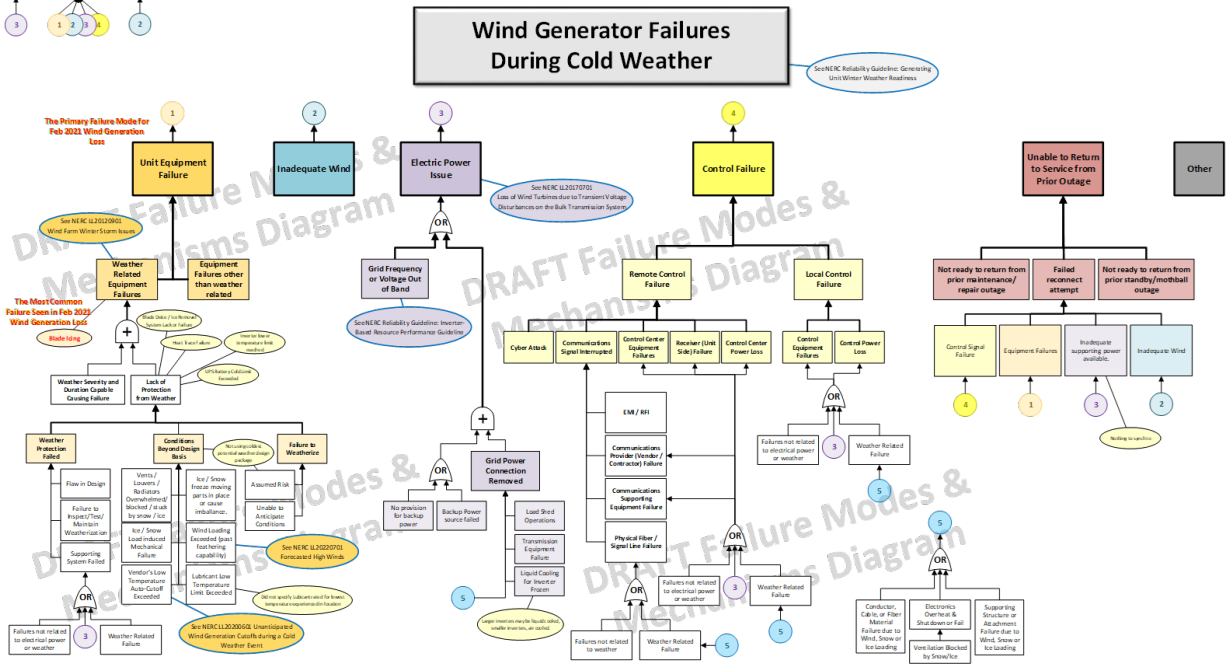
For more details, see Failure Modes & Mechanisms

[Task Force webpage]



Draft Generic Gas and Wind Generator Cold Weather Issues





Industry volunteers sought!

For more details, see Failure Modes & Mechanisms

[Task Force webpage]

NERC Alert Overview

Rule of Procedure s. 810 establishes three distinct levels of NERC Alerts

- **Level One – Industry Advisories**
- **Level Two – Recommendations to Industry**
- **Level Three – Essential Actions**
  - Essential Actions require approval of the NERC Board of Trustees prior to issuance

For Level Two and Three Alerts, NERC is required to provide a report to FERC within 30 days of receiving responses

NERC Winter Preparation-Related Alerts

Alert Name	Level	Issuance Date	Acknowledgement Date (if appliable)	Response Date (if applicable)	Report Date (if applicable)
Cold Weather Preparations for Extreme Events I	Two	August 18, 2021	August 23, 2021	September 17, 2021	October 18, 2021
Cold Weather Preparations for Extreme Events II	Two	September 12, 2022	September 19, 2022	October 6, 2022	November 7, 2022
Cold Weather Standards	One	February 13, 2023	N/A	N/A	N/A
Cold Weather Preparations for Extreme Events III	Three	May 15, 2023	May 22, 2023	October 6, 2023	November 3, 2023

Essential Actions for Generator Owners

1. Calculate the Extreme Cold Weather Temperature (ECWT) for each plant location prior to the next winter season

2. Identify in the cold weather preparedness plan the Generator Cold Weather Critical Components and freeze protection measures implemented on those components prior to the next winter season

3. Identify which units are capable of operating at the ECWT as currently built, and which units require additional freeze protection measures to operate at that temperature

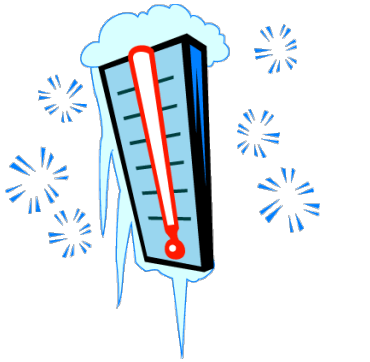
4. Identify which units experienced a Generator Cold Weather Reliability Event in the 2022–2023 winter season

7. Provide its RC, BA, and TOP the ECWT for its location prior to the next winter season and whether Generator Cold Weather Critical Component freeze protection measures will not be implemented on components prior to the next winter season

8. Share their responses with their respective BAs and TOPs to allow for updates to any operating plans before the next winter seasons

Extreme Cold Weather Temperature in the NERC Alert

The Extreme Cold Weather Temperature (ECWT) is 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
- This calculated temperature does not take into account time, wind speed, or humidity

ECWT is also used in NERC Standard EOP-012-1. Technical reference document—Calculating Extreme Cold Weather Temperature—provides an example approach for calculating the ECWT. Frequently asked questions are included in the NERC Alert.

NOTE: ECWT is different than the PUCT requirement for sustained operation based on the 95th percentile minimum average 72-hour wind chill temperature ERCOT's historical weather study.

Transmission Operator and Balancing Authority Essential Actions

5. Each TOP should update their operating plan(s) prior to the next winter season, to include provisions to minimize the overlap of circuits that are designated for manual load shed and circuits that are utilized for under frequency load shed (UFLS) or under voltage load shed (UVLS).

6. Each BA should update their operating plan(s) prior to the 2023–2024 winter season, to include provisions for TOPs to implement operator controlled manual load shed; and manage generating resources in its BA Area.

TEXAS RE
Ensuring electric reliability for Texans

ERCOT Winter Weatherization Activities Update

A Presentation at Texas Reliability Entity's Winter Weatherization Workshop

David Kezell
Director, Weatherization and Inspection

September 13, 2023

2022-2023 Winter Weatherization Background

- **Phase II** of PUC Rule 25.55 (16 TAC § 25.55), adopted on September 29, 2022, kept winter weather emergency preparedness standards and **added summer weather standards** for generation and transmission facilities.
- Phase II introduced the provision of a “cure period” to allow correction of identified deficiencies in required weather emergency preparation measures. It also requires submission of a declaration of weather preparedness by June 1 and December 1 each year.
- Winter weatherization inspections occurred December 2022 - February 2023. Summer weatherization inspections started June 5 and will continue through the end of September.
- A few new provisions of the phase II rule are effective in “Beginning in 2023.”

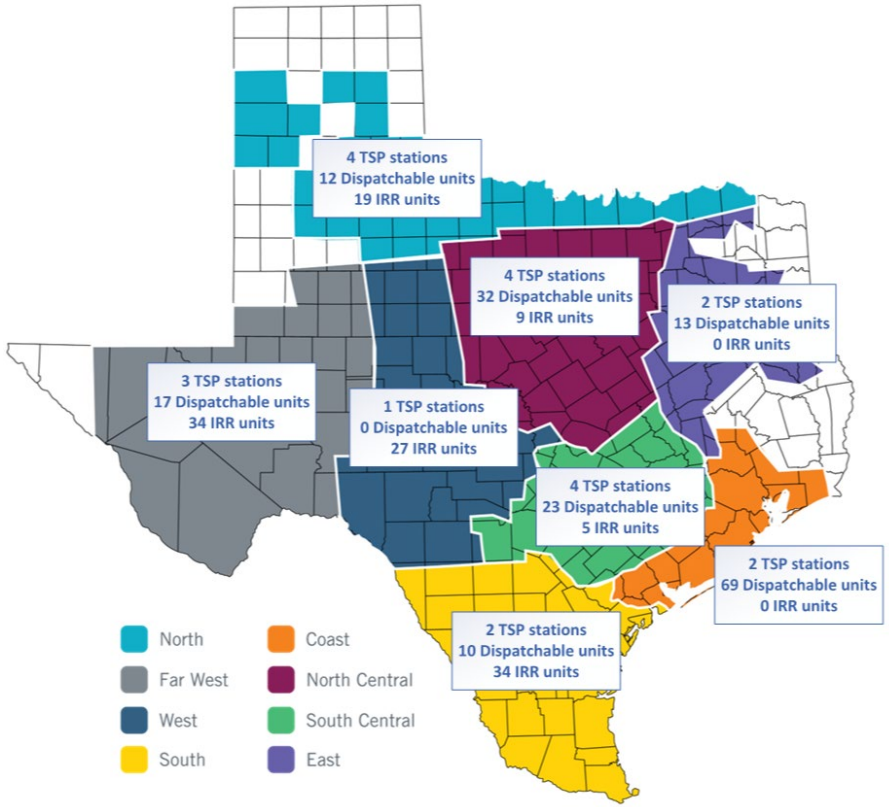
Phase II PUC Rule § 25.55

- 16 TAC §25.55 requires Market Participants (MPs) to:
  - Establish and maintain weather preparation measures for both winter and summer seasons
  - Make notarized declarations of preparedness in both winter and summer
  - Beginning in 2023, create a list of all cold- and hot-weather-critical components

- Beginning in 2023, the rule establishes weather-zone-specific cold and hot temperatures at which MPs must implement measures reasonably expected to ensure sustained operation.

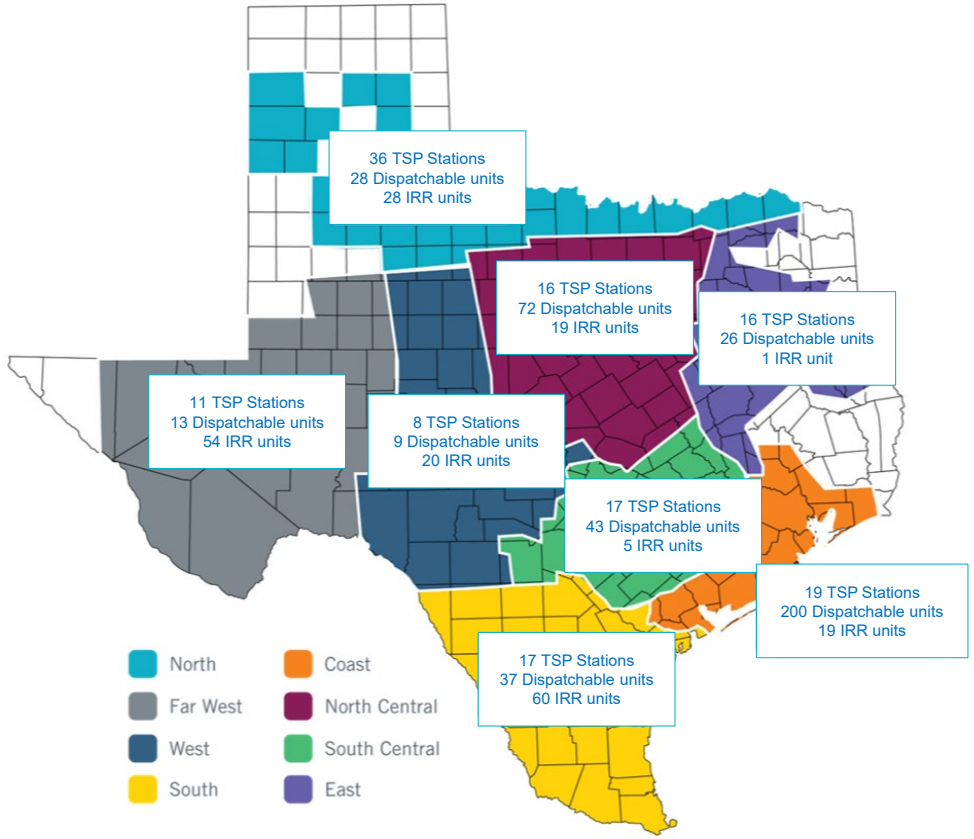
- ERCOT is responsible to:
  - Deliver biannual reports that address whether each GE and TSP has submitted a declaration
  - Develop winter and summer inspection checklists for resources and TSPs
  - Inspect to determine compliance (every resource 1x/3yr, 10% of TSP facilities 1x/3yr)
  - Provide inspection reports and establish cure periods for identified deficiencies
  - Report to Commission staff any entity that does not cure its deficiency(ies) within the cure period
  - File an historical weather study every five years; next one in 2026

ERCOT Weatherization Inspections Overview



Winter 2021-2022 On-site Inspections

22 Transmission
174 Dispatchable
128 IRR
324 Total



Winter 2022-2023 On-site Inspections

140 Transmission
428 Dispatchable
206 IRR
774 Total

Key Winter Weather Preparation Measures for Generation Resources & TSPs

16 TAC § 25.55(c)(1) and (f)(1) require:

- Implementation of winter weather emergency preparation measures reasonably expected to ensure sustained operation during winter weather conditions
- Maintenance of those measures throughout the 3-month winter period
- Reviewing and revising staffing plans to be used during winter weather emergencies
- Training relevant personnel on winter weather preparations and operations

Other requirements:

- Submit a declaration of preparedness to ERCOT between Nov. 1 and Dec. 1 each year
- Provide ERCOT, Commission staff, or designated contractors access during inspections
- Remedy any compliance deficiencies within an assigned “cure period”

Additional ERCOT winter weatherization information is available at https://www.ercot.com/gridinfo/generation/winterready

Past Winter Weatherization Compliance Challenges

Generation Resources:

- Records of training and reviewing staffing adequacy plans
- Records of functionality verification throughout the 3-month winter period
- Records of monitoring freeze protection
- Records of thermal insulation inspections

Transmission Service Provider (TSP) Facilities:

- Records of training and reviewing staffing adequacy plans
- Records of SF6 gas pressure checks
- Records of annual verification of proper oil quality in transformers
- Records of checking operation of heaters in control cabinets

"Beginning in 2023" Requirements from the PUC Rule

Parts of Weather Emergency Preparedness rule became/become effective in 2023:

- Summer (Effective 6/1/23)
  - Implement **additional** weather emergency preparation measures **reasonably expected to ensure sustained operation during greater of:**
    (1) maximum ambient temperature at which facility experienced sustained operations or
    (2) 95th percentile max. average 72-hour temperature in ERCOT weather study for facility's weather zone
  - Create **list of all hot weather critical components**, review annually prior to beginning of summer, update as necessary
- Winter (Effective 12/1/23)
  - Implement **additional** weather emergency preparation measures **reasonably expected to ensure sustained operation at 95th percentile minimum average 72-hour wind chill value in ERCOT weather study** for facility's weather zone
    - Create **list of all cold weather critical components**, review annually prior to beginning of winter, and update as necessary
- ERCOT historical weather study can be found at https://interchange.puc.texas.gov/search/documents/?controlNumber=52691&itemNumber=6

ERCOT Historical Weather Study

ERCOT, in consultation with the Office of the Texas State Climatologist, developed a report providing various historical weather data. ERCOT submitted this report to the PUC on December 15, 2021. A revision was submitted in July 2022.

Summer Requirement - maximum ambient temperature at which facility experienced sustained operations or

Weather Zone	95th Percentile Maximum Average 72-Hour Temperature	99th Percentile Maximum Average 72-Hour Temperature
North	96.1°	98.0°
North Central	95.4°	97.8°
West	92.9°	93.9°
Far West	92.7°	95.0°
East	91.6°	96.8°
Coast	90.1°	92.1°
South Central	92.3°	93.0°
Southern	88.9°	92.2°
Valley	88.6°	89.2°
Panhandle	90.3°	91.3°

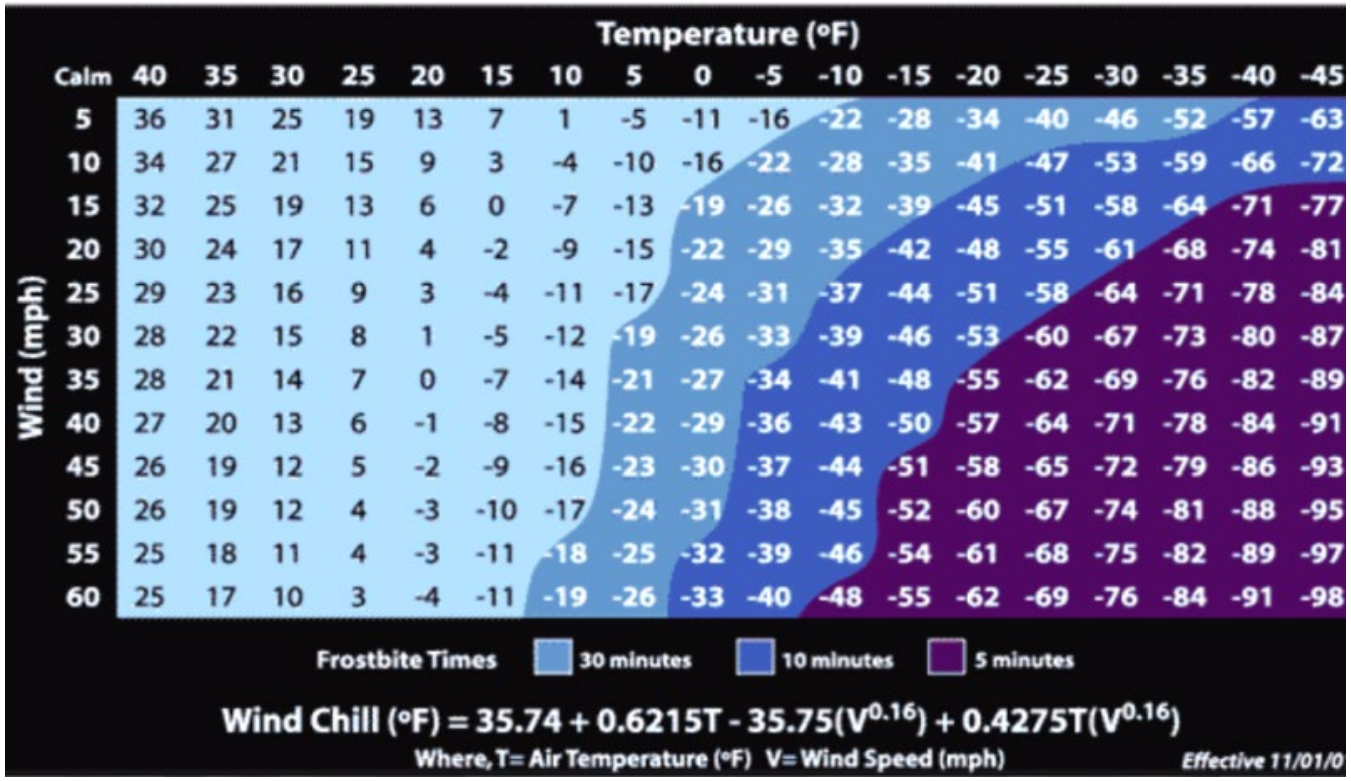
Table 67: Historical Maximum Average 72-Hour Temperature Data

Winter Requirement

Weather Zone	95th Percentile Minimum Average 72-Hour Wind Chill	99th Percentile Minimum Average 72-Hour Wind Chill
North	-5.0°	-10.5°
North Central	-0.5°	-5.1°
West	0.3°	-7.6°
Far West	1.3°	-5.2°
East	4.4°	-0.7°
Coast	18.1°	4.1°
South Central	8.4°	3.8°
Southern	16.3°	11.7°
Valley	20.0°	16.9°
Panhandle	-17.6°	-19.6°

Table 72: Historical Minimum 72-Hour Average Wind Chill Data

Wind Chill Chart and Rule Interpretation



PUCT accepted ERCOT's clarified interpretation of "wind chill temperature" on July 20, 2023. https://interchange.puc.texas.gov/search/documents/?controlNumber=54444&itemNumber=44

ERCOT will use chart values as follows:

- Determine Adequacy of Winter Weather Emergency Preparation Measures
  - MPs provide temps + wind speeds in current equipment design and calculate associated Wind Chill value using formula in NOAA/NWS Wind Chill Chart:

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

(T = temperature and V = wind speed for equipment design)

- If *design* Wind Chill value (°F) is ≤ chart value, presumption - *subject to confirmation during inspection* - facility meets Rule
- If *design* Wind Chill value (°F) > chart value, presumption facility does *not* meet Rule and MP must implement ***additional*** weather emergency preparation measures to reasonably ensure sustained operations at or above chart value

Winter Rule Interpretation (cont'd)

Evaluation of Failures when Actual Temperature Exceeds Chart Value

If facility has weather-related failure when *ambient temperature* > chart value, ERCOT will evaluate circumstances

- May inspect facility to determine if MP failed to meet requirements
- Evaluation will consider wind chill values calculated from *actual* temperatures and wind speeds at/near facility at time of failure
- If *actual* calculated wind chill value at time of failure ≤ chart value ***and*** MP applied ***and*** maintained weather emergency preparation measures, ERCOT will not consider that failure out of compliance w/ Rule
- If *actual* calculated wind chill value at/near facility at time of failure > chart value, ERCOT may determine weather emergency preparation measures were inadequate for sustained operation at chart value
    - ERCOT will assign cure period to remedy deficiency

Comparison of PUCT Rule vs. NERC Standard

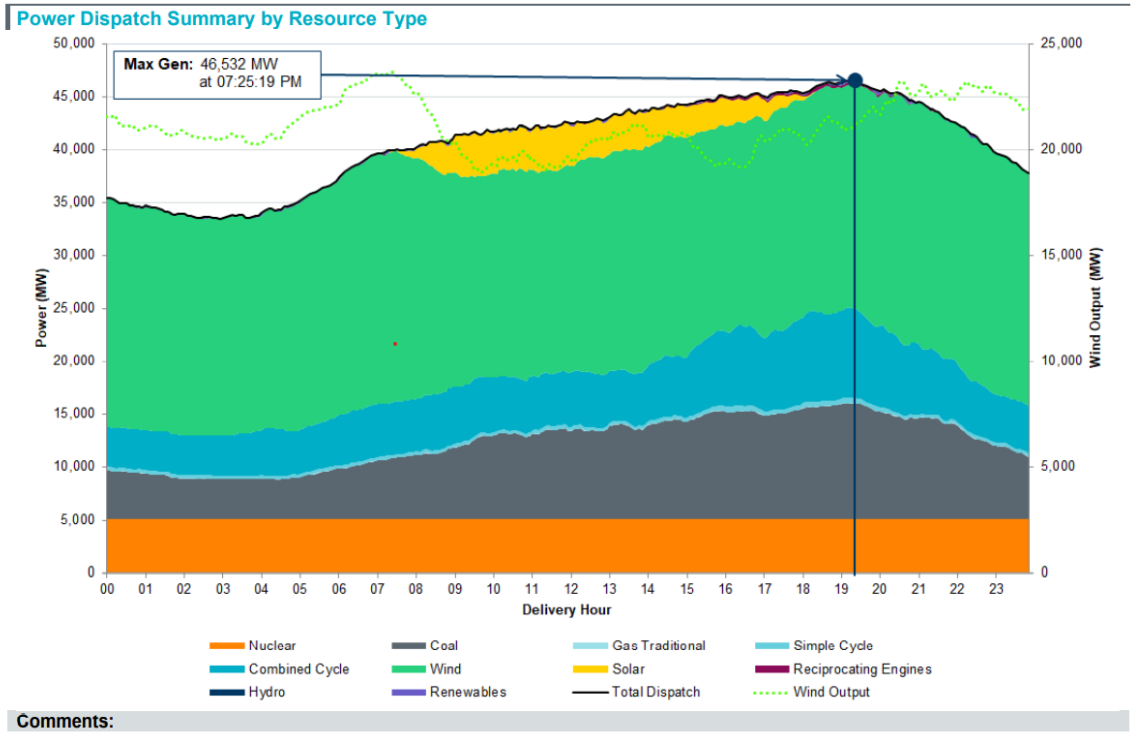
This chart allows an effective comparison of some of the Texas 16 TAC § 25.55 rule requirements (in black) with some NERC EOP-012-2 requirements (in red)*.

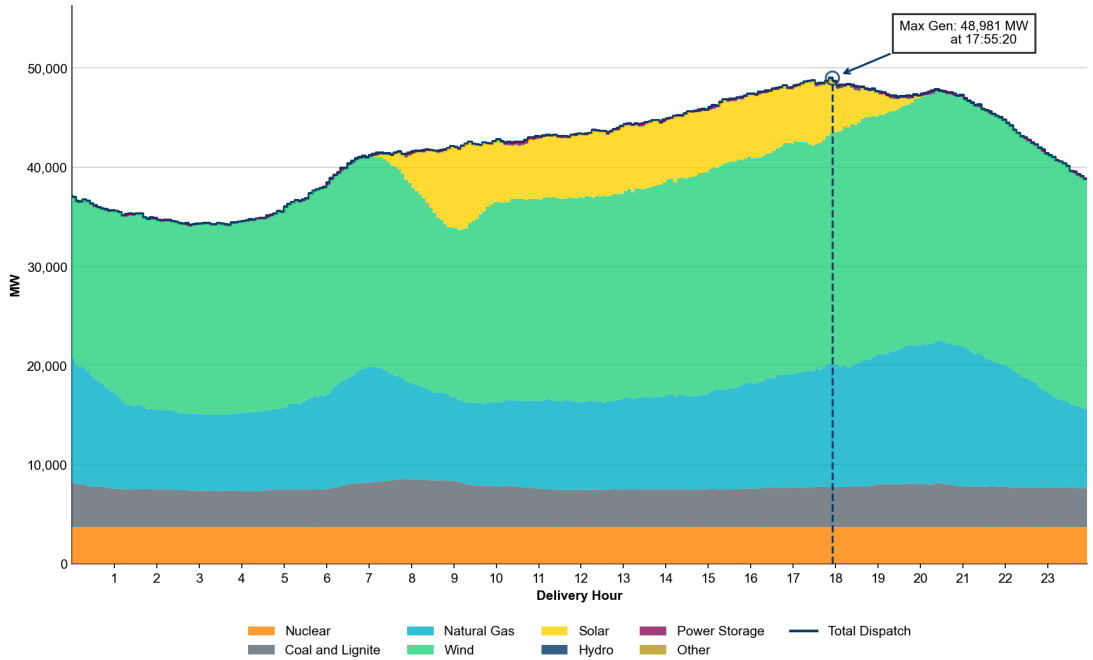
It also demonstrates that both the rule and standard were not established to protect against all historically experienced temperatures (in blue) but rather to support increased system reliability during significantly cold conditions without being extreme in their levels of required protection measures.

	NERC Adopted Existing Gen	PUCT Phase II (New and Existing Gen and Trans)	NERC Adopted New Gen	Lowest Winter Storm URI Temp	Lowest Recorded Temp
ERCOT Weather Zone	**Lowest 0.2 Percentile Temp (ºF) (Updated Aug 2023)**	**95th Percentile Minimum Average 72-Hour Wind Chill (ºF) *(pg 58)***	***Wind Chill (ºF) from* Lowest 0.2 Percentile *Temp with 20 mph wind (Updated Aug 2023)***	**Feb 2021 Minimum Temp (ºF) *(pg 13)***	**Minimum Recorded Temp (ºF) *(pg 13)***
North	8.6	-5	-10.8	-4	-13
N. Central	15.6	-0.5	-1.6	-2	-8
West	11.6	0.3	-6.8	-4	-9
Far West	10.6	1.3	-8.1	-2	-11
East	16.5	4.4	-0.4	-6	-6
Coast	22.8	18.1	7.9	13	5
S. Central	18.5	8.4	2.3	7	-2
Southern	26.5	16.3	12.8	17	11
Valley	31.6	20.0	19.4	22	12
Panhandle	0.5	-17.6	-21.3	-11	-16

**The PUC rule and NERC standard have differing timelines for compliance. The PUC rule covers both generation and transmission facilities while the NERC standard covers just generating units.*

Big Days for Wind – February 21, 2022 and April 17, 2023





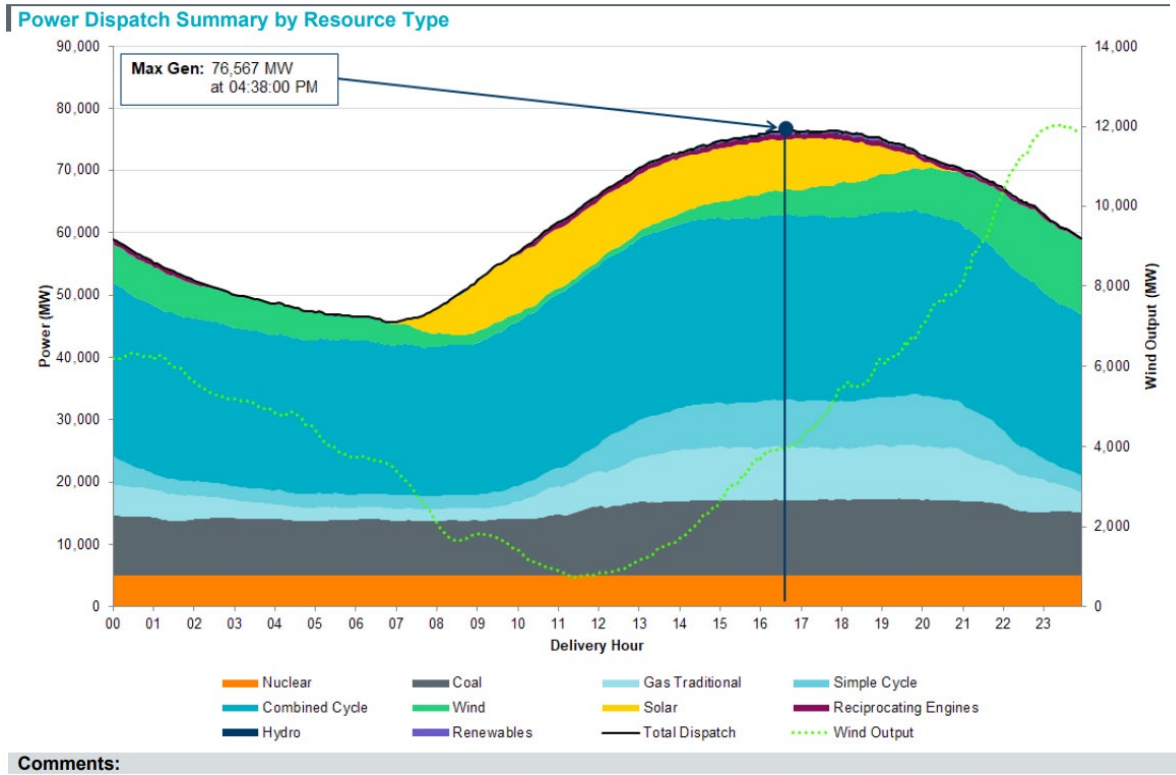
Wind roughly between 20 – 25 GW all day.

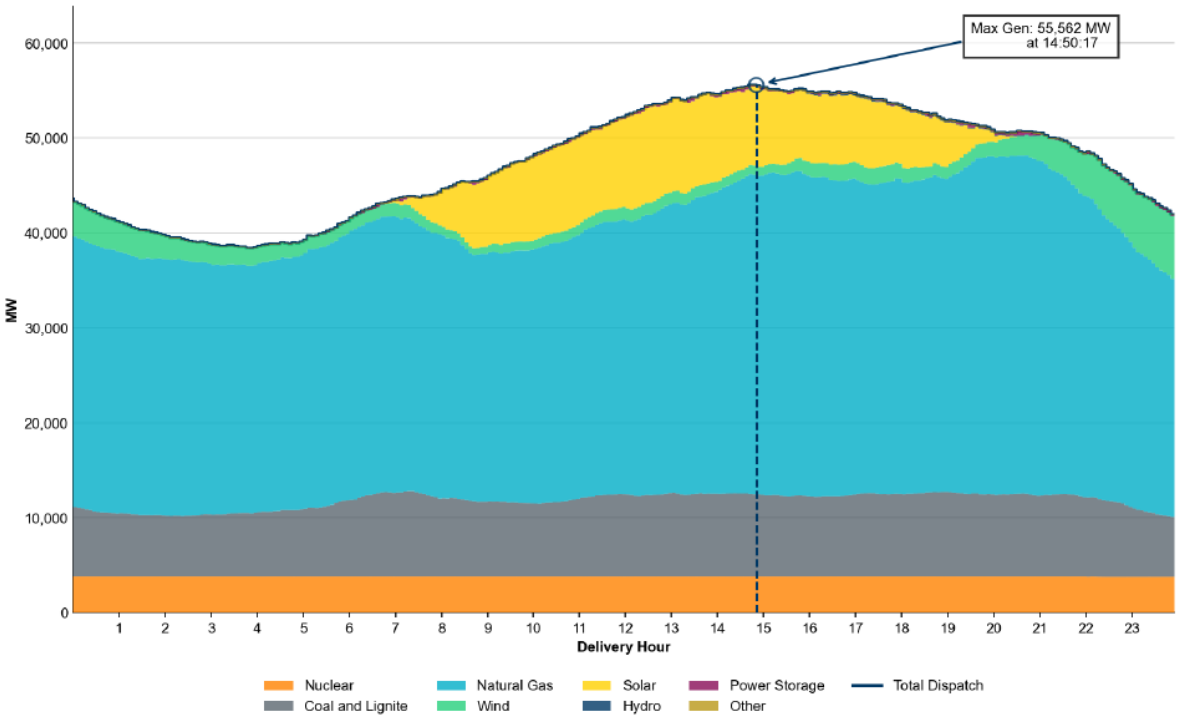
Contributed 51.7% of the daily energy requirement!

Wind strong all day.

Contributed 50.6% of the daily energy requirement!

Sometimes the Wind Dies Down – July 10, 2022 and May 16, 2023

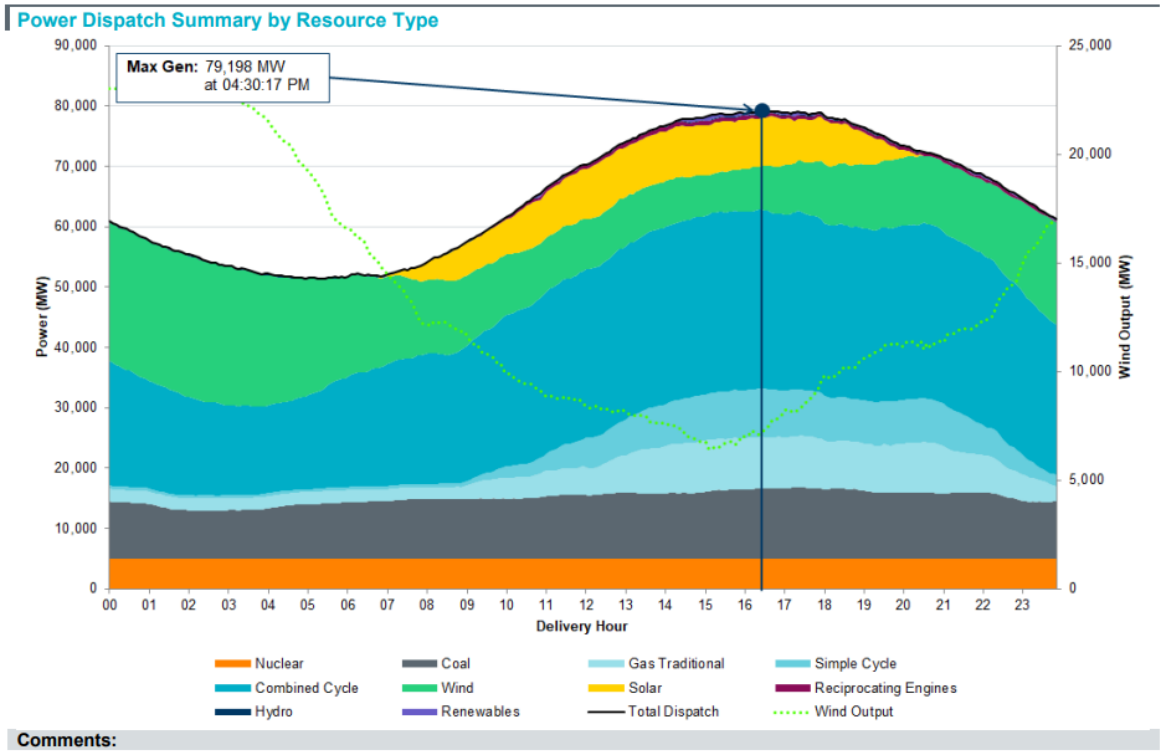


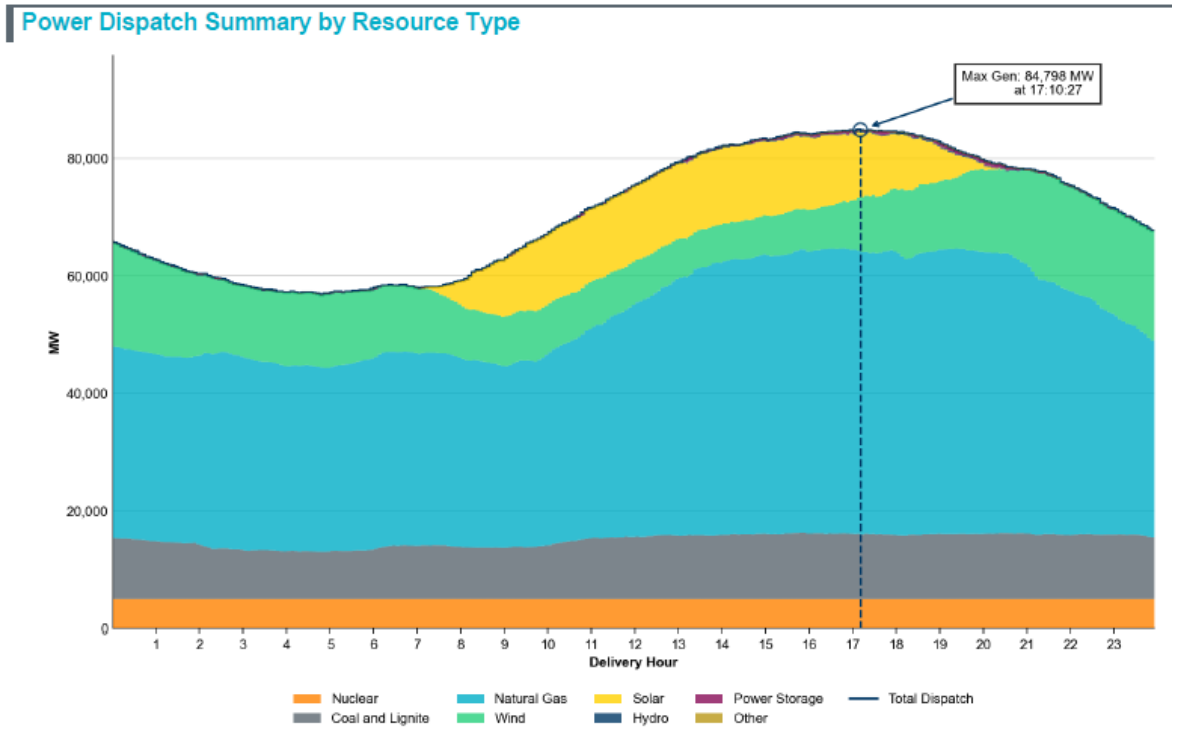


At peak solar provided ~11%, wind 5%, gas 60%, coal 16%, nuclear 6%, other 2%. Wind dropped to <700 MW or about 2% of its capacity.

At peak solar provided ~15%, wind 2%, gas 61%, coal 15%, nuclear 7%, other 1%. Wind dropped to very low levels through most of the day.

All-Time Peak Days on Consecutive Years – July 20, 2022 and August 10, 2023





Generation mix at 80.1 MW 2022 peak was 9% wind,10% solar, 58% gas, 15% coal, 6% nuclear, and 2% other.

Generation mix at 85.4 MW 2023 peak was 11% wind,13% solar, 57% gas, 13% coal, and 6% nuclear.

Key Takeaways

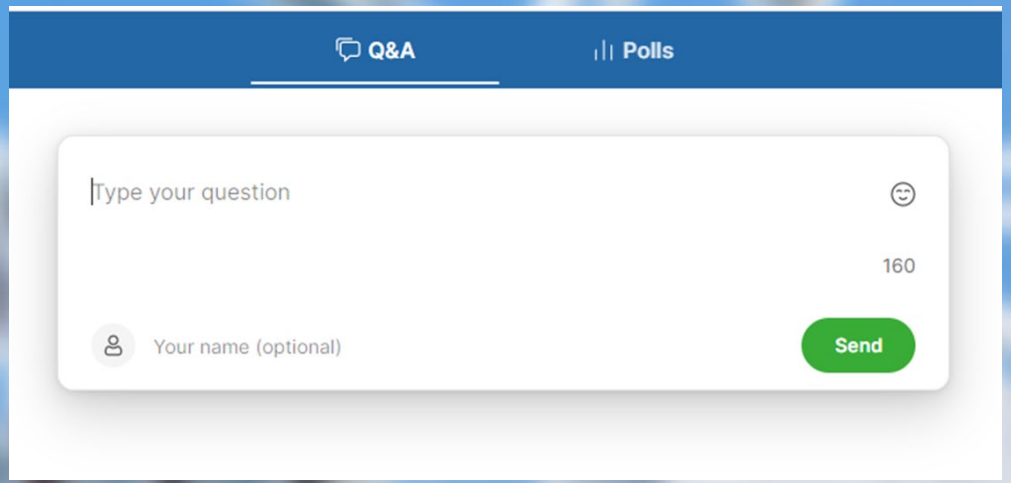
- Effective weatherization of all power facilities is essential to reliability during extreme cold and extreme hot weather conditions and to meet ERCOT's rapidly growing electricity demand.
- 16 TAC § 25.55 - the PUC Weather Emergency Preparedness Rule is having a beneficial effect on system reliability. Active Market Participant diligence in weatherization preparation and maintenance activities are important contributing factors to reliability improvements.
- Collaborative discussions during inspections as well as corrective actions taken for any compliance deficiencies within provided cure periods have brought many benefits.
- Existing generation facilities complying with the PUCT rule's winter requirements are likely well-positioned for compliance with similar parts of NERC's EOP-12-2.
- More ERCOT weatherization information can be found at https://www.ercot.com/gridinfo/generation/summerready and https://www.ercot.com/gridinfo/generation/winterready.

Winter Weatherization Workshop

Return at: 11:10 a.m.

- Executive Welcome
- Updates Since Uri
- Inquiries and Alerts
- ERCOT Weatherization Activities Update
- **Weatherization Standards**
- PUCT Winterization Activities Update
- RRC Winterization Activities Update
- 2023-24 Winter Weather Forecast and Review of Historical Winter Extremes
- Winter Weather Prep and Lessons Learned
- NERC Winterization Activities Update
- Entity Inspection Program

To submit questions during the workshop, please visit **slido.com** and enter today's participant code: **TXRE**



Weatherization Standards

Rachel Coyne – Texas RE
Venona Greaff – Project 2021-07 SDT

Project 2021-07 Extreme Cold Weather Grid Operations, Preparedness, and Coordination

Standard Authorization Request (SAR) Posted for comment November 2021

10 Recommendations in the SAR based on Joint Inquiry Key Recommendation 1

Standards Committee Executive Committee (SCEC) accepted revised SAR February 25, 2022, and authorized the drafting team to begin work

Two phases

- Winter 2022/2023
- Winter 2023/2024

Project 2021-07 SAR Phase 1 - Winter 2022/2023

Development and implementation of corrective action plan (CAP) for identified equipment during outages, failures to start, or derates

Conduct annual unit-specific cold weather preparedness training

Retrofit existing generating units and design new units to operate to specified ambient temperature and weather conditions

Load shed procedures should only be used for manual load shed as a last resort and should start with the final stage

Project 2021-07 Extreme Cold Weather Grid Operations, Preparedness, and Coordination Phase 1

FERC Approved February 16, 2023

EOP-011-3 – Effective TBD

EOP-012-1 – Effective October 1, 2024

EOP-012-1 Phase in Dates

EOP-012-1 Effective Date = 10/1/2024

- Requirement R1 = 4/1/2028
- Requirement R2 = 4/1/2028
- Requirement R3 = 10/1/2024
- Requirement R4 = 10/1/2029
- Requirement R5 = 10/1/2024
- Requirement R6 = 10/1/2024
- Requirement R7 = 10/1/2024

Project 2021-07 SAR Phase 2 Due Winter 2023/2024

- Identify cold weather critical components and systems for each generating unit
- Identify and implement freeze protection measures for the cold weather critical components and systems
- Account for effects of precipitation and accelerated cooling effect of wind when providing temperature data
- Determine the generating unit capacity that can be relied upon during “local forecasted cold weather”
- Operating plans should prohibit use for demand response of critical natural gas infrastructure loads
- Protect critical natural gas infrastructure loads from manual and automatic load shedding

Phase 2: EOP-011 and TOP-002

Key Recommendation 1 from Joint Inquiry Report

1h – Require Balancing Authorities' operating plans (for contingency reserves and to mitigate capacity and energy emergencies) to prohibit use for demand response of critical natural gas infrastructure loads	1i – To protect critical natural gas infrastructure loads from manual and automatic load shedding (to avoid adversely affecting Bulk Electric System reliability)

Phase 2: EOP-011 and TOP-002 1i

To require BAs and TOPs provisions for operator-controlled manual load shedding to include processes for identifying and protecting critical natural gas infrastructure loads in their respective areas

To require BAs, TOPs, PCs, and TPs respective provisions and programs for manual and automatic (e.g., underfrequency/undervoltage) load shedding to protect identified critical natural gas infrastructure loads from manual and automatic load shedding by manual and automatic load shed entities within their footprints

To require manual and automatic load shed entities to distribute criteria to natural gas infrastructure entities that they serve and request the natural gas infrastructure entities to identify their critical natural gas infrastructure loads

To require manual and automatic load shed entities to incorporate the identified critical natural gas infrastructure loads into their plans and procedures for protection against manual and automatic load shedding

Phase 2: EOP-011-4

Proposed Changes to Meet FERC Directives	• Automatic Load Shed • Demand Response programs
Proposed Changes Address Identification and Prioritization of Critical Natural Gas Infrastructure Load (Recommendations 1h and 1i)	• Manual Load Shed • Automatic Load Shed • Demand Response programs
Added Functional Entities to Applicability	• Distribution Provider • UFLS-only Distribution Provider • Transmission Owner

EOP-011-4: Critical Natural Gas Infrastructure Load

The SDT added clarifying language in the applicable requirements and expanded content in the Technical Rationale document in lieu of making "critical natural gas infrastructure Load" a defined term

- Criticality of certain gas facility types will vary based on system characteristics
- Entities need flexibility to determine critical facilities based on the specifics of their system and footprint
- A broad definition may negatively impact reliability by over-designating facilities as critical

A definition would have been overly broad and would not provide substantial additional clarity given the diversity of these types of facilities throughout the BES footprint

EOP-011-4: Critical Natural Gas Infrastructure Load

The phrase "which are essential to the reliability of the BES" has been added to related requirements to specifically link any determination of criticality to the impacts of the load on BES reliability

Technical Rationale provides additional guidance on:

- Reasonable application of the term critical natural gas infrastructure loads
- Identification of critical natural gas infrastructure loads
- Prioritization of critical natural gas infrastructure loads

EOP-011-4 Changes – R1

TOP Emergency Operations Plan to Include:

- Provisions to minimize the overlap of circuits that are designated for manual or automatic load shed and circuits that serve designated critical loads which are essential to the reliability of the BES
- Provisions for identification and prioritization of designated critical natural gas infrastructure loads which are essential to the reliability of the BES
  - Added the qualifier “essential to the reliability of the BES”
  - Some rewording was done to all Requirement language to clarify the SDT’s intent in the application of these requirement to manual and automatic load shed

EOP-011-4 Changes – R2

Balancing Authority Operations Plan to Include

- Provisions for excluding critical natural gas infrastructure loads that are essential to the reliability of the BES as interruptible load, curtailable load, and demand response during extreme cold weather periods within each BA Area
- Provisions for Transmission Operators to implement operator-controlled manual Load shedding or automatic Load shedding in accordance with Requirement R1 Part 1.2.5
  - The qualifier “essential to the reliability of the BES” was added
  - R2.2.8 was clarified to state the obligation is only during Extreme Cold Weather periods
  - Wording was refined to clarify the SDT’s intent in the application of these requirement to manual and automatic load shed

EOP-011-4 Changes – 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

- Moved to a separate Requirement (new R7)
- Added a notification provision to ensure that identified entities are appropriately notified
- Annual requirement

EOP-011-4 Changes – R8

Distribution Providers, UFLS-Only Distribution Providers, and Transmission Owners to create load shedding plan that includes

- Minimized overlap of circuits designated for manual or automatic load shedding from circuits that serve designated critical load which are essential to the reliability of the BES
- Minimized overlap of circuits designated for manual load shed and circuits that are utilized for UFLS and UVLS
- Limited utilization of UFLS or UVLS circuits from manual load shed to situations where warranted by system conditions

EOP-011-4 Changes – R8 Cont'd

Distribution Provider, UFLS-Only Distribution Provider, and Transmission Owner to a create Load shedding plan that includes:

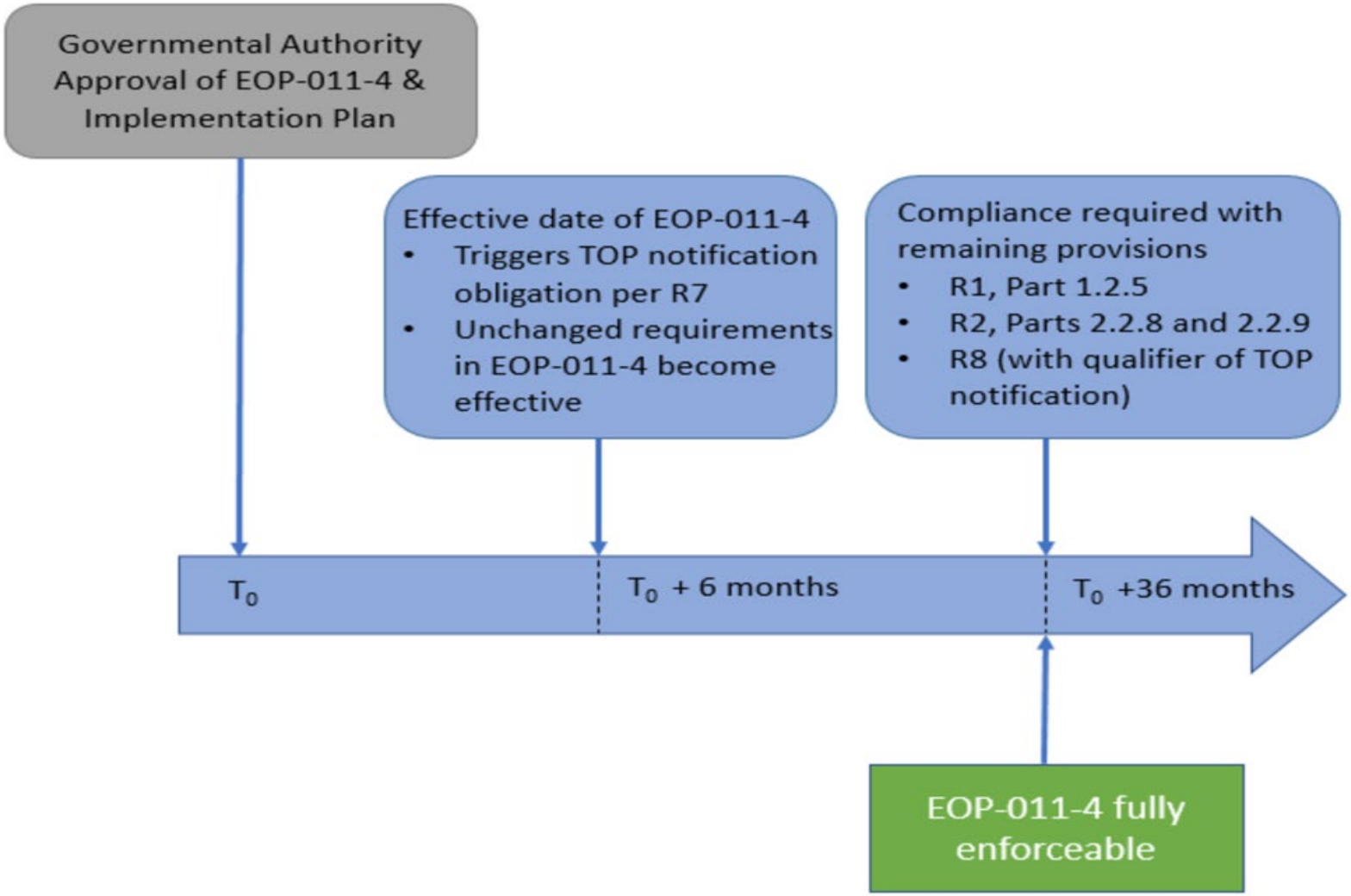
- Identification and prioritization of designated critical natural gas infrastructure loads which are essential to the reliability of the BES
  - Applicable to entities are notified by a TOP per R7
  - Reworded "Operating Plan" to "Load shedding plan"
  - Additional edits to be consistent with TOP Requirement edits
  - Added provisions to provide the Load shedding plan to the TOP for review

Summary of Changes

EOP-011-4

- Provided a clear notification provision from TOPs to DPs, UFLS-Only DPs, and TOs that will be subject to certain requirements – R7
- Reworded to “Load Shedding Plan” in R8 to address concerns with the use of the term “Operating Plan” in reference to DP, UFLS-Only DP, and TO obligations
- Provided additional clarity in technical rationale around approach for identifying critical natural gas infrastructure loads
- Various clarifying changes to standard language
- Extended implementation timeframes where warranted by legitimate industry concerns

EOP-011-4 Implementation Plan



Summary of Changes

- Removed the direct link between the Operating Process and Operating Plan due to concerns that link would require an extreme cold weather process year round
- Various clarifying changes to standard language
- Extended implementation timeframe as warranted by legitimate industry concerns

Implementation Plan

SDT increased proposed implementation timeline from 12 months to 18 months to address industry concerns with the required effort to consider previous extreme cold weather periods when determining adequate reserve margins in the new extreme cold weather Operation Process.

EOP-012: 2/16/2023 FERC Order Directives

Phase 2 Includes Directives from the 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.
- **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 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.

EOP-012: 2/16/2023 FERC Order Directives Cont'd

Phase 2 Includes Directives from the FERC Order:

- **Generator Capability Requirements:** Modifications to ensure 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.
- **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.
- **Implementation Plan:** Require a shorter implementation period than five years post approval.

EOP-012: 2/16/2023 FERC Order Directives Cont'd – Applicability

Modify EOP-012-1 to ensure requirements capture all BES resources needed for reliable operation during cold weather

Modify EOP-012-1 to exclude only those generation resources not relied upon during "freezing conditions"

Additional implementation time is not needed

- NERC to ensure modified applicability section of EOP-012-1 is implemented as of effective date approved in the order

EOP-012: SDT Proposal to Meet FERC Directives

- **Functional Entities: Generator Owner and Generator Operator (no change from EOP-012-1)**
- **Clarification of Facilities: "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 Implementation Plan

FERC Directive to revise EOP-012 to require a shorter implementation period and staggered implementation for unit(s) in a generator owner's fleet

- Industry has been aware of and alerted to the need to prepare their generating units for cold weather since at least 2011
- Consideration should be given to the amount of time that industry has already had to implement freeze protection measures when determining the appropriate shorter implementation period

Current Draft: Standard shall become effective the later of:

- 1) October 1, 2024; or
- 2) The first day of the first calendar quarter three months after the effective date of the order approving the standard

Project Timing

Past

- EOP-012-2 Initial Ballot closed 7/20/2023
- EOP-011-4, TOP-002-5 Additional Ballots closed 9/12/2023

Future

- NERC Board directive to submit Phase 2 changes by 9/30/2023
- FERC 2/16/2023 directives due by 2/16/2024

Present

- SDT reviewing EOP-011-4, TOP-005 comments received
- SDT revising EOP-012-2

Resources

- 2021-07 Project Page
  - Includes drafts of EOP-011-4, TOP-002-5, and EOP-012-2 as well as implementation plans and technical rationale
- Joint Inquiry Report
- 2/16/2023 FERC Order
- EOP-012-1 Implementation Plan

TEXAS RE
Ensuring electric reliability for Texans

Weather Preparation Update

Thomas Gleeson

Executive Director

Public Utility Commission of Texas

What’s new in 2023?

- A look back at 2022
- Summer weather preparation
- Winter wind chill requirements

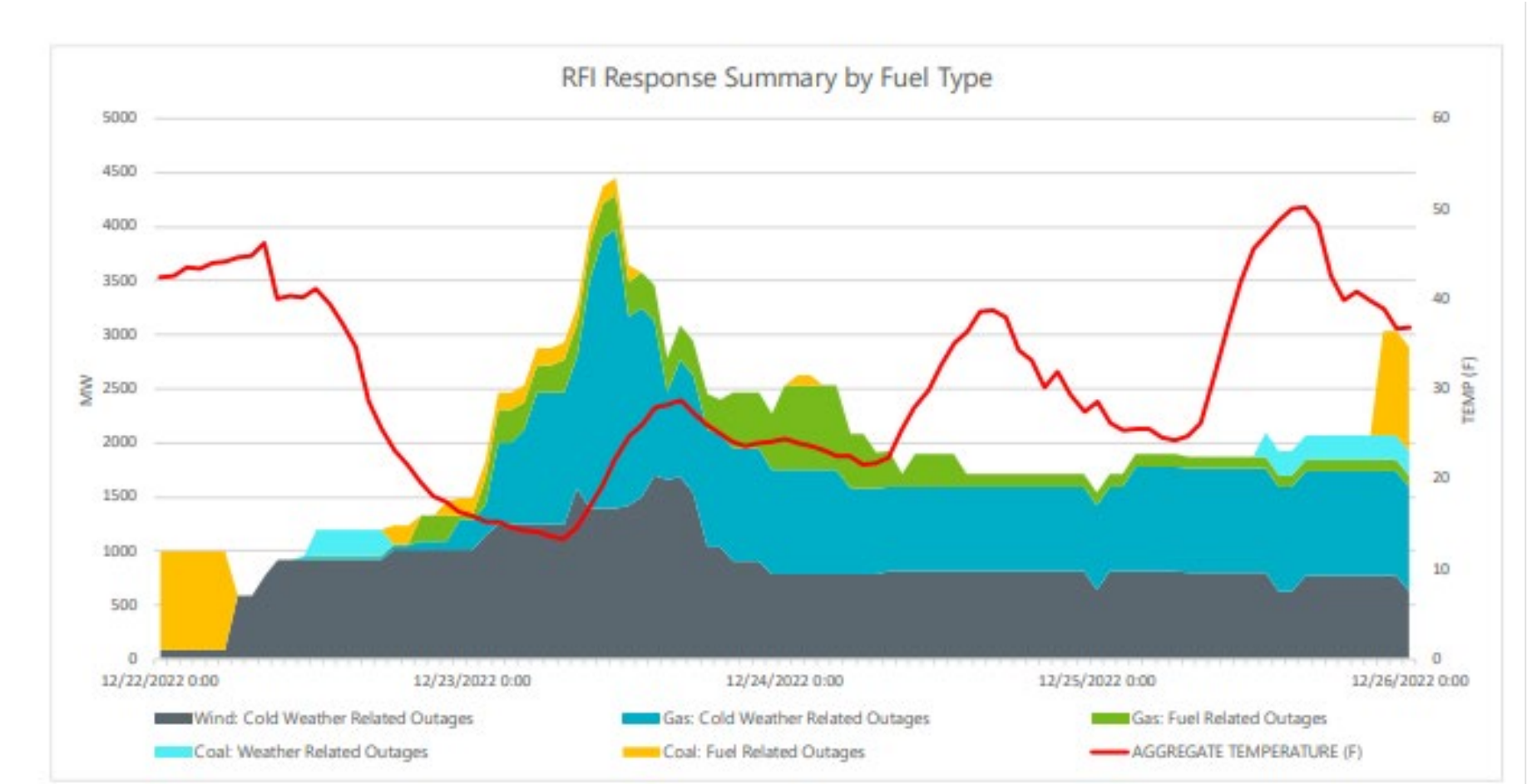
Winter Inspections 2022

- Inspections began in December 1, 2022
- ERCOT inspected:
  - 634 generation resources (~57% of all ERCOT-located resources)
  - 140 transmission voltage substations and switchyards (~2.5% of those ERCOT-located facilities)

Winter Storm Elliot

- Elliott was the coldest weather event in ERCOT, except for Uri, in the last 15 years
- Before the storm, ERCOT inspected about 250 resources for weather readiness
  - Four of those inspected sites had outages or derates

Outages- Winter Storm Elliot



Summer Weather Preparation

- Began June 1, 2023- Texas is the first in the nation
- Anticipate around 500 inspections of generation and transmission
- Final inspection report in October 2023

Wind Chill Requirements

- New wind chill standards are based on the 95th percentile minimum average 72-hour wind chill
- Inspections begin December 1, 2023

Weather Zone	95th Percentile Minimum Average 72-Hour Wind Chill
North	-5.0°
North Central	-0.5°
West	0.3°
Far West	1.3°
East	4.4°
Coast	18.1°
South Central	8.4°
Southern	16.3°
Valley	20.0°
Panhandle	-17.6°

Questions?

Critical Infrastructure Division Inspections and Audits

Mysti Doshier

September 2023

Inspection Process Agenda

- Introductions

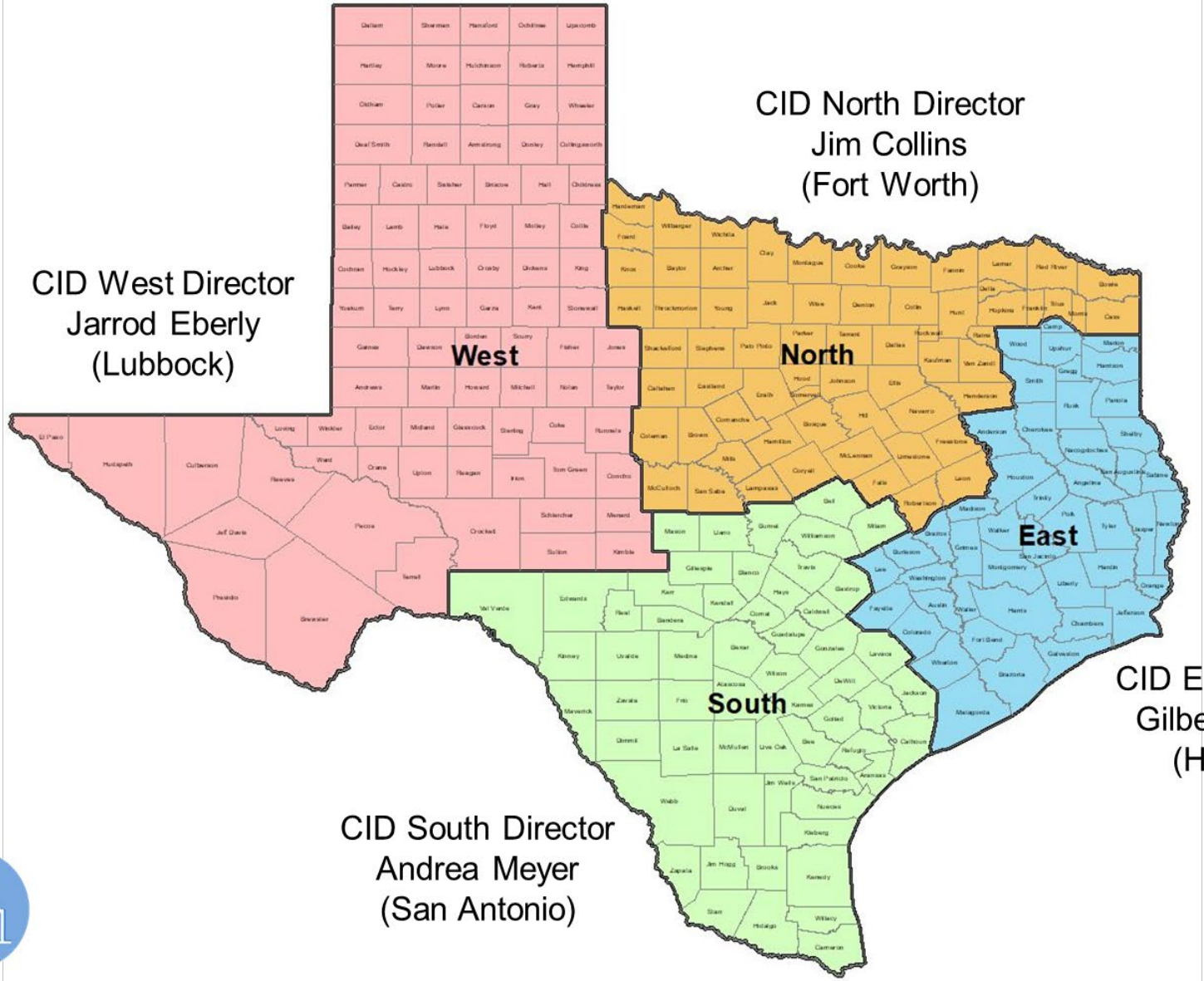
- What We Learned Through Winter of 2023

- Inspection Process

i. Inspection Schedule
ii. Preparation/Review
iii. Inspection
iv. Documentation

- Questions

CID – Regional Map



What We Learned

- Majority of operators achieve compliance
  - >99% of facilities at the time of initial inspection.
  - If a violation was accessed, then 99% became compliant within 30 days.
- During the winter events of 2022/2023.
  - Compressors were the first in the critical infrastructure supply chain to experience issues.
  - Most operators followed their emergency operations plans filed with RRC.

Improvements

- Clearer expectations
  - Communication is **Key**
- Building lead time and planning ahead
  - Begin the process prior to the December attestation
- Refine Data
  - Verifying locations from previous submissions

What's Happening Now

Extreme Heat Cycle Inspections

- July 5th- September 29th summer inspection season

June 20th	• Schedule inspections
July 5th to July 29th	• Begin inspections • Complete all storage and processing facilities
September 22nd	• Complete remaining inspections

Inspection Process

Inspection Initiation

An inspection will originate from one of two places.

- A regular inspection conducted in accordance with the Commission's inspection schedule
  - Facilities required to comply with 3.66
- An inspection scheduled in response to a weather-related stoppage notification
  - All facilities required to comply with 3.66

Inspection Schedule

Facilities required to comply with 3.66

Gas supply chain facility

- Designated critical by 3.65
- On the electricity supply chain map

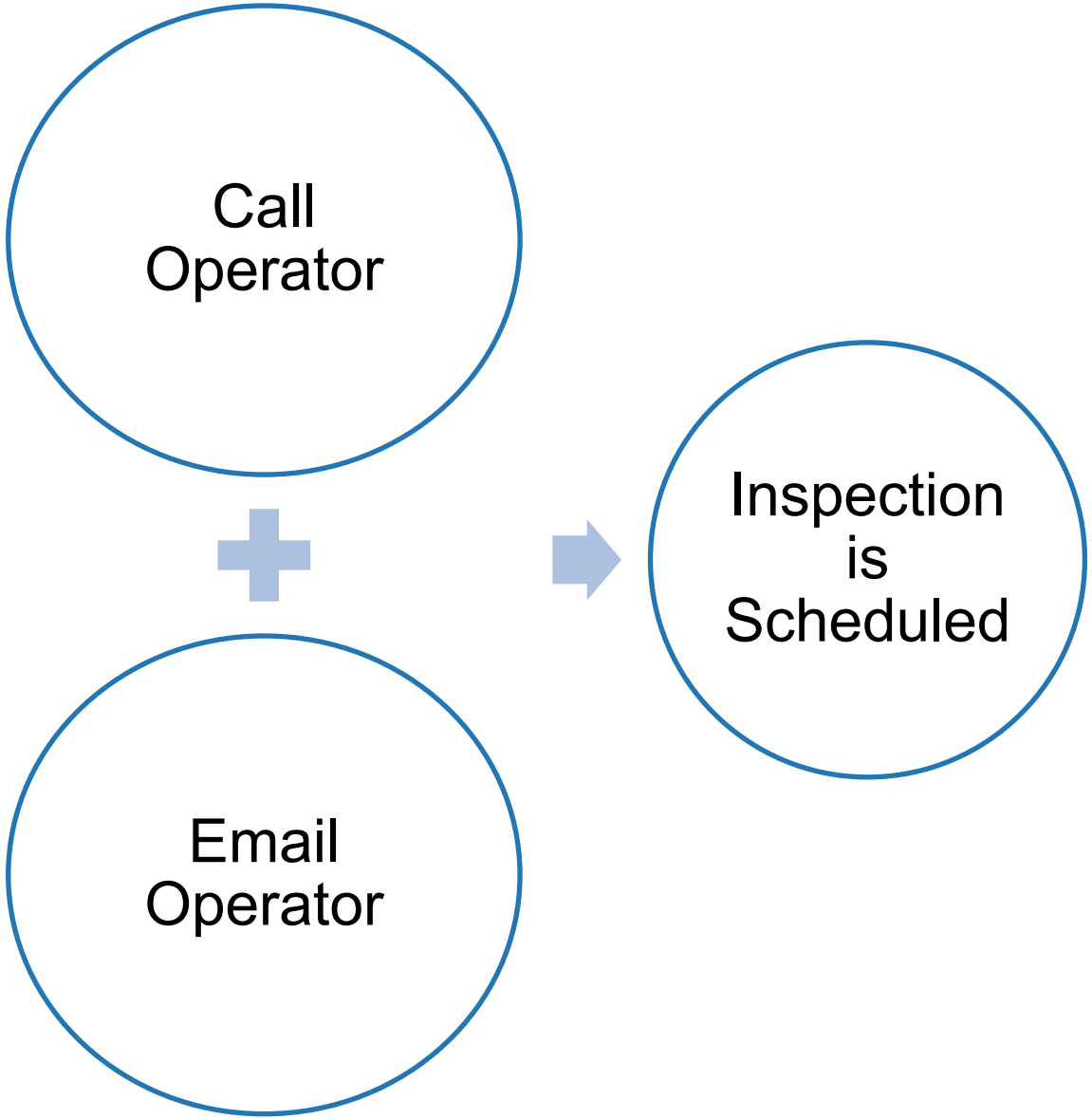
Gas pipeline facility

- Directly serves a natural gas electric generation facility
  - Facility provides power to the electric grid
- On the electricity supply chain map

Inspection Schedule - Winter

Before Dec 1	• Schedule early if weatherized • Site Verifications
After Dec 1	• 3.66 facilities required to be weatherized • Inspect priority 1 facilities first
During weather emergency	• Notification of forced weather-related stoppage • Inspection from notification

Connect and Schedule Inspection



Prepare/Review for Inspection

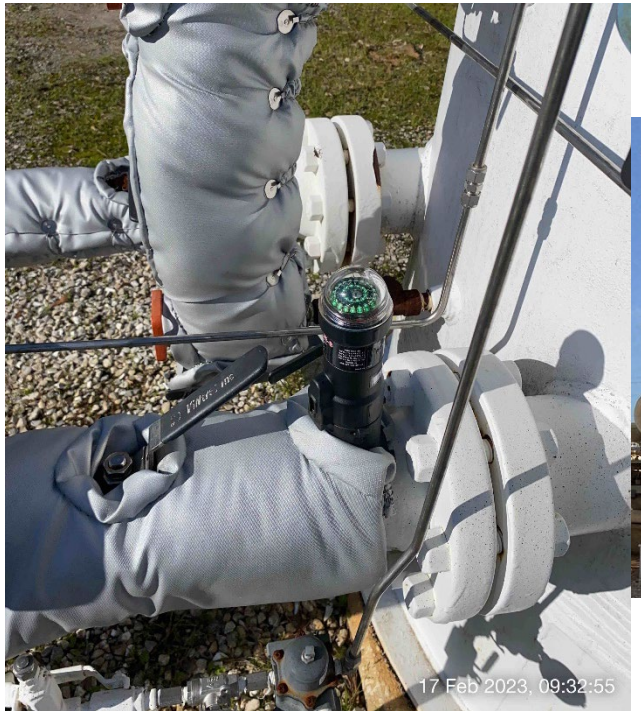
RRC inspectors will use attestation information when inspecting facilities subject to §3.66

Inspector should be able to identify which weatherization methods apply to which facility

Inspector will confirm with operator, safety requirements and further items to consider.

Inspection

- **Confirm Weather Preparedness**
- **Confirm Facility Weatherization (Facility Observations)**
  - **Weatherize all facilities subject to Rule 3.66**

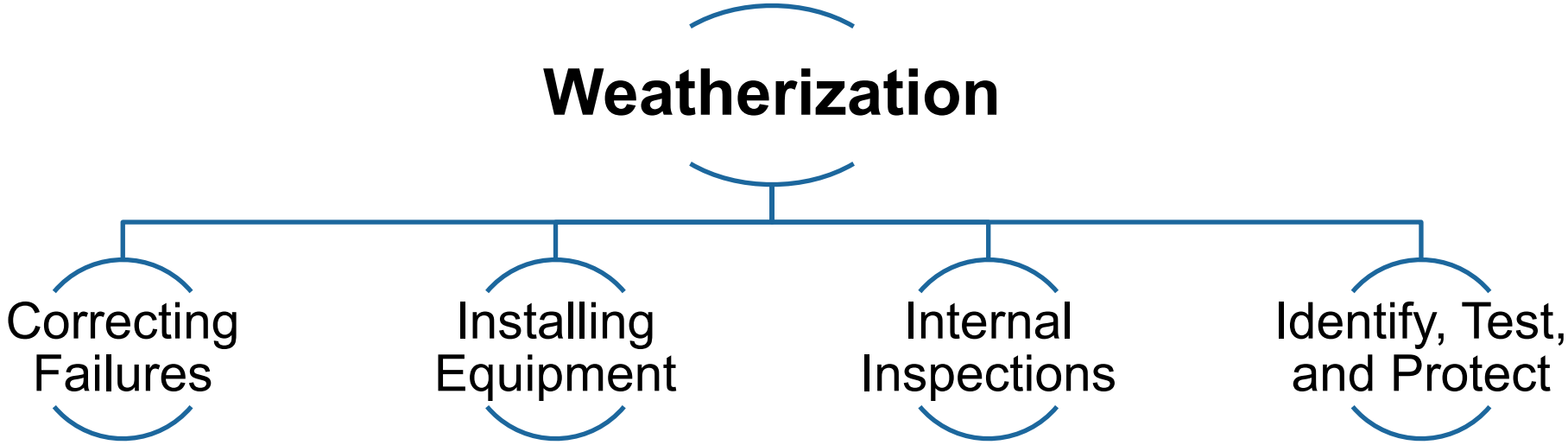


Weather Emergency Preparedness

Required weather emergency preparation measures:

- Consideration of the risk to the health and safety of employees and protection of the environment.
- Providing training on weather emergency preparations and operations to relevant operational personnel
- **Weatherization** of the facility

Weatherization



What "Right" Looks Like (1 of 3)

A few facility observations that inspectors will look for during an inspection:

- Methanol injection/drip
- Water removal – e.g. solid absorption, glycol unit
- Thermal insulation/heat tracing
- Wind breaks and temporary enclosures
- Heating devices
- Monitoring devices, instrument controls (Nitrogen), enclosing sensors
- Drip pots (prevent static water)

What “Right” Looks Like (2 of 3)

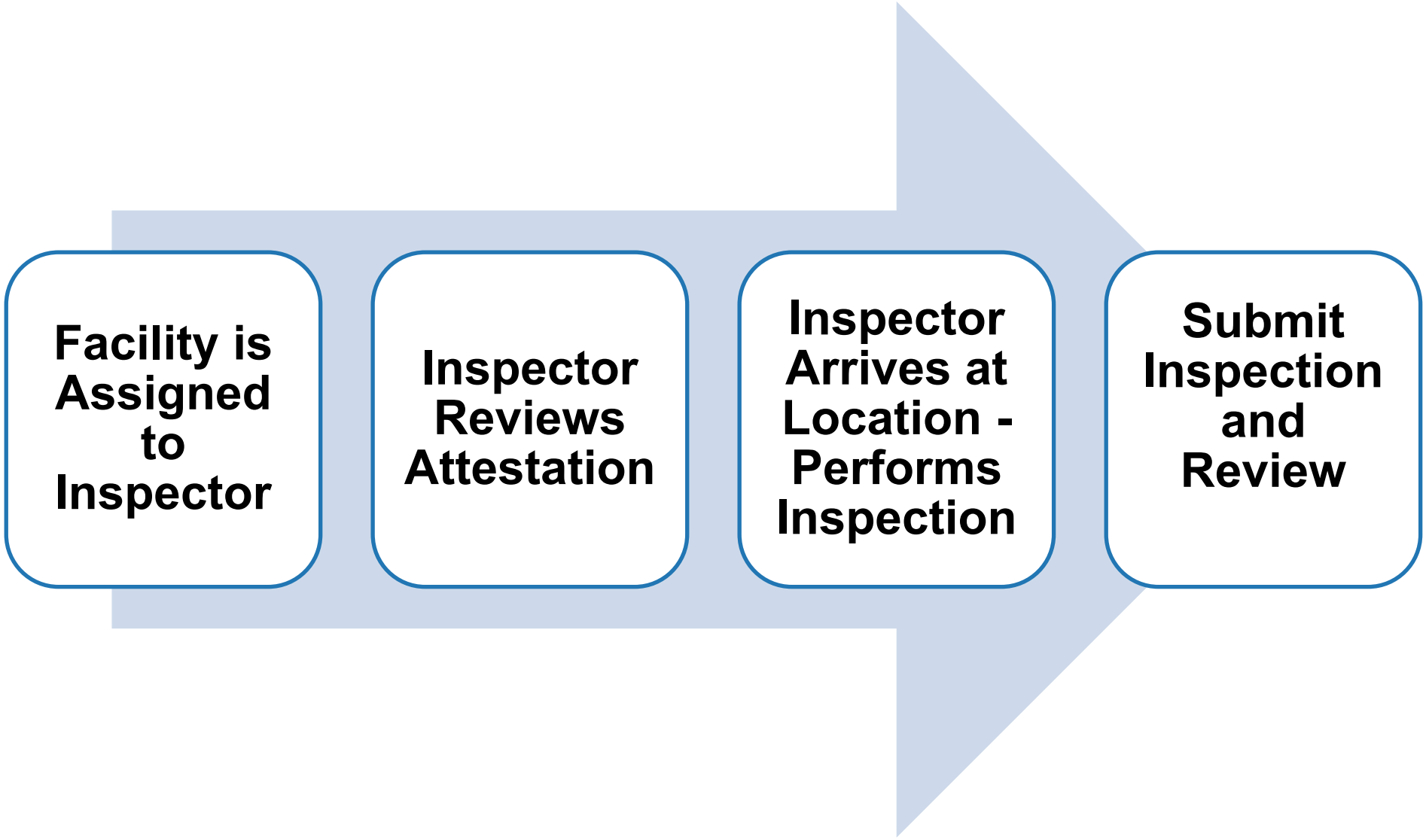
What “Right” Looks Like (3 of 3)

Documentation

Critical Infrastructure Inspection System (CIIS)

- Confirmation of weather preparedness is documented.
- Weatherization methods of facility are documented as facility observations.
- Inspections are reviewed.
  - Inspector Comments.
  - Facility Observation(s).
  - Location(s) [Geolocation(s)].

Summary


Facility is Assigned to Inspector
Inspector Reviews Attestation
Inspector Arrives at Location - Performs Inspection
Submit Inspection and Review

Conclusions

Before December 1 – site verification and early inspection scheduling (not required but recommended).

December 1 – 3.66 facilities required to have weather preparations implemented.

Forced Stoppage – Inspect facility once RRC is notified of forced stoppage

July 5 – September 29 Extreme Heat Inspections

CID – Director Contact Information

Gilbert Herrera – East Region

- gilbert.herrera@rrc.texas.gov
- 737-288-1507

Jim Collins – North Region

- jim.collins@rrc.texas.gov
- 512-964-0174

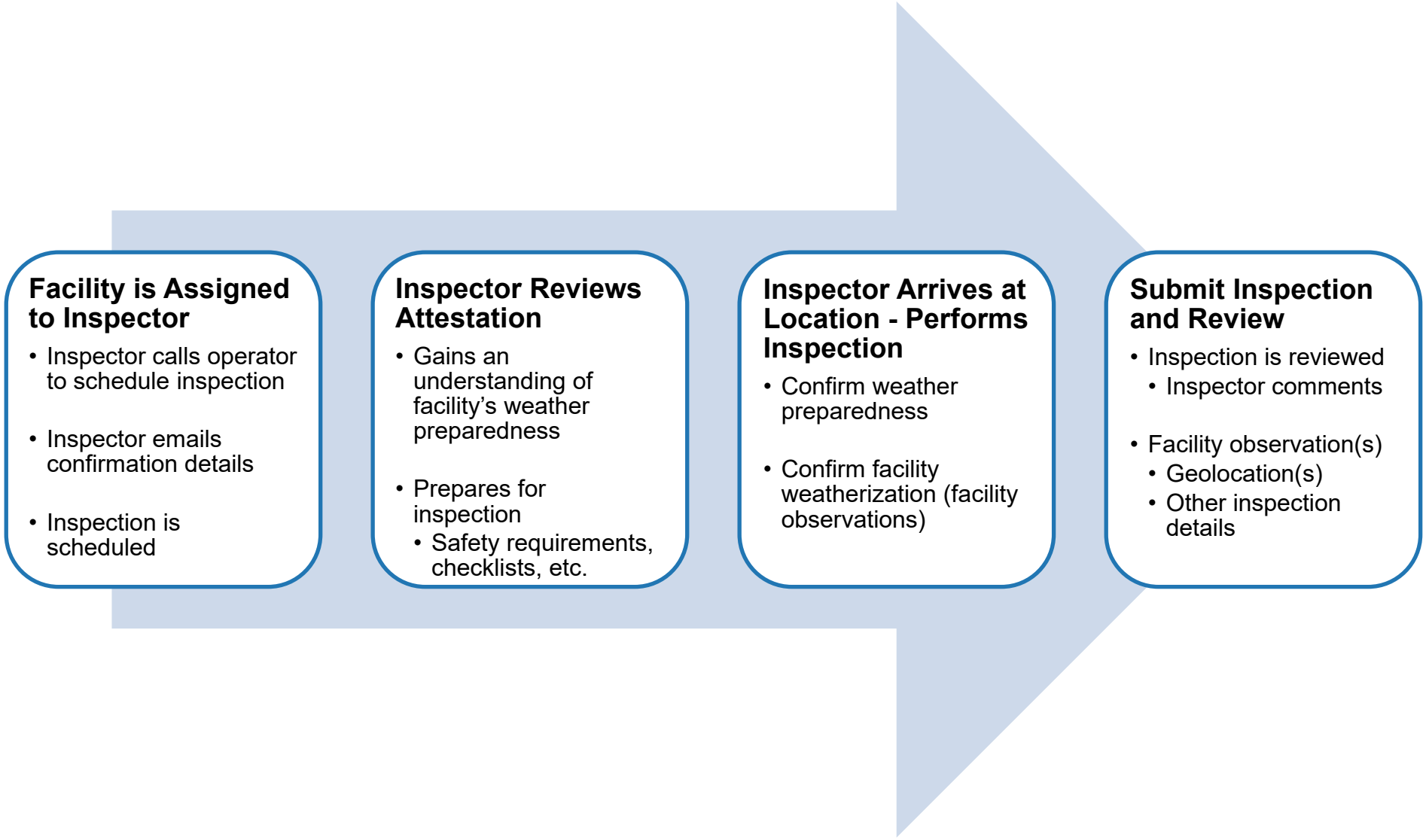
Jarrod Eberly – West Region

- jarrod.eberly@rrc.texas.gov
- 512-463-6737

Andrea Meyer – South Region

- andrea.meyer@rrc.texas.gov
- 325-277-2959

Questions


Facility is Assigned to Inspector
• Inspector calls operator to schedule inspection
• Inspector emails confirmation details
• Inspection is scheduled
Inspector Reviews Attestation
• Gains an understanding of facility's weather preparedness
• Prepares for inspection
• Safety requirements, checklists, etc.
Inspector Arrives at Location - Performs Inspection
• Confirm weather preparedness
• Confirm facility weatherization (facility observations)
Submit Inspection and Review
• Inspection is reviewed
• Inspector comments
• Facility observation(s)
• Geolocation(s)
• Other inspection details

Priority 1 Facilities - Winter

- Leases producing 5,000 mcf/day or more.
- Gas Processing Facilities.
- Storage Facilities.
- Components of Transmission lines directly connect to power generators.
- Compressors.

Priority 1 Facilities – Heat

- Gas Processing Facilities.
- Storage Facilities.

Notifications

Weather-related forced stoppage during a weather emergency:

- ✓ Notify the Commission immediately through the CID notification portal if the stoppage is not resolved within **24 hours** of discover.

Major Weather-related forced stoppage during a weather emergency:

- ✓ Notify the Commission within **one hour** of discovery of the stoppage, contact the Commission through the CID 24-hour emergency telephone number and submit a notification through the CID notification portal.

Major and Repeated Stoppage (1 of 2)

Major weather-related forced stoppage:

A weather-related forced stoppage during a weather emergency that is the result of the deliberate disregard of this section or that results in:

- (A) a loss of production exceeding 5,000 Mcf of natural gas per day per oil lease;
- (B) a loss of production exceeding 5,000 Mcf of natural gas per day per gas well;
- (C) a loss of gas processing capacity exceeding 200 MMcf per day;
- (D) a loss of storage withdrawal capacity exceeding 200 MMcf per day; or
- (E) a loss of transportation capacity exceeding 200 MMcf per day.

Major and Repeated Stoppage (2 of 2)

Repeated weather-related forced stoppage

- More than one weather-related forced stoppage violation within a 12-month period

Weather Emergency

- Weather conditions such as freezing temperatures, freezing precipitation, or extreme heat in the facility's county or counties that result in an energy emergency as defined by §3.65
- A weather emergency does not include weather conditions that cannot be reasonably mitigated such as tornadoes, floods, or hurricanes

Energy Emergency

Any event that results in firm load shed or has the potential to result in firm load shed required by the reliability coordinator of a power region in Texas.

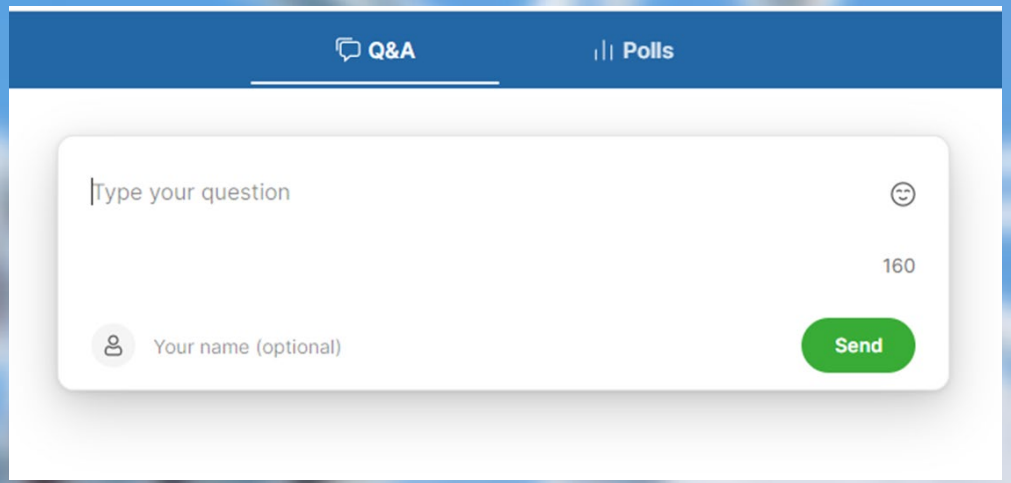
An event that has the "potential to result in firm load shed" is when the reliability coordinator of a power region in Texas has issued an Energy Emergency Alert Level 1 or 2

Winter Weatherization Workshop

Return at: 1:25 p.m.

- Executive Welcome
- Updates Since Uri
- Inquiries and Alerts
- ERCOT Weatherization Activities Update
- Weatherization Standards
- PUCT Winterization Activities Update
- RRC Winterization Activities Update
- **2023-24 Winter Weather Forecast and Review of Historical Winter Extremes**
- Winter Weather Prep and Lessons Learned
- NERC Winterization Activities Update
- Entity Inspection Program

To submit questions during the workshop, please visit **slido.com** and enter today's participant code: **TXRE**



2023-24 Preliminary Winter Weather Outlook

Chris Coleman
ERCOT Sr. Meteorologist

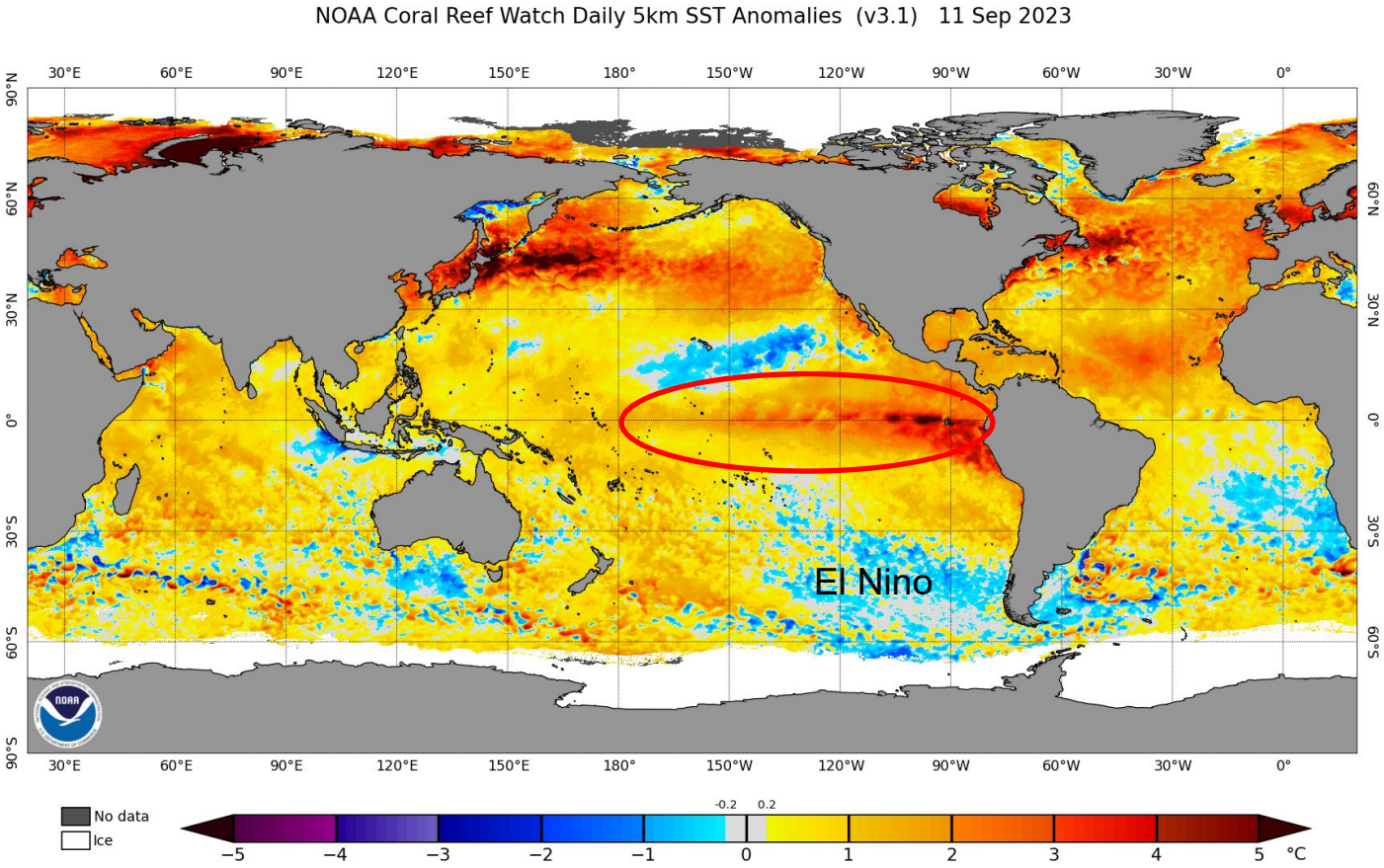
Generator Weatherization Workshop
Sept. 13, 2023

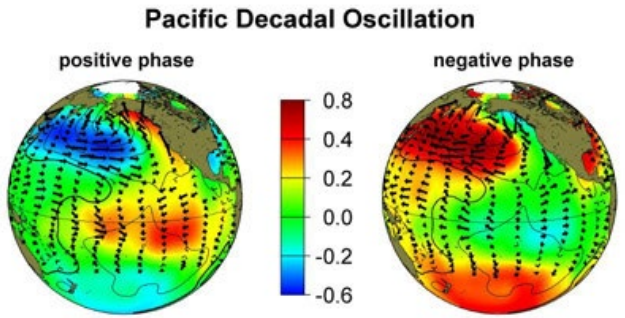
Agenda

- An usual 2023
- Updating the summer
- Review of last winter (and other recent winters)
- Expectations for the upcoming winter

Unusual Pattern

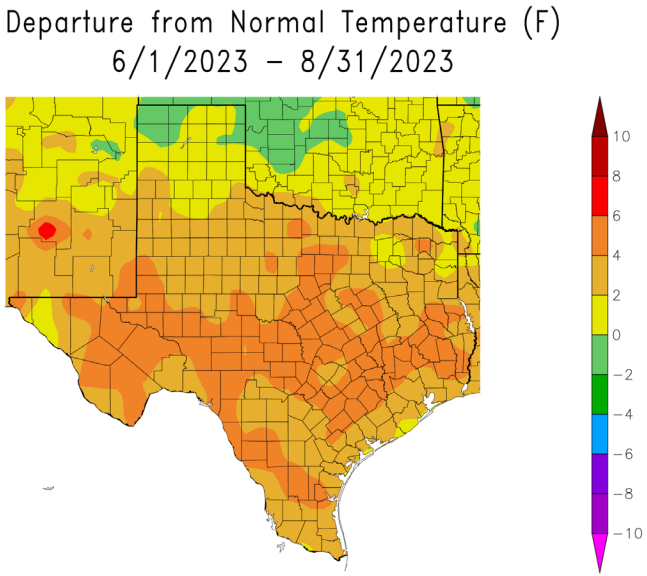
- Fast and aggressive turnover from prolonged La Nina to strong El Nino
- El Nino (especially strong cycles) occurring during a negative PDO (Pacific Decadal Oscillation) are very uncommon
  - The last time this happened was 1963
- Texas went from the 80th driest April-June (2023) period to a very hot (#2) and dry (#7) summer
  - 2011, 2022, and 1998 (the other 3 top 4 hottest summers) were all preceded by top 7 driest April-June periods
  - A dry spring is typically a good indicator of a hot summer (2023 was not a dry spring)
  - Texas has never experienced a flip this extreme
- **There is very little historical precedence for what is occurring in 2023**



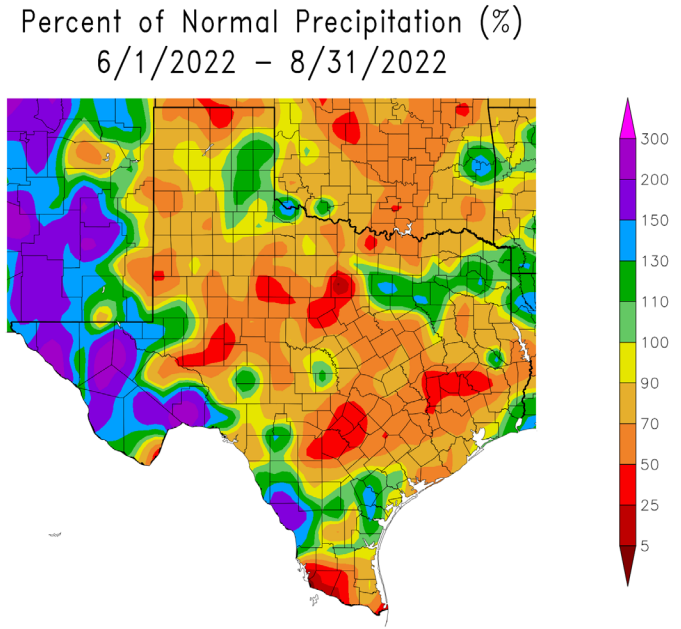


Updating Summer 2023

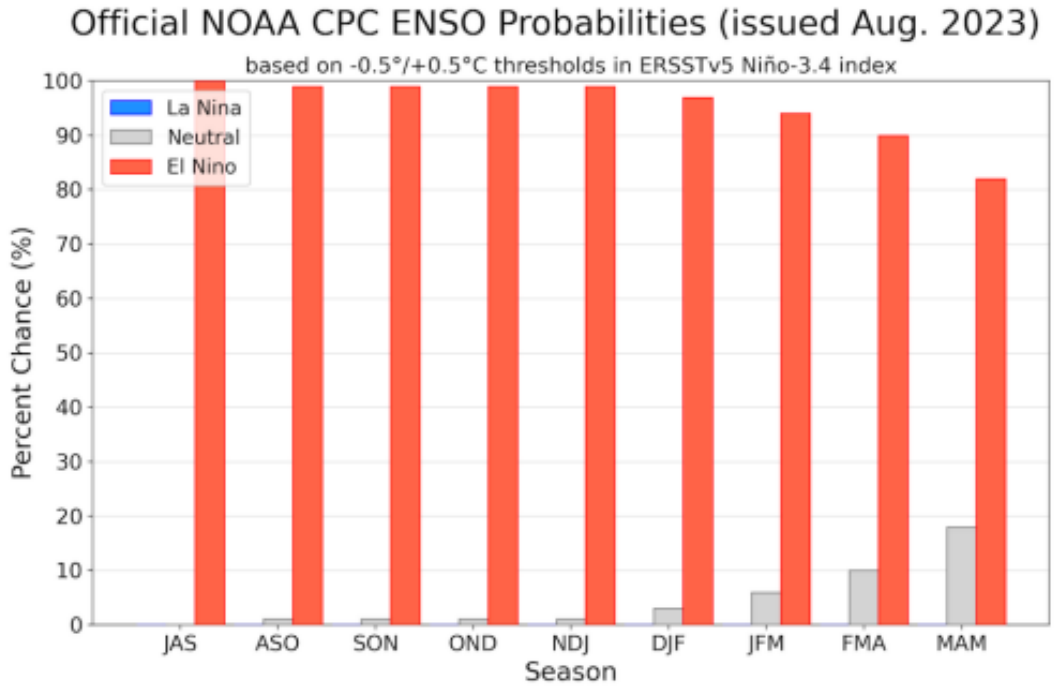
- **June-August 2023** replaced 2022 as the **second hottest** on record for the state of Texas, with 2011 continuing to hold the #1 spot (period of record: 1895-current)
- The Jun-Aug period was the 7th driest on record. This was the driest summer period since 2011 (1st driest) and second driest Jun-Aug period this century
- *100-degree days:*
  - *Dallas: 47 days. 4th most on record (2011, 1980, 1956)*
  - *Houston: 22 days. Most since 2011, second most was 10 in 2015*
  - *Austin: 68 days. Tied for 3rd most with 2009 (2011, 1925). One more would put 2022 into #2*
  - *San Antonio: 58 days. Most since 2009 (59).*

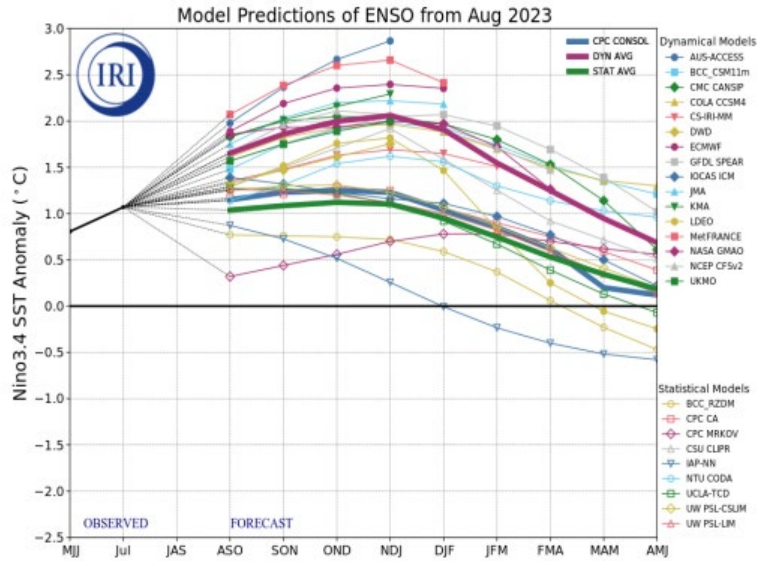


Current Fall 2023 Outlook suggests this dry pattern will continue through at least October (possibly November as well)

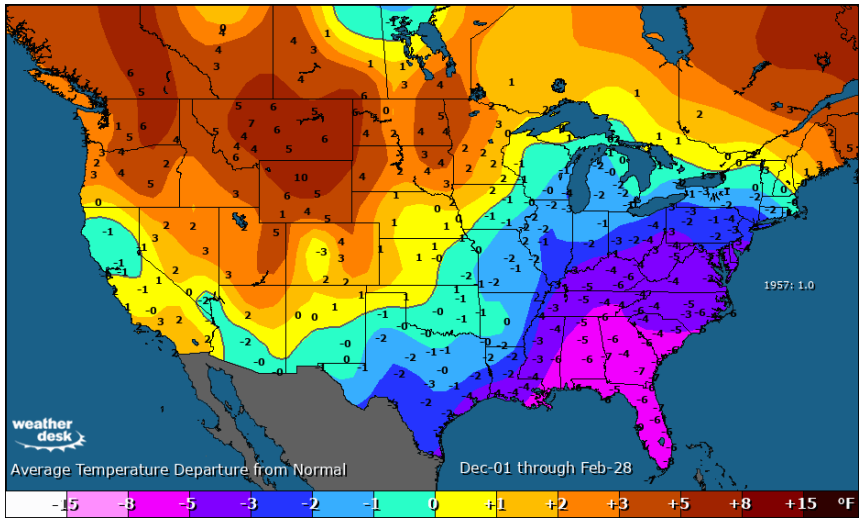


El Niño



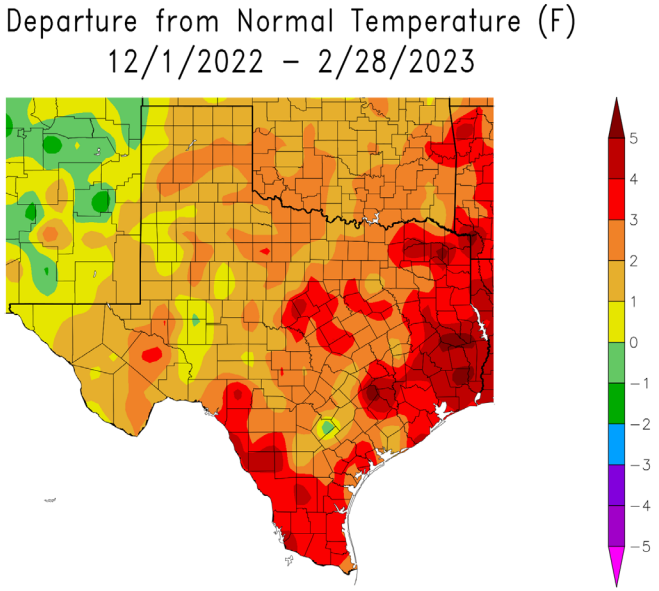


- El Niño is expected to continue through the winter season
- This comes after three consecutive winters impacted by La Niña
  - The last time this happened was 1957 →



1957-58 Winter Temperature Anomaly

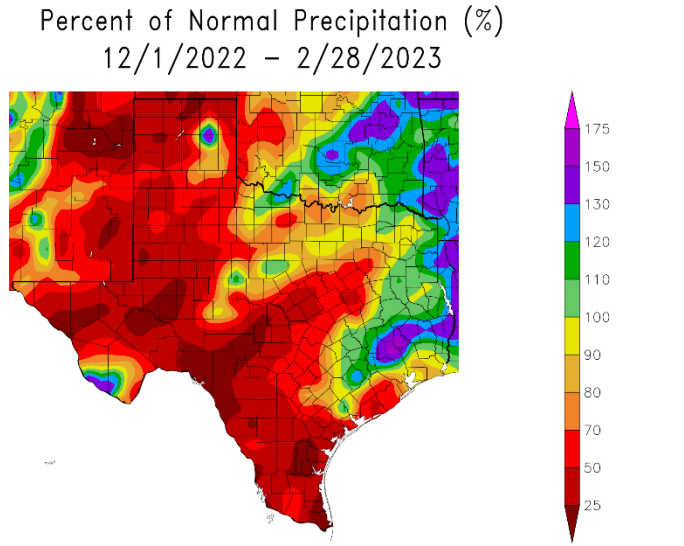
Reviewing Last Winter



Temperature anomaly

ERCOT winter (Dec 1 – Feb 28)

- Last winter was the 6h warmest on record (128 historical winters)
- However, it featured a period of extreme cold right before Christmas
- Austin fell to 15° on 12/23 (and 12/22-12/24 lows were all in the teens). That was the second coldest low since 1990 – topped only by February 2021.
- This emphasizes the point made annually – mild (above normal) winters can and do have periods of extreme cold



Precipitation anomaly

Seasonal Rankings – what is normal?

- "Normal" may no longer be the best way to express seasonal (or monthly, or possibly even daily) temperatures
- As Texas keeps having many more above normal temperature seasons, it keeps raising the bar for what is "normal"
- **We commonly use a 15-year normal (2008-2022). Applying that normal to all historical summers (1895-2023) results in only 19 of 129 summers coming in above normal**
- This is why I'll oftentimes give all-time rankings and comparisons with recent years (in addition to or instead of "normal")

Mean Temperature Ranking of Recent Texas Winters (128 historical winters)

2022-23	**123rd coldest (6th warmest)**
2021-22	**113th** coldest
2020-21	42nd
2019-20	**113th**
2018-19	95th
2017-18	78th
2016-17	**128th** coldest (warmest winter on record)
2015-16	**120th**
2014-15	70th
2013-14	30th
2012-13	**111th**
2011-12	101st

Since 2001, only 3 winters have ranked in the coldest third (1-43) of historical winters (2009-10 is the other)

Winter vs Summer

Winter extremes happen quickly

- A strong cold front moves through dropping temperatures sharply – sometimes 30-40 degrees in a matter of an hour or two.
- High wind speeds also tend to accompany strong cold fronts, resulting in even colder wind chills – and cold air that more readily penetrates buildings and other structures.
- A winter load peak can be 20,000+ MW greater than the day prior

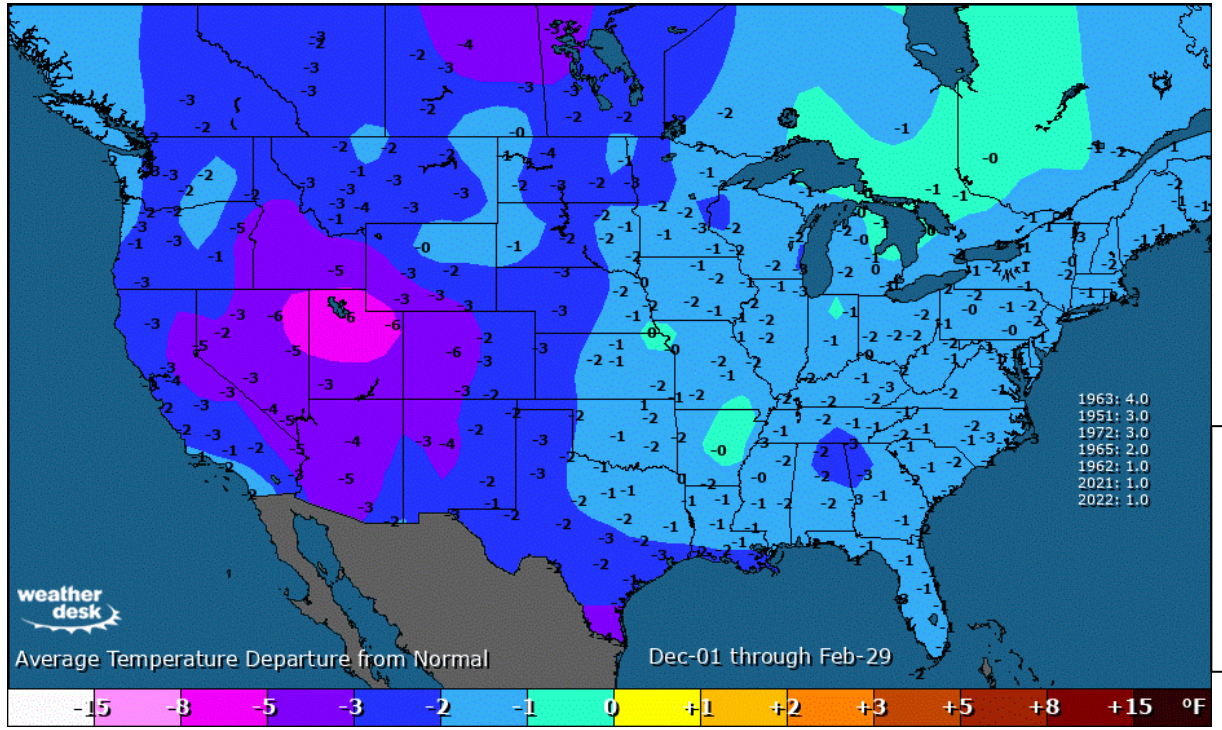
Summer extremes are typical, with an uninterrupted build of heat over an extended period

- A hot summer pattern in Texas is the result of high pressure that parks itself over the state, limiting rain chances and cloud cover, while allowing the high angle of the Texas sun in the summer to reach its full impact
- It's commonly the day-after-day build of heat that result in load peaks during summer
- A summer load peak is likely only a few hundred to a couple thousand megawatts higher than the previous day

Because of this difference, a summer long-range weather outlook tends to do a better job at capturing extremes and peaks than a winter long-range outlook. Remember, a very strong cold front can move through in an otherwise mild winter (cold winters are defined more by the frequency of cold fronts).

Preliminary Winter 2023-24 Temperature Outlook

Analog weighted consensus: 1963-64, 1951-52, 1971-72, 1965-66, 1962-63, 2021-22, 2022-23

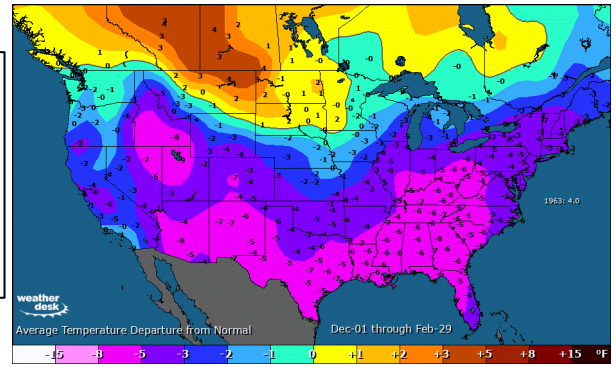


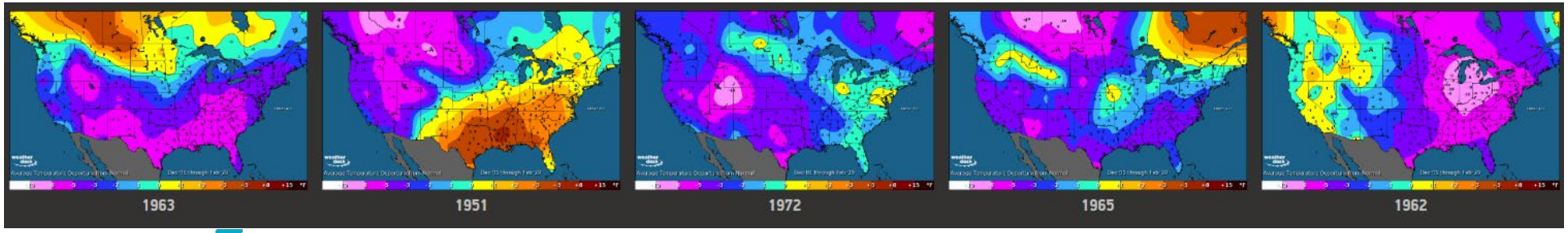
Coldest temps for DFW; state temp rank

1963-64: 4°; 5th coldest
1951-52: 16°; 124th
1971-72: 15°; 101st
1965-66: 9°; 24th
1962-63: 9°; 14th
(2021-22): 19°; 113th
(2022-23): 11°; 123rd

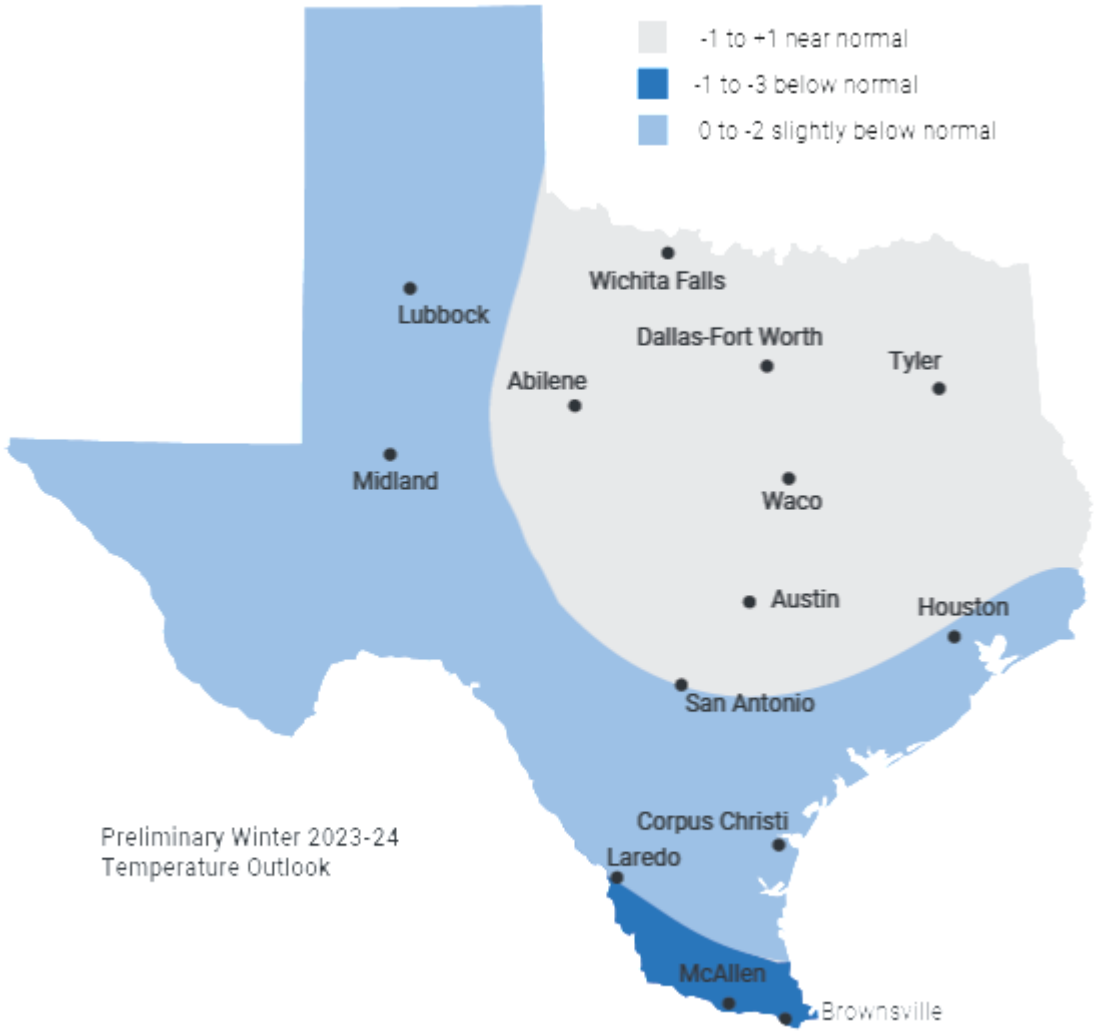
The all-time average coldest day is 14° at DFW; this century alone, 17°

The 6 best historical matches (analogs) are all from over 50 years ago. The patterns tend to work better than intensities From distant analog years





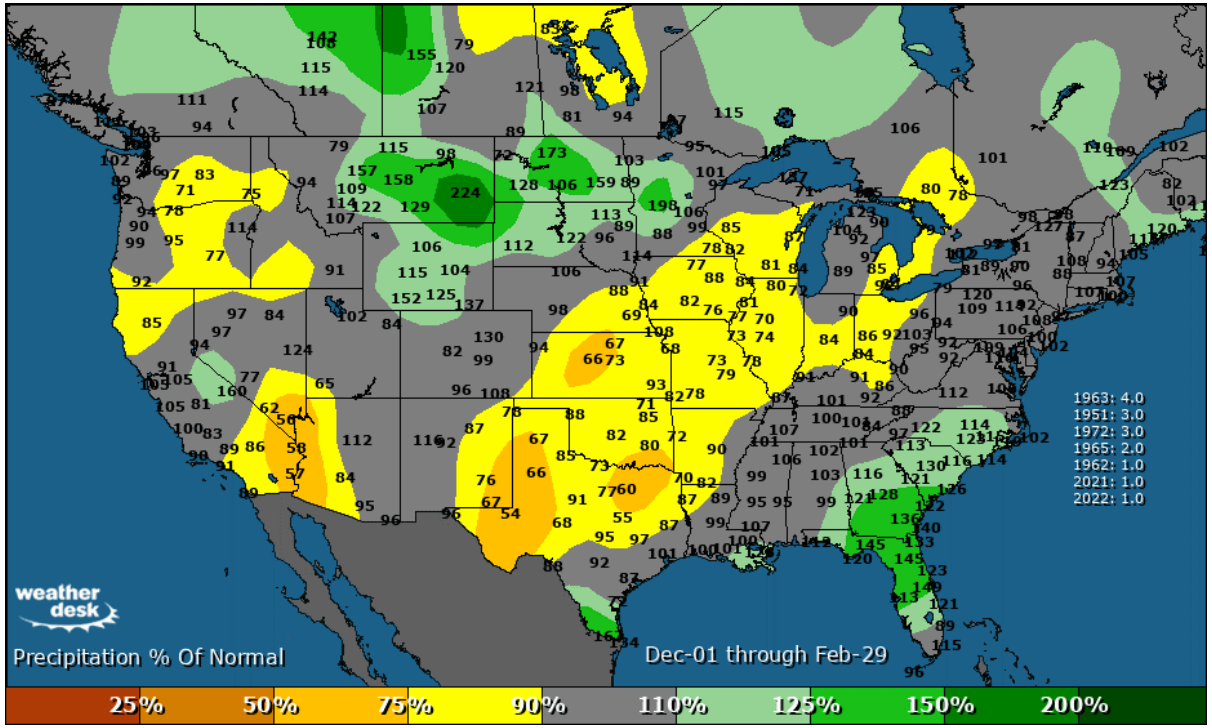
Preliminary Winter 2023-24 Temperature Outlook



This relatively cold winter outlook doesn't guarantee a period (or more) of extreme cold – but it does suggest more below normal days and less above normal days – which *could* result in a period (or more) of extreme cold

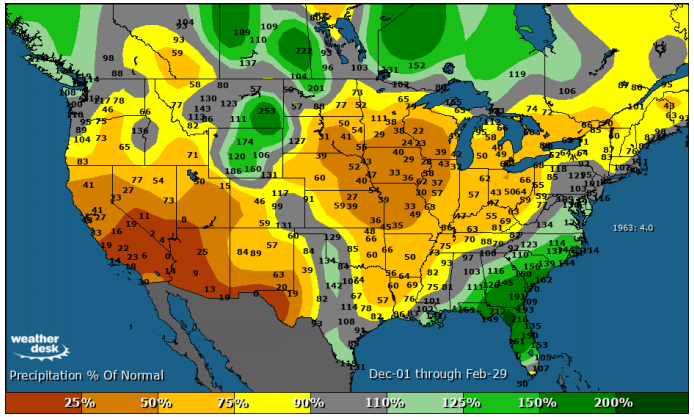
Preliminary Winter 2023-24 Precipitation Outlook

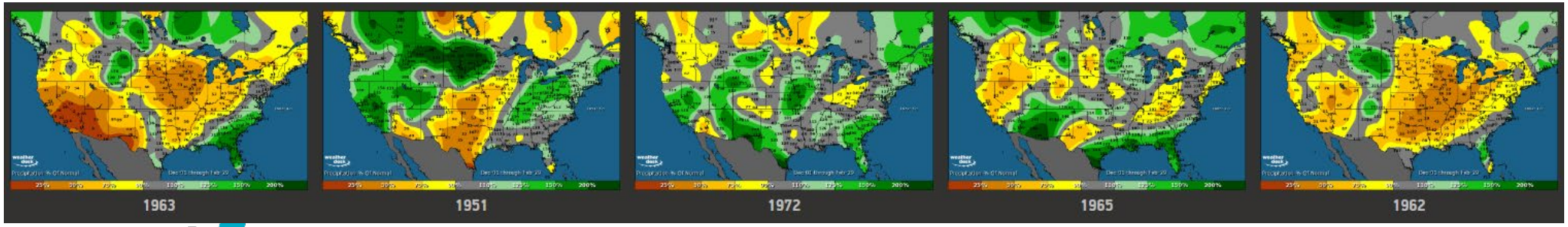
Analog weighted consensus: 1963-64, 1951-52, 1971-72, 1965-66, 1962-63, 2021-22, 2022-23



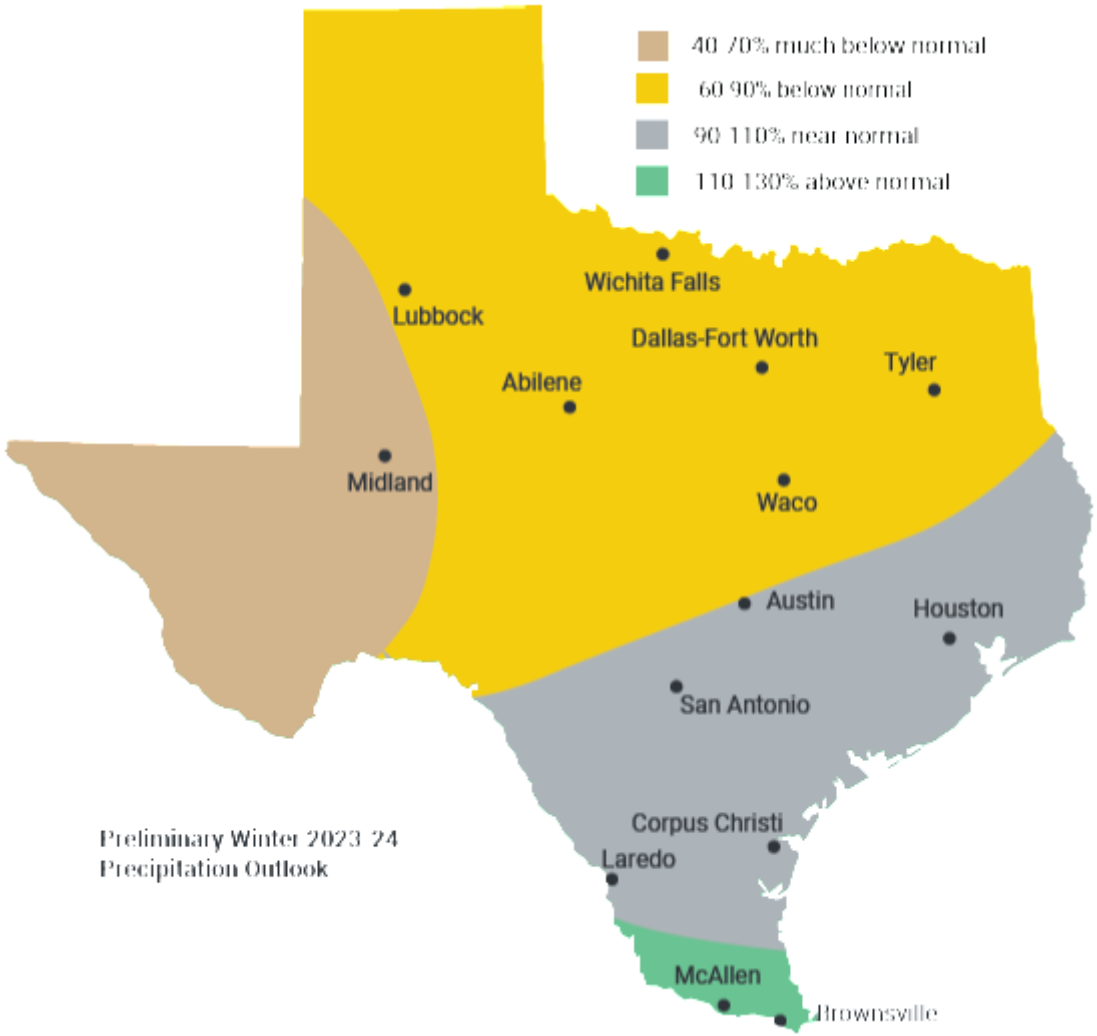
Snowfall for Dallas-Fort Worth

1963-64: 15.3”
1951-52: 0.6”
1971-72: trace
1965-66: 7.3”
1962-63: 0.1”
(2021-22): 1.7”
(2022-23): 1.3”

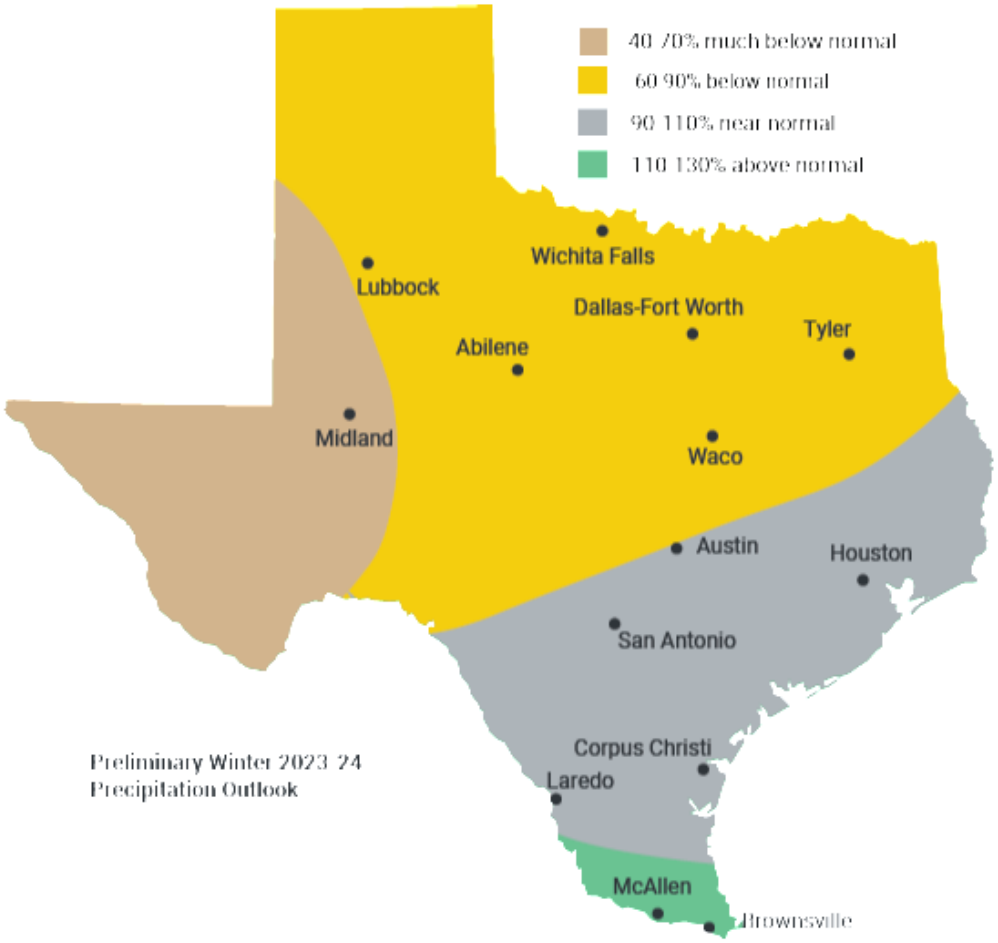


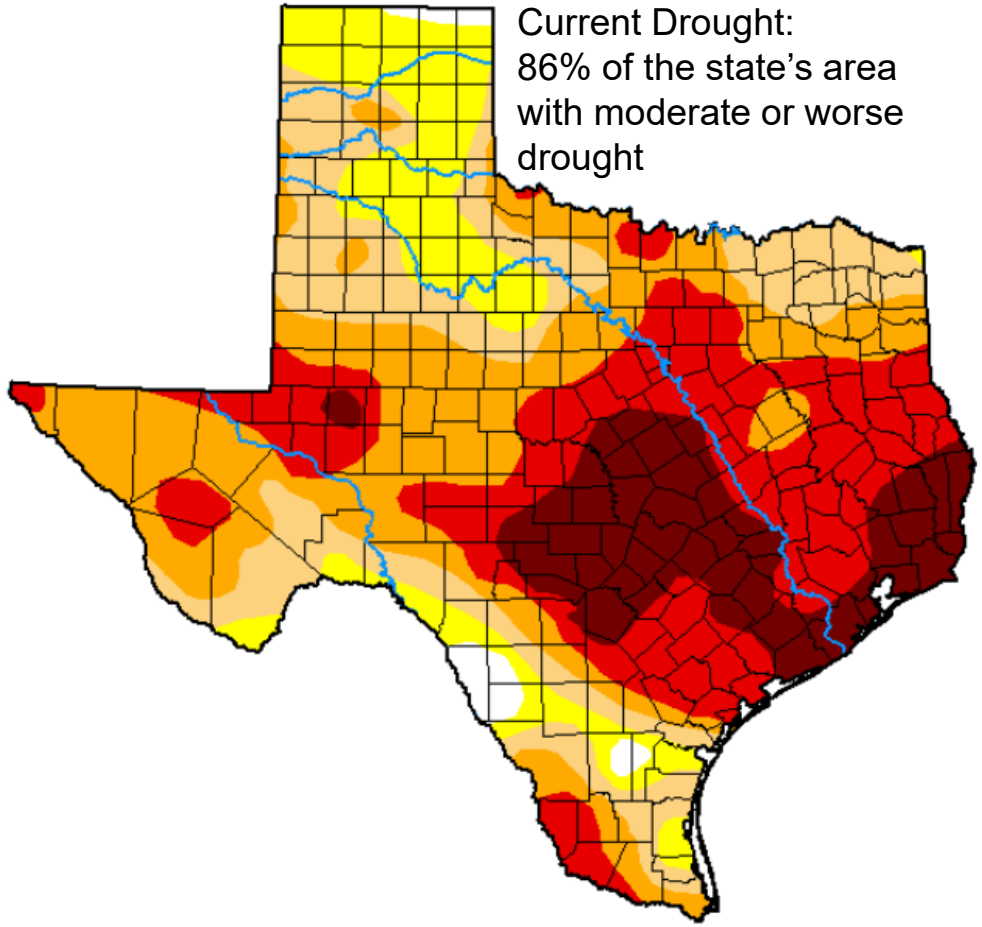


Preliminary Winter 2023-24 Precipitation Outlook



Winter 2023-24 Precipitation Outlook vs Drought





Current Drought:
86% of the state's area with moderate or worse drought

It's quite possible – even with an El Nino – the drought continues into 2024

Winter Weather Outlook Summary

- The preliminary winter forecast suggests the upcoming winter could be the coldest since the “polar vortex” winter of 2013-14
- The winter is forecasted to continue with a mostly dry pattern, which would act to sustain or increase the drought
- Given the highly unusual weather patterns and atmospheric/ oceanic cycles, please check for the final winter outlook
- There is not a strong correlation between the winter temperature anomaly and period(s) of extreme cold
- **Each and every winter should be accompanied by a mindset for a period of extreme cold**

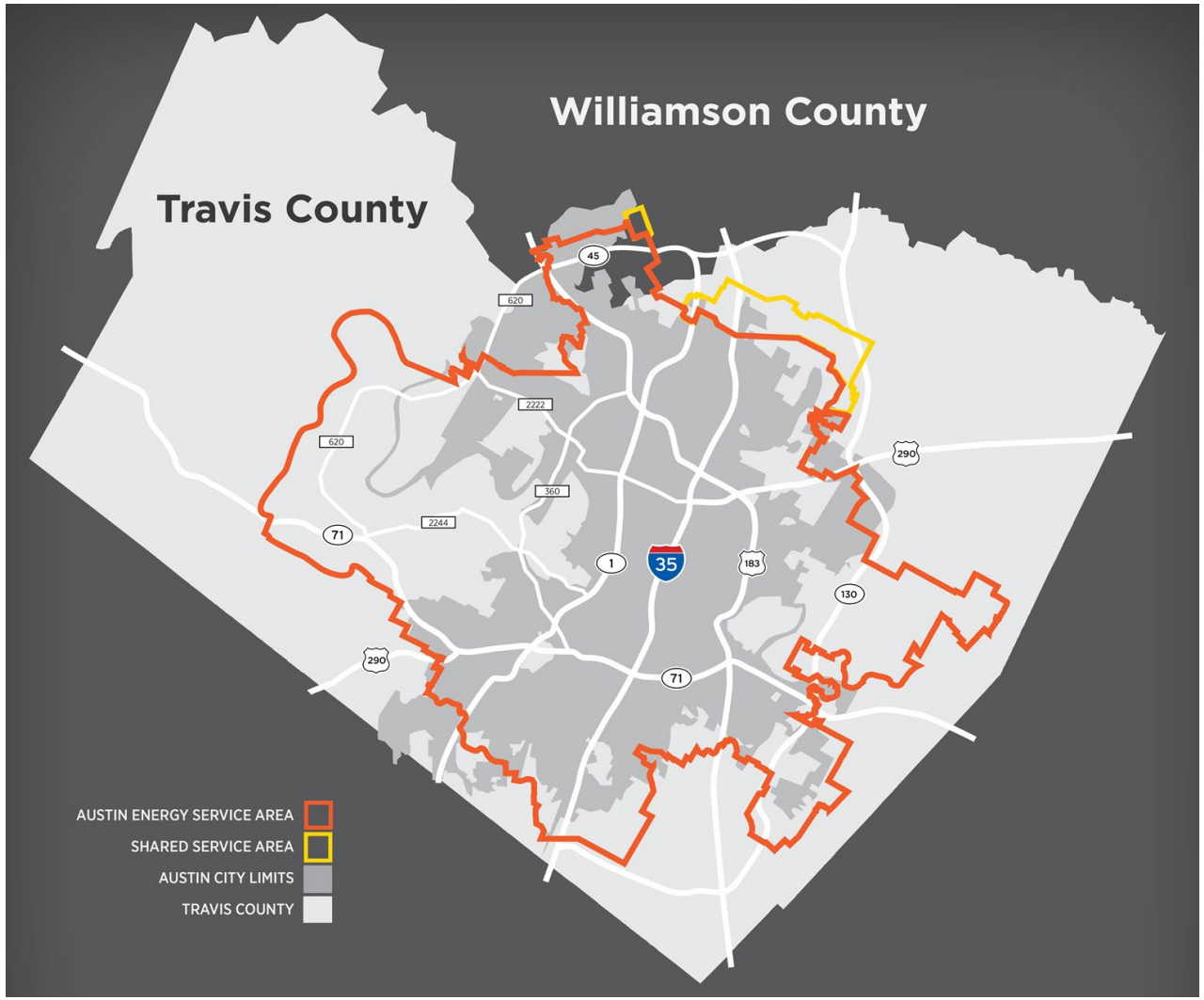
Winter Weather Preparation and Lessons Learned

Brock Carter
Director, Corporate Compliance Programs

September 13, 2023

Austin Energy Overview

- Founded in 1895
- 3rd largest municipally owned utility
- 630 miles of Transmission Lines
- 75 Substations
- 530,000+ customers
- Wind, Solar, Local Solar, Coal, Gas, Nuclear, Biomass Generation
- 437 square mile service territory
- 50% service area outside City of Austin
- Vertically integrated utility in ERCOT wholesale market



Austin
Bee Cave
Cedar Park
Creedmoor
Del Valle
Lakeway
Pflugerville
Rolling Wood
Sunset Valley
Village of the Hills
Westlake Hills

Austin Energy Thermal Generation

Austin Energy owns/operates two thermal generation plants

Decker Creek Power Station

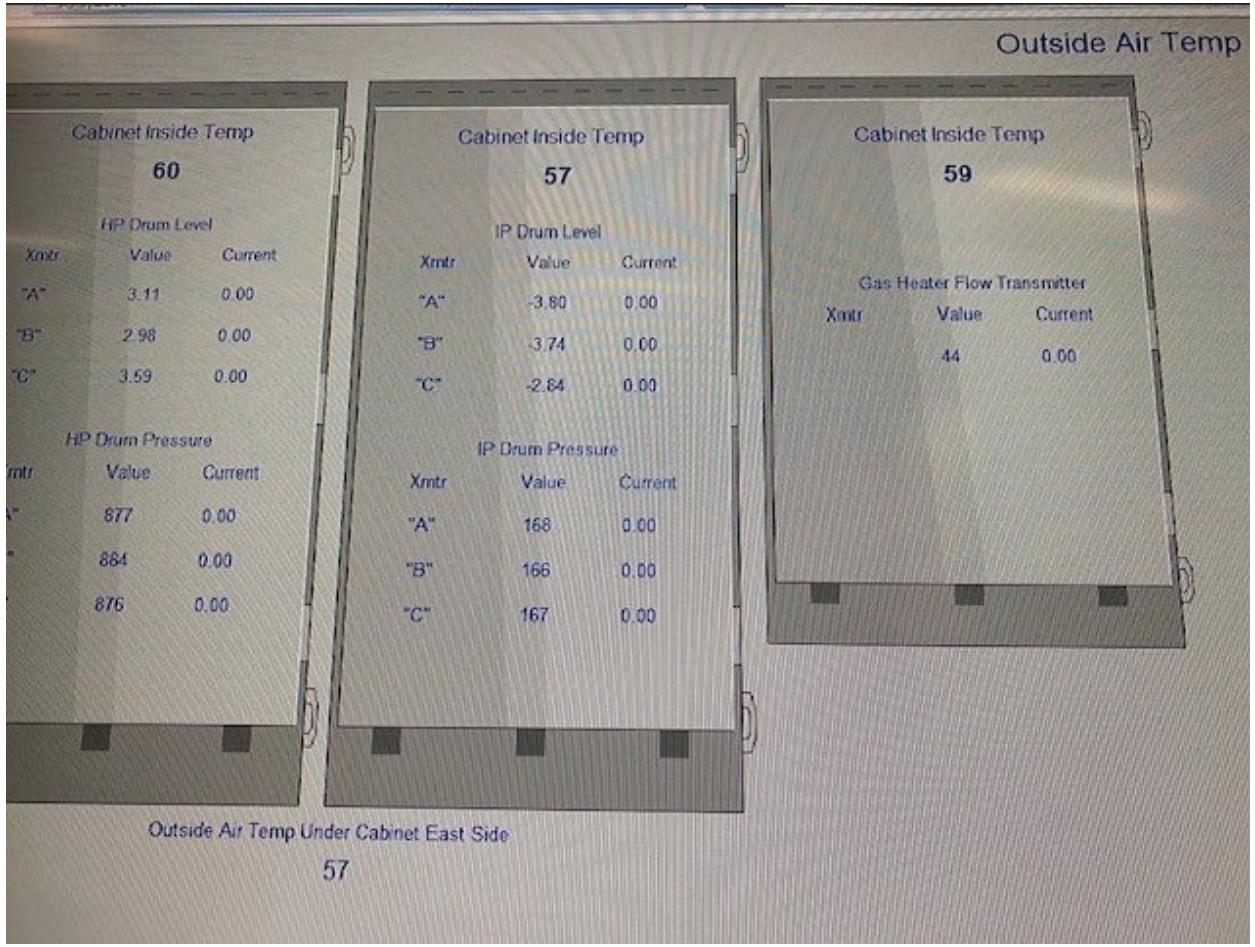
- 48 MW Gas Turbines (4 units)
- 192 MW total generating capacity
- Recently retired 2 steam units
- Black Start resource

Sand Hill Energy Center

- 47 MW Gas Turbines (6 units)
- 295 MW Combined Cycle (1 gas unit and 1 steam unit)
- 577 MW total generating capacity

Pre URI Weatherization Improvements

- Austin Energy made recommended weatherization improvements to its plants following the February 2011 winter storm
  - Heat tracing
  - Wind walls
  - Additional insulation
- Heat trace study performed 2017 following a trip due to a frozen pressure sensing line
- Instrumentation upgraded prior to URI, included wireless remote monitoring



Control Room wireless monitoring display

URI Lessons Learned

- Each event provides unique challenges
  - DP1 steam unit retired prior to URI led to challenges with heat loss for DP2 steam unit
  - Winter weather readiness will need to be reassessed as changes are made at the plants
- Plant staffing plans
  - The existing staffing plans worked very well and staff was onsite ready for the event
  - Logistics must be improved to support staff
- Heat tracing and insulation
  - Plant personnel required to manually de-ice during storm
  - Better engineering analysis needed to determine gaps in heat tracing and insulation

Post URI Weatherization Improvements

- 2021 comprehensive heat trace audit
  - Condensation in control boxes
  - Condensation in control cables
  - Failed self-regulating heating cable
  - Exposed power cables
  - New heat trace panel
  - Insulation for pipe fittings
  - Repairs of existing heat tracing
  - Insulation around existing heat tracing
  - Majority of the recommendations complete by winter 2021
- Third party engineering analysis
  - Prioritized recommendations
  - Minimum temperature on the report
- Additional third party engineering analysis

Post URI Weatherization Improvements

Left: High Pressure (HP) drum with wind walls. Drum end is fully enclosed with access panel.

Center: Internal view of east end of HP drum. Grating is covered in concrete fiber board to further protect the drum sensing lines (insulated and heat traced) from wind.

Right: View of completed east drum end enclosures.

Post URI Weatherization Improvements

Left: HRSG ground level with completed wind walls.

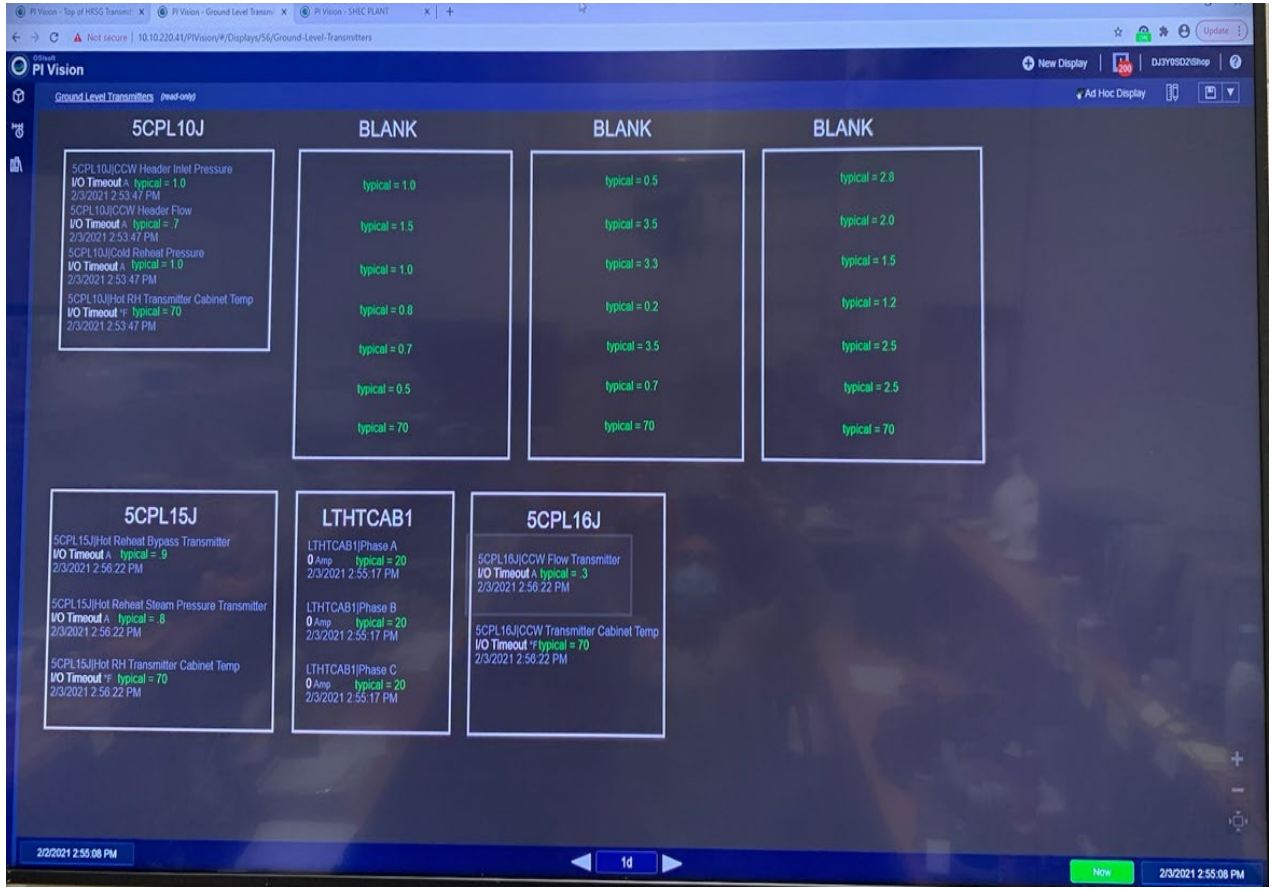
Right: New heat trace monitoring panels for simple cycle units at Sand Hill.

Post URI Weatherization Performance

- There have been no weather related trips for AE thermal units during subsequent cold post URI weather events

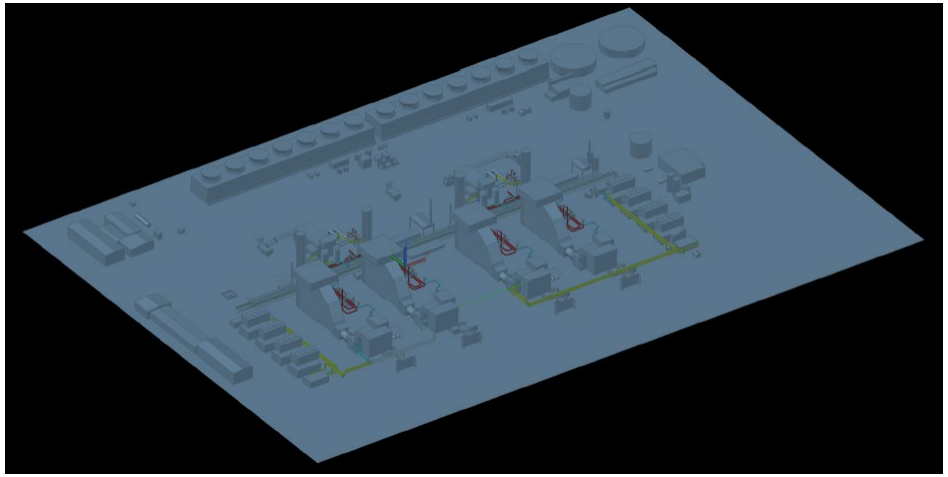
- Plant staffing
  - Improved logistic plans for plant staffing

- Improved heat tracing and insulation
  - Personnel were not required to manually de-ice
  - Improved heat tracing monitoring



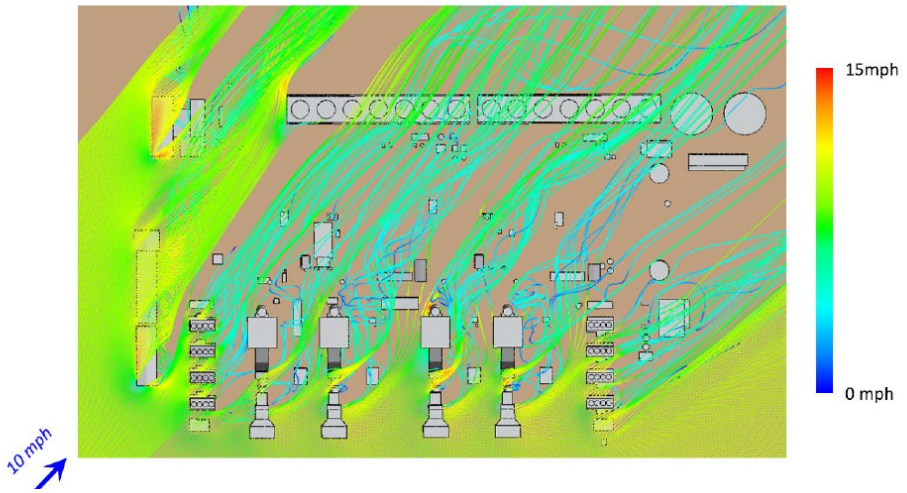
Future Weatherization Improvements

- Winterization Evaluation Study
  - Evaluate the impact of wind and temperate conditions for areas of concern
  - Site location
  - Existing insulation and heat trace design
  - Historical NOAA data
- 3D model used for evaluation
  - Evaluate airflow patterns and flow velocities in areas of concern
  - Heat loss over time
  - Time to freeze
- Additional weatherization measures tailored to location specific conditions



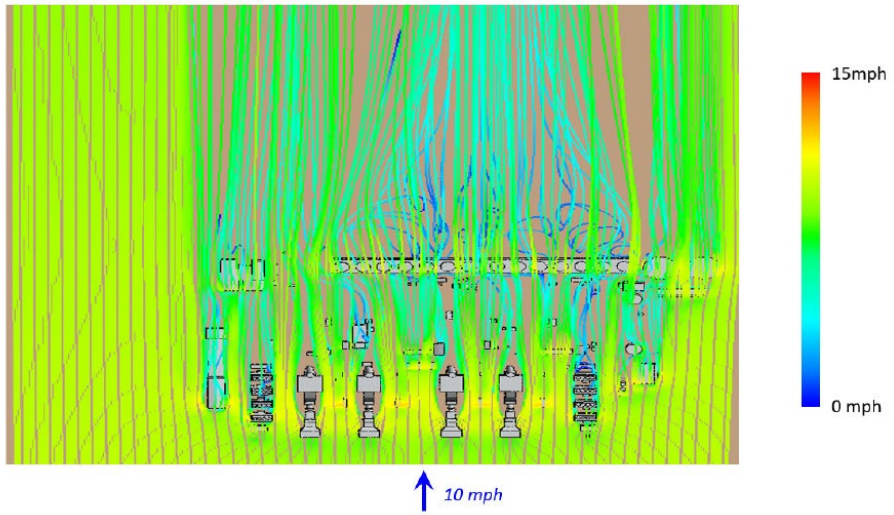
Future Weatherization Improvements

Southwest 10 mph wind

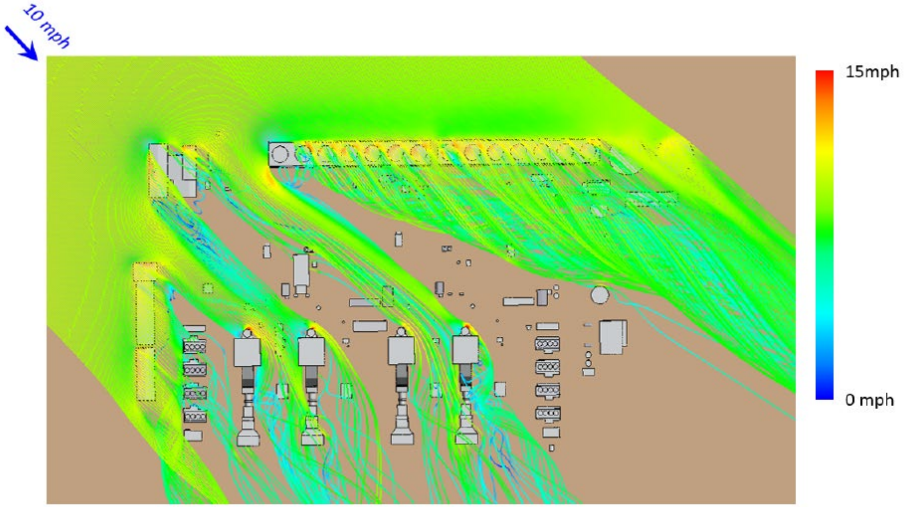


West 10 mph wind

South 10 mph wind

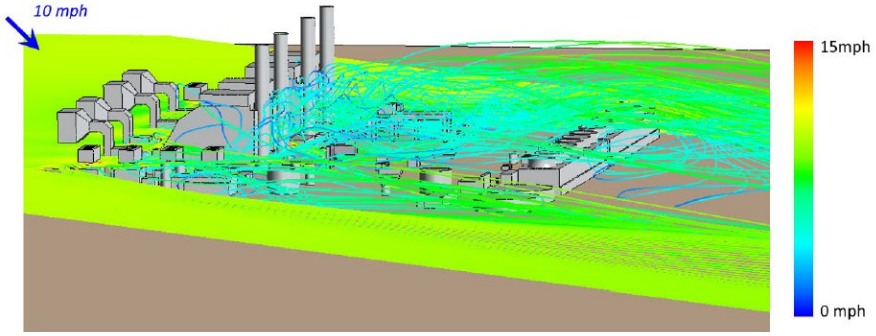


Northwest 10 mph wind

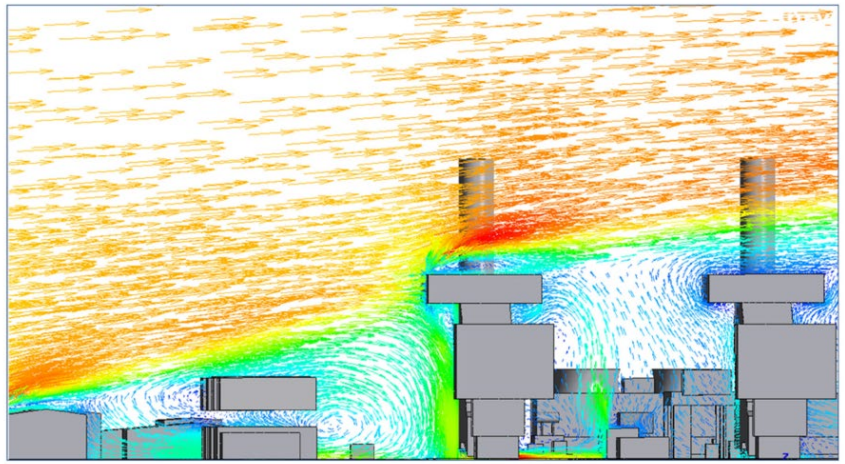


Future Weatherization Improvements

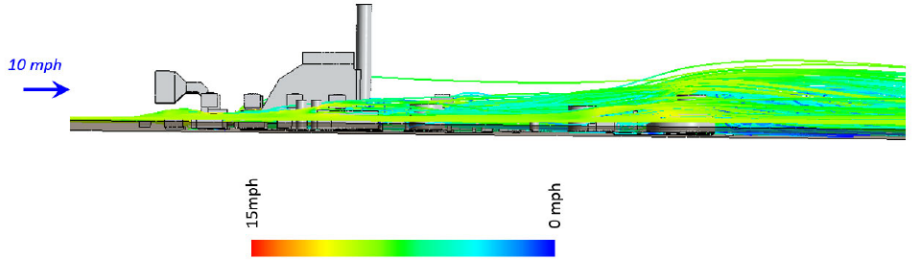
Southwest 10 mph wind



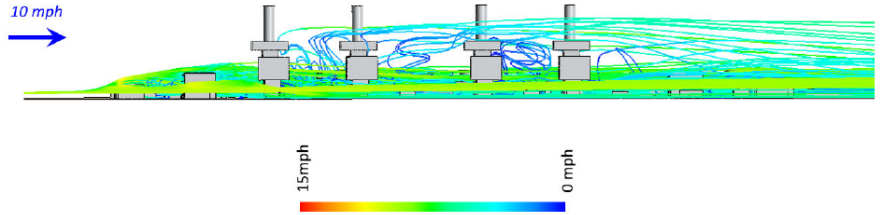
West wind 10 mph: Zoom in



South 10 mph wind



West 10 mph wind



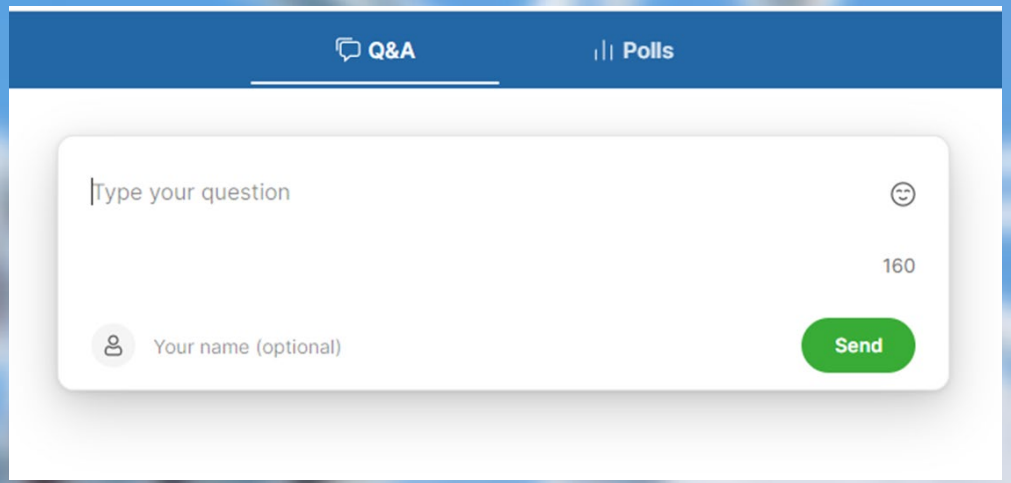
Customer Driven.
Community Focused.

Winter Weatherization Workshop

Return at 2:35 p.m.

- Executive Welcome
- Updates Since Uri
- Inquiries and Alerts
- ERCOT Weatherization Activities Update
- Weatherization Standards
- PUCT Winterization Activities Update
- RRC Winterization Activities Update
- 2023-24 Winter Weather Forecast and Review of Historical Winter Extremes
- Winter Weather Prep and Lessons Learned
- **NERC Winterization Activities Update**
- Entity Inspection Program

To submit questions during the workshop, please visit **slido.com** and enter today's participant code: **TXRE**



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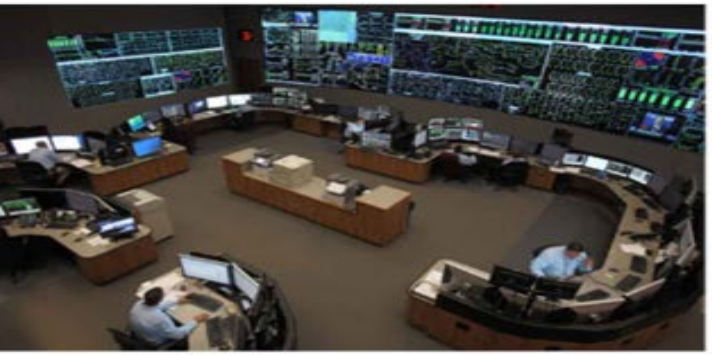
NERC Winterization Activities Update

Kiel Lyons, Senior Manager Compliance Assurance
Texas RE 2023 Winter Weatherization Workshop
September 13, 2023

RELIABILITY | RESILIENCE | SECURITY

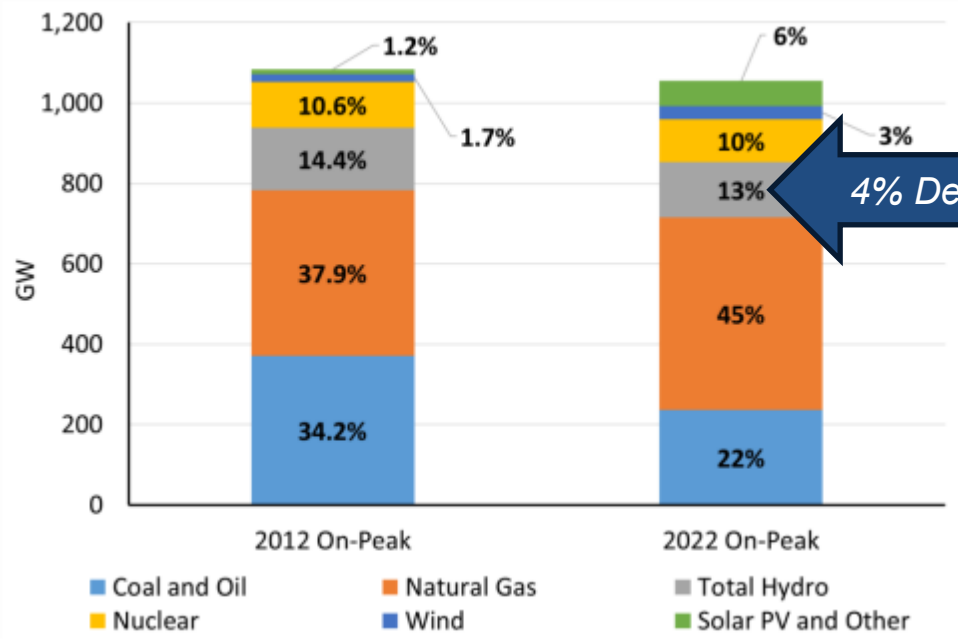



Agenda

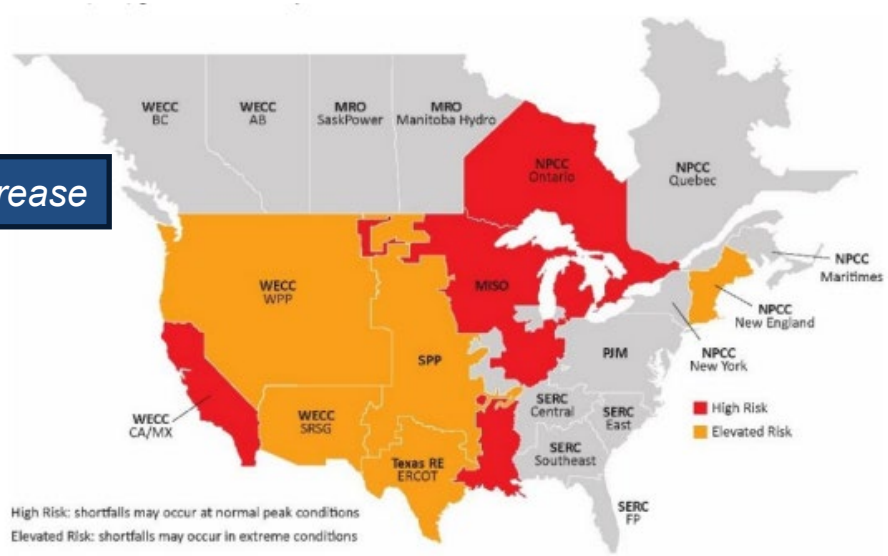
- Adapting Winter Preparation for an Evolving System
- NERC Winter Preparation Activities
  - Winter Preparedness SGAS
  - Winter Reliability Assessment
  - CMEP IP
- Q&A

Evolution of an Interconnected System

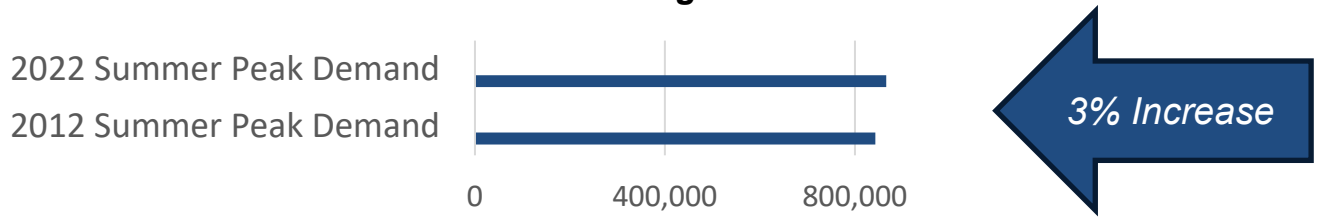
2012 and 2022 Peak Capacity Resource Mix NERC-Wide



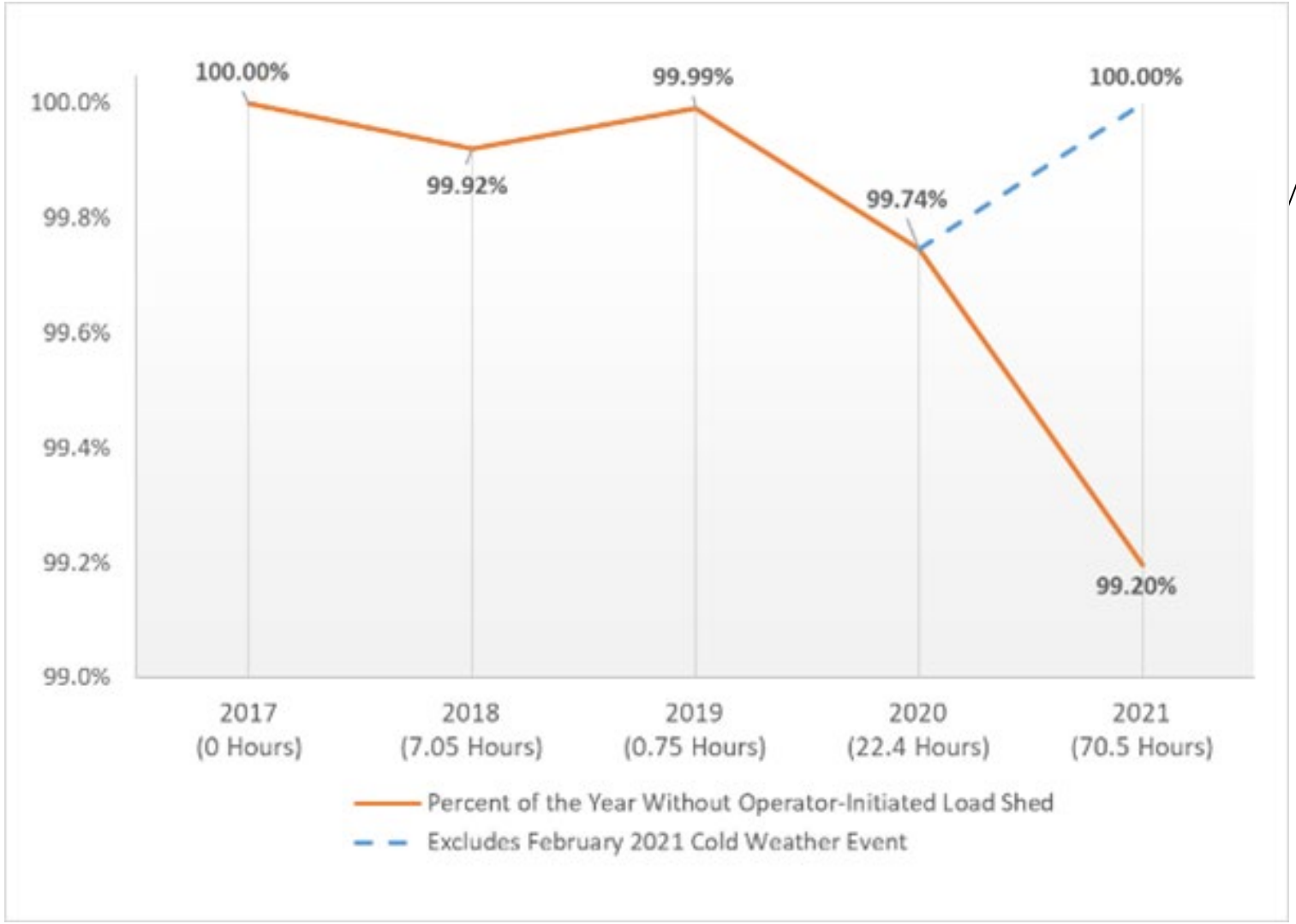
2025 Risk Areas



NERC-Wide Summer Peak Demand Changes 2012 and 2022



Hours Without Operator-Initiated Firm Load Shed (%/year)

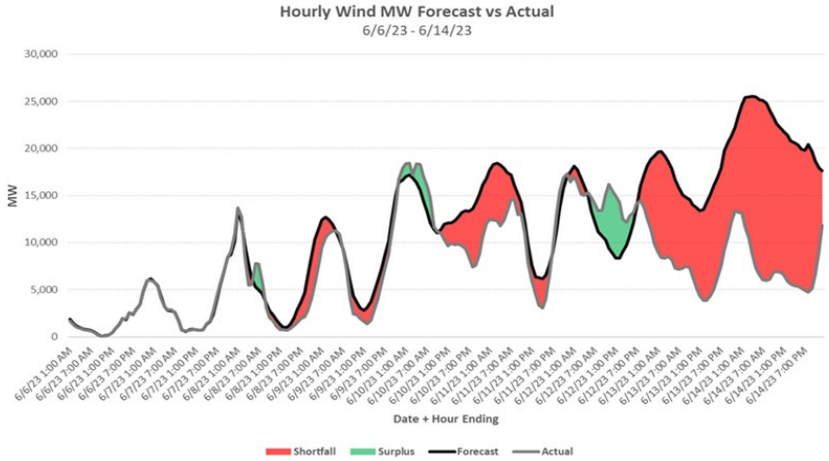


2021

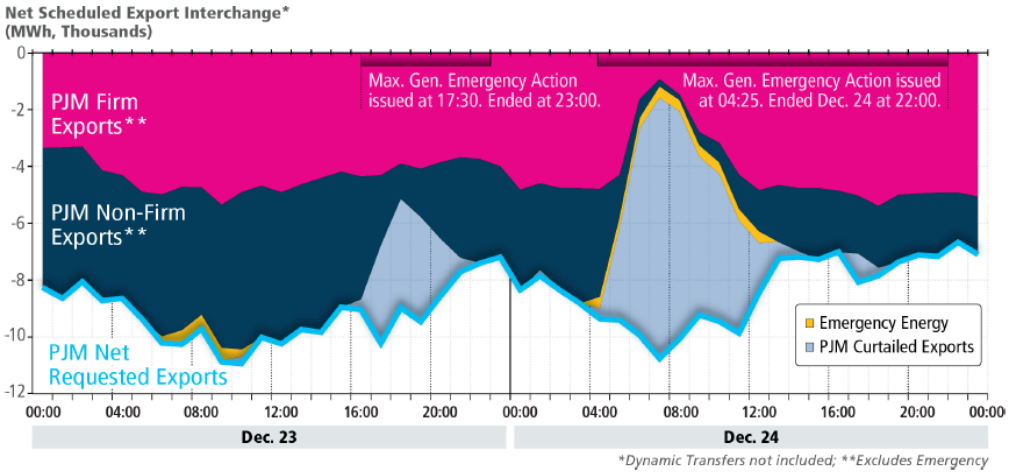
- 10 EEA-3 Alerts
- 1,015 GWh unserved energy
- Occurred February

Recent Examples Highlight Need for Wide-Area Energy Assessments

ERCOT, SPP, MISO: *A "wind drought" caused 60 GW of installed wind capacity to generate 300 MW*



ERCOT



PJM: *Transmission system during extreme cold weather limited the ability to export to support southern neighbors*

Winter Storm Elliot Wide-Area Inquiry Nearing Completion: Preliminary Results

Similarities to Past Extreme Cold Weather Events

	2011 Event	2014 Event	2018 Event	2021 Event	2022 Event
Significant levels of incremental unplanned electric generating unit losses with top causes found to be mechanical/electrical, freezing, and fuel issues.	✓	✓	✓	✓	✓
Significant natural gas production decreases occurred, with some areas of the country more severely affected.	✓			✓	✓
Short-range forecasts of peak electricity demands were less than actual demands for some BAs in event area	✓		✓	✓	✓

NERC Cold Weather Preparedness Activities

- Annual Winter Preparedness Webinar
- Standards Development
- Level III Alert
- Winter Reliability Assessment
- Small Group Advisory Session (SGAS)
- CMEP IP and Compliance Monitoring Focus

2022-23 WRA Recap

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Recommendation to Industry

Cold Weather Preparations for Extreme Weather Events – II

Initial Distribution: September 12, 2022

Several extreme winter weather[1] events have occurred over the past few years, causing major interruptions to resources, transmission paths and ultimately, end-use customers. In light of these events, as well as the February 2021 Texas cold weather event, the recently expedited Federal Energy Regulatory Commission (FERC) approval of the Cold Weather Reliability Standard, and the 2021 Cold Weather Preparations for Extreme Weather Events alert, it is necessary to understand how entities are taking steps to mitigate this risk. The Cold Weather Reliability Standard becomes enforceable on April 1, 2023. In the interim, this second Cold Weather Preparations for Extreme Weather Events Alert is being issued to further understand how Reliability Coordinators (RCs), Balancing Authorities (BAs), Transmission Operators (TOPs), and Generator Owners (GOs) plan for and progress toward mitigating risk for the upcoming winter and beyond.

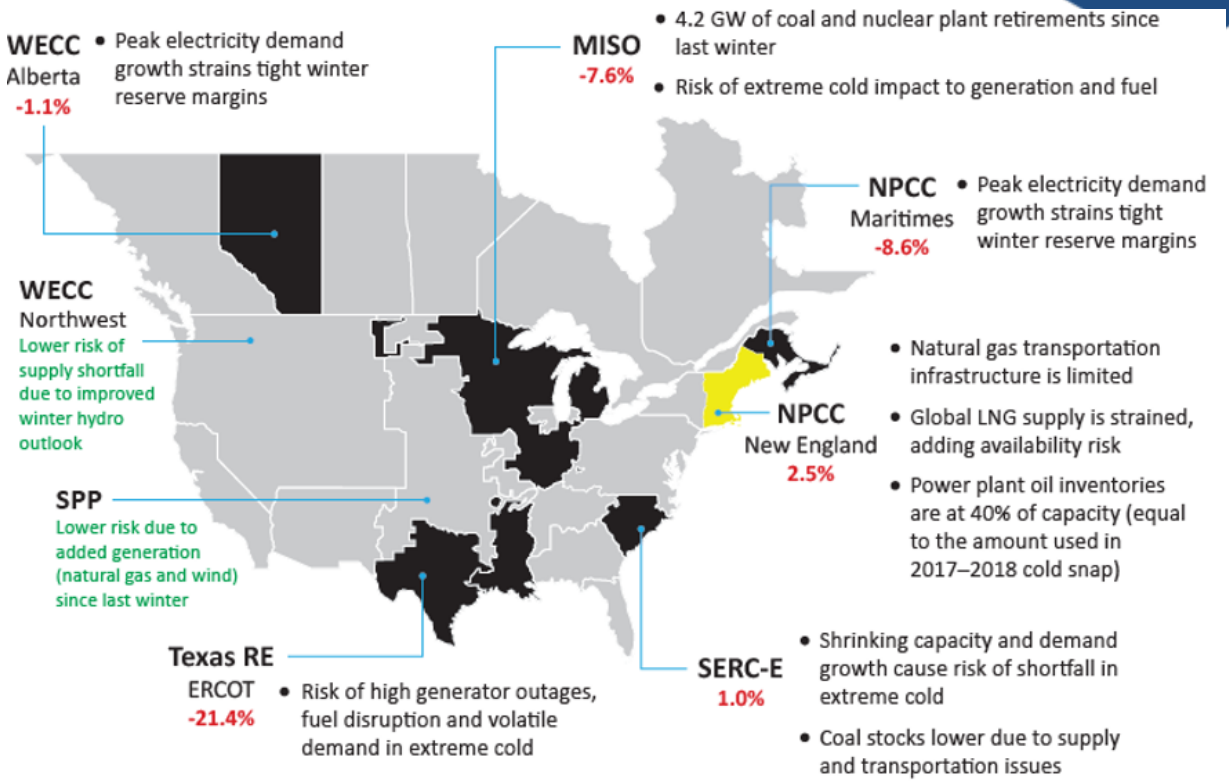
Why am I receiving this? >>
About NERC Alerts >>

Status:	**Acknowledgement Required by Midnight Eastern on September 19, 2022** **Reporting Required by Midnight Eastern on October 6, 2022**
	PUBLIC: No Restrictions More on handling >>
Instructions:	This Level 2 NERC alert provides specific recommended actions that NERC registered entities should consider in response to a particular issue. Pursuant to Rule 810 of NERC's Rules of Procedure,[2] NERC registered entities shall (1) acknowledge receipt of this advisory within the NERC Alert System, and (2) report to NERC on the status of their activities in relation to this recommendation (as provided below). For United States entities, NERC will aggregate the responses and provide an anonymized report to FERC. This Level 2 NERC alert is not the same as a Reliability Standard and it does not create a mandatory obligation to take the recommended actions. Your organization will not be subject to penalties for failure to implement the recommendations. Issuance of this recommendation, however, does not alter the requirements of any approved Reliability Standard nor excuse the failure to follow the practices discussed in the recommendation if such failure

[1] Extreme Winter Weather is using the same definition of Extreme Cold Weather as defined in the Polar Vortex Review dated September 2014; Extreme Cold Weather conditions occurred in lower latitudes than normal, resulting in temperatures 20 to 30° F below average.
[2] https://www.nerc.com/AboutNERC/Pages/Rules-of-Procedure.aspx

RELIABILITY | RESILIENCE | SECURITY

September 2022 NERC Level II Alert



Percentages indicate the projected reserve margin with electricity demand, generation outages, and energy derates under extreme conditions.

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- Generators and fuel supplies remain vulnerable in extreme cold
- Other risk factors include higher peak-demand projections and generator retirements

Conducting the 2023-2024 WRA

- NERC and Regions began collecting data and risk inputs in July
- Capacity and energy risk assessment based on:
  - Scenario analysis of average and extreme conditions
  - Evaluation of all risk periods—not solely peak demand hour
- Additional focus for 2023-24 Winter
  - Fuel supply concerns
  - Actions from the *FERC NERC Regional Entity Staff Joint Cold Weather Outage Inquiry Report* recommendations
  - NERC Level III Alert (2023) Information
- Report publication in mid-November

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Announcement

NERC Warns Generation Resources Tight in Large Portion of North America this Winter

November 17, 2022

ATLANTA – NERC's *2022-2023 Winter Reliability Assessment* warns that a large portion of the North American bulk power system is at risk of having insufficient energy supplies during severe winter weather. NERC advises industry to be ready to implement operating plans to manage potential supply shortfalls and to ensure fuel supplies are secured, and generators and natural gas facilities are weatherized.

"Fuel supply issues appear prominently in this year's assessment. Reliability Coordinators across North America are closely monitoring the coal and liquid fuel inventories, as well as the potential impacts that transportation disruptions can have on availability and replenishment of all fuels," said John Moura, NERC's director of Reliability Assessment and Performance Analysis. "Also, while the grid has a sufficient supply of capacity resources under normal winter conditions, we are concerned that some areas are highly vulnerable to extreme and prolonged cold. As a result, load-shedding may be required to maintain reliability."

The assessment finds high peak-demand projections, inadequate generator weatherization, fuel supply risks, and limited natural gas infrastructure are contributory factors to reliability risk. Regions at particular risk this winter include:

- **Texas, SERC-East and southern parts of MISO** risk a significant number of generator forced outages in extreme and prolonged cold temperatures. Generators and fuel supply infrastructure are not designed for such conditions and remain vulnerable without weatherization upgrades. Peak electricity demand increases substantially during extreme cold which compounds the risk.
- **Midcontinent ISO (MISO)** has retired more than 4.2 GW of nuclear and coal-fired generation since last winter, with few resources being added. Consequently, reserve margins in the region have fallen by more than 5%. An extreme cold-weather event that extends deep into MISO's area could lead to high generator outages from inadequate weatherization in southern units and unavailability of fuel for natural-gas-fired generators.

CONTACT:
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Cold Weather Preparedness SGAS

- Educational opportunity for registered entities to meet with NERC and Regional Entity representatives
- Increase awareness and ensure bulk power system reliability through discussions on cold weather preparedness Standards
  - EOP-011-2
  - IRO-010-4
  - TOP-003-5
- SGAS General Webinar
  - Over 500 industry participants

Cold Weather Preparedness SGAS

CMEP Implementation Plan (IP)

- Nature and frequency of cold weather events
- Grid transformation heightens the effects and complicates mitigation
- Expose weaknesses, such as poor coordination
- Focus on EOP-011-2

"The Joint Team urges industry to continue its efforts to respond to the past cold weather report recommendations, NERC guidelines and Alerts, and implement as many actions as possible in preparation for the upcoming winter!"

Questions and Answers

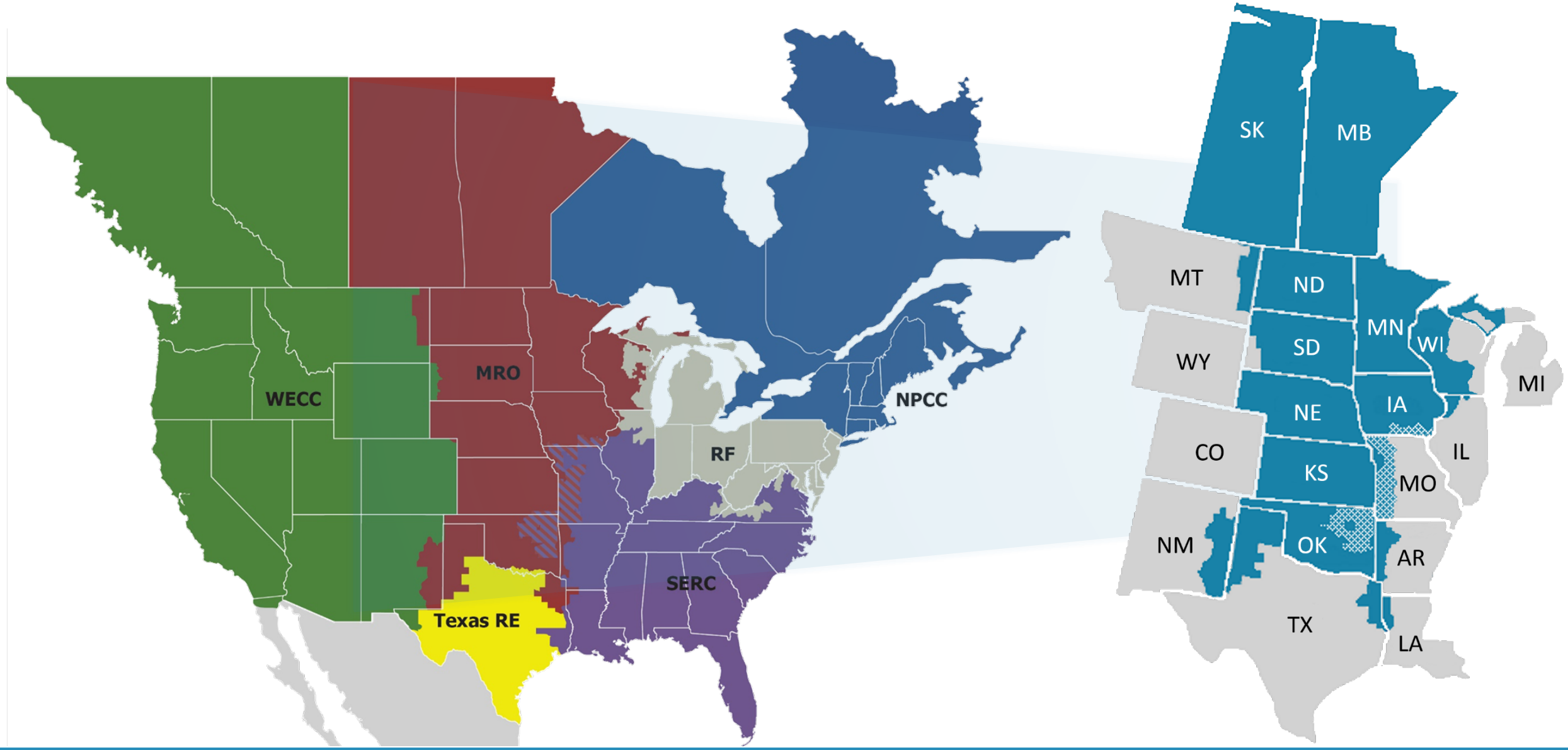
MIDWEST RELIABILITY ORGANIZATION

MRO Generator Weatherization Program (GWP) 2023 Overview

Jake Bernhagen, P.E.

MRO Manager of Reliability Performance

CLARITY | ASSURANCE | RESULTS



The ERO Enterprise and MRO

About MRO's Reliability Analysis Department

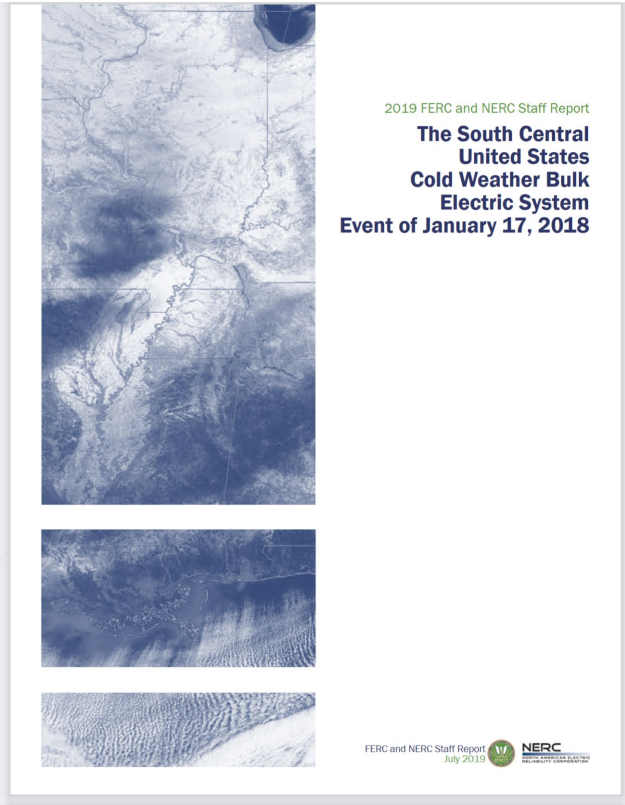
- **What we do:**
  - Reliability Assessments
  - Bulk Power Situational Awareness
  - Event Analysis
  - Performance Analysis
  - Entity Registration and Certification

MRO Generator Winterization Program

- Address risk not covered by Reliability Standards
- Promotes winter weather preparedness for Generator Owners/Operators
- Voluntary program
- Winterization Readiness Evaluation
- Identify best practices and recommendations

Background

- **February 1-5, 2011 (Southwest Cold Weather Event)**
- **January 3-7, 2014 (Polar Vortex)**
- **January 15-19, 2018 (South Central Cold Weather Event)**
  - Report recommendation: enhanced outreach to Generator Owners & Generator Operators
- **February 8-20, 2021 (Winter Storm Uri)**
  - 23,418 MWs of firm load shed
  - 28 recommendations from the February 2021 Cold Weather Report
- **December 21-26, 2022 (Winter Storm Elliot)**
  - Report expected to be published in Q4 2023



MRO Generator Winterization Program Summary

Survey	• High level survey to develop baseline understanding of facility's winterization efforts
Generator Site Visit	• Observation of efforts taken by generation facilities to minimize impact of cold weather to plant operations
Site Report	• Summarize findings from the survey and site visit, identify best practices and make recommendations
Findings Report	• Summary of program data analysis and findings (annual comparisons)

MRO Generator Winterization Program Summary

Survey

- High level survey to develop baseline understanding of facility's winterization efforts

- Current survey consists of 60 questions
- Questions are broken into 8 categories
- Survey sent to all site visit participants
- Additional surveys sent out on as needed basis
- Survey available on MRO's website for self-evaluation

MRO Generator Winterization Program Summary

Generator Site Visit

- Observation of efforts taken by generation facilities to minimize impact of cold weather to plant operations

- **Sites chosen based on GADS data, regional location, and program needs/goals. For 2023:**
  - Nuclear Power Plant practices/procedures
  - Newer Units
  - Hydro Power Plant practices/procedures
  - Wind Farm/Plant practices/procedures
  - Units of different geographical location (northern, middle continent/regional, and southern)
  - Units with special protections

MRO Generator Winterization Program Summary

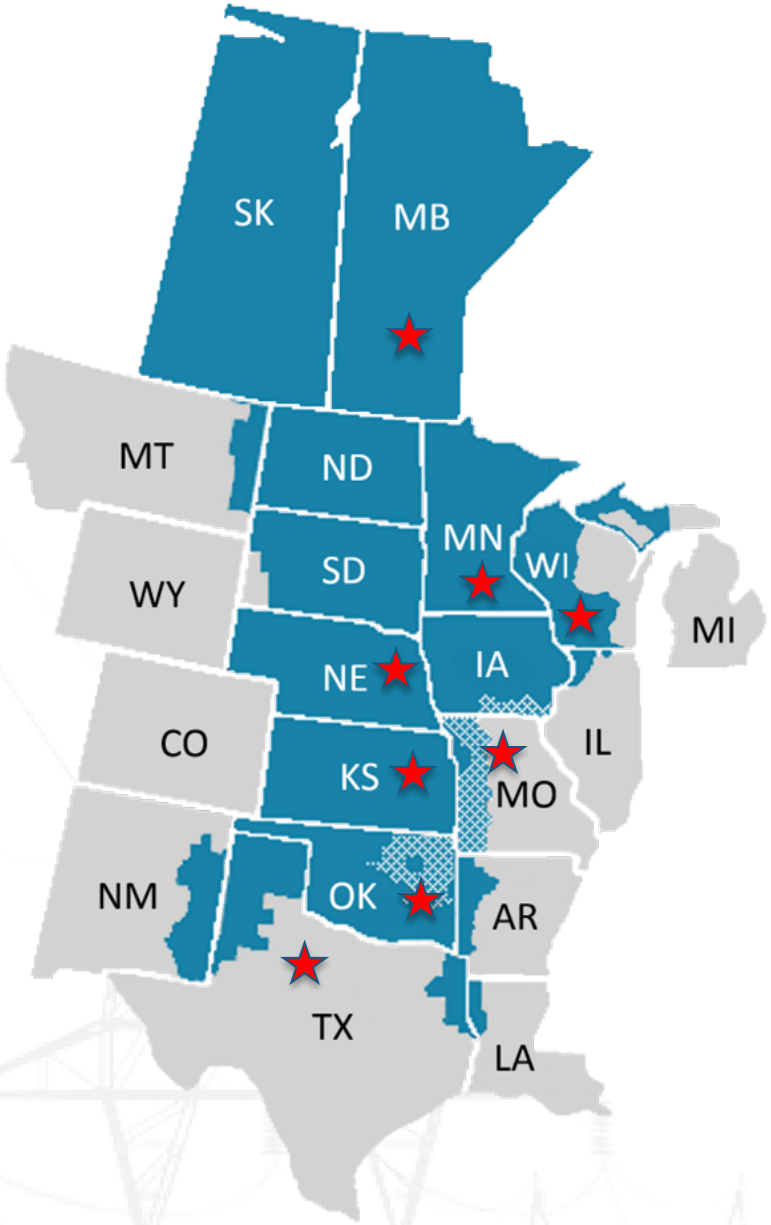
Site Report

- Summarize findings from the survey and site visit, identify best practices and make recommendations

- Non-binding deliverable
- Review of winter preparedness (performance rating)
- Review of winterization plan/program and effectiveness (measured against NERC Guideline's seven key components)
- Identification of positive observations, best practices and recommendations

3 years of visits…

- **2021**
  - Four site visits in MN
  - Natural gas, fuel oil
- **2022**
  - Seven site visits across six states
  - Coal, natural gas
- **2023**
  - Nine site visits across six states
  - Nuclear, hydro, wind, coal, natural gas



MRO Generator Winterization Program

- **Introduced in 2021**
  - Focused on identifying preparations and establishment of winterization program/plan
  - Ten GOs volunteered
  - On-site visits at four of the ten sites, others surveyed
  - All had some level of winter preparation activities taking place, but not all had an established winterization program/plan
  - Heat tracing and insulation were identified as the prominent preventative measures

MRO Generator Winterization Program

- **2022 GWP Program**
  - Focused on level of readiness and the program/plan's effectiveness
  - Surveyed and conducted six on-site visits
  - All had establishment of winter preparedness activities and documented program/plans
  - Challenges in determining plant OEM minimum designed or operating temperatures

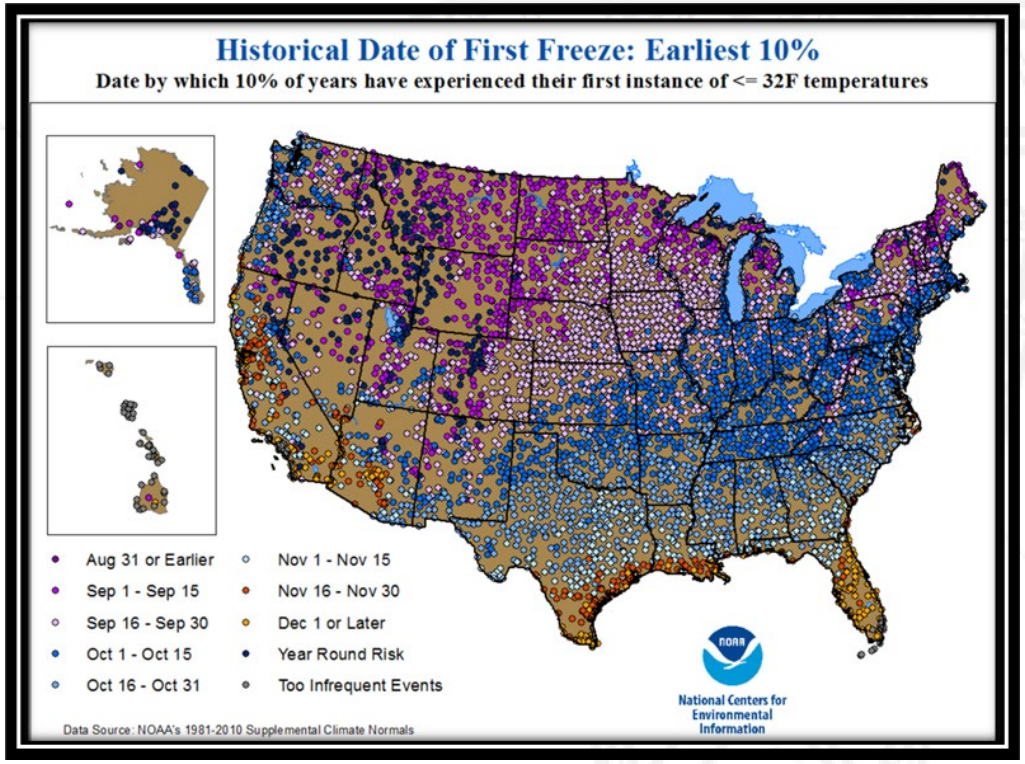
- **GWP 2021-2022 general findings report published in 2023**

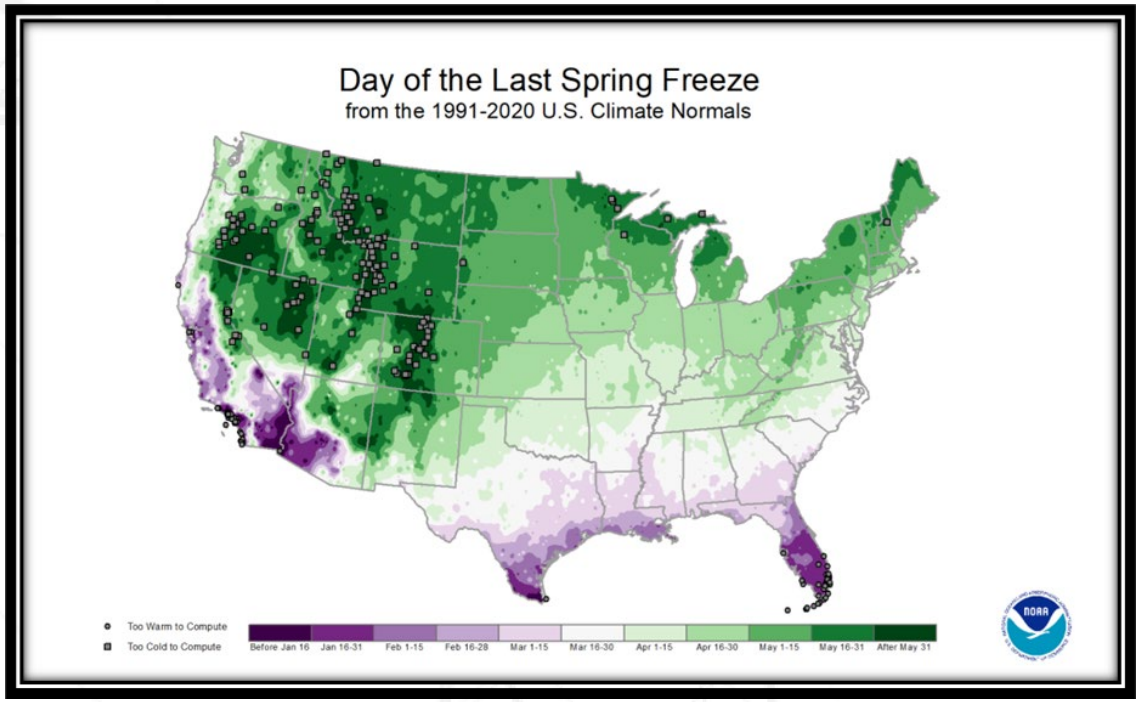
MRO Generator Winterization Program

- **2023 GWP Program**
  - Focus continues on level of readiness and the program/plan's effectiveness
  - Survey and conduct nine on-site visits
  - Focus on a greater variety of generation types

- **GWP 2022-2023 general findings report to be published in 2024**

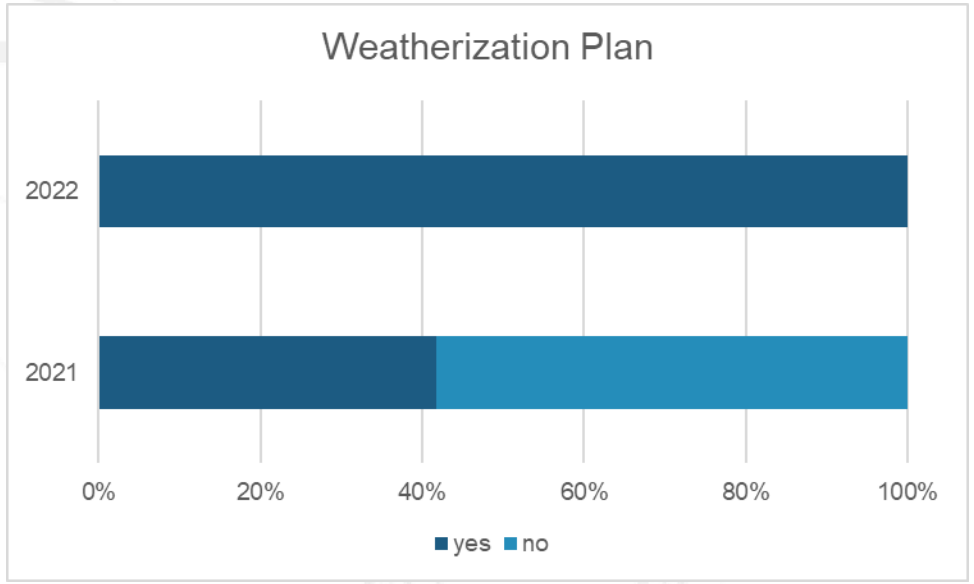
What Have We Found So Far?



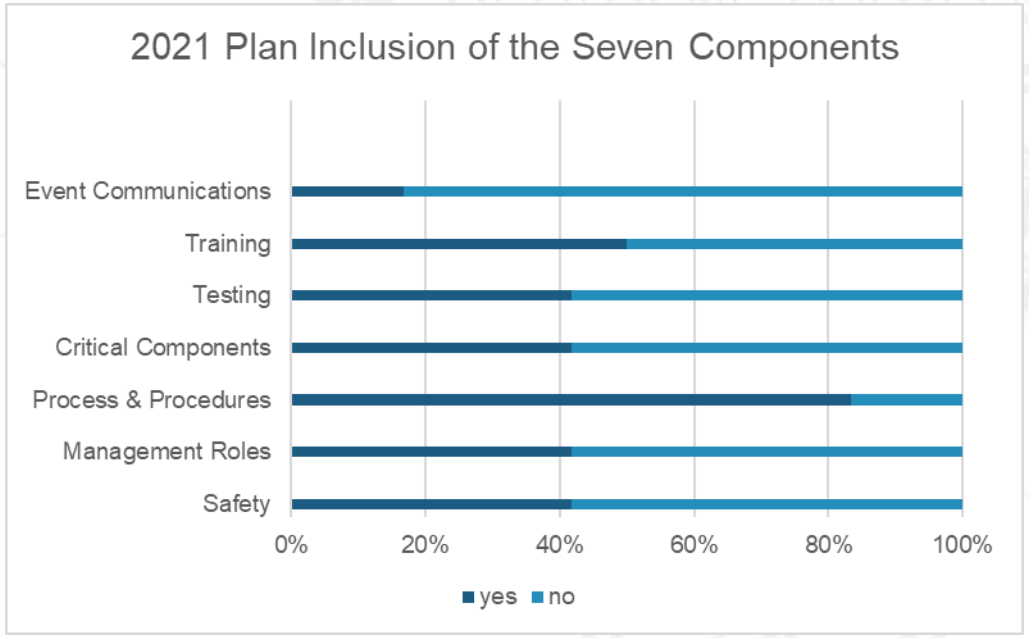


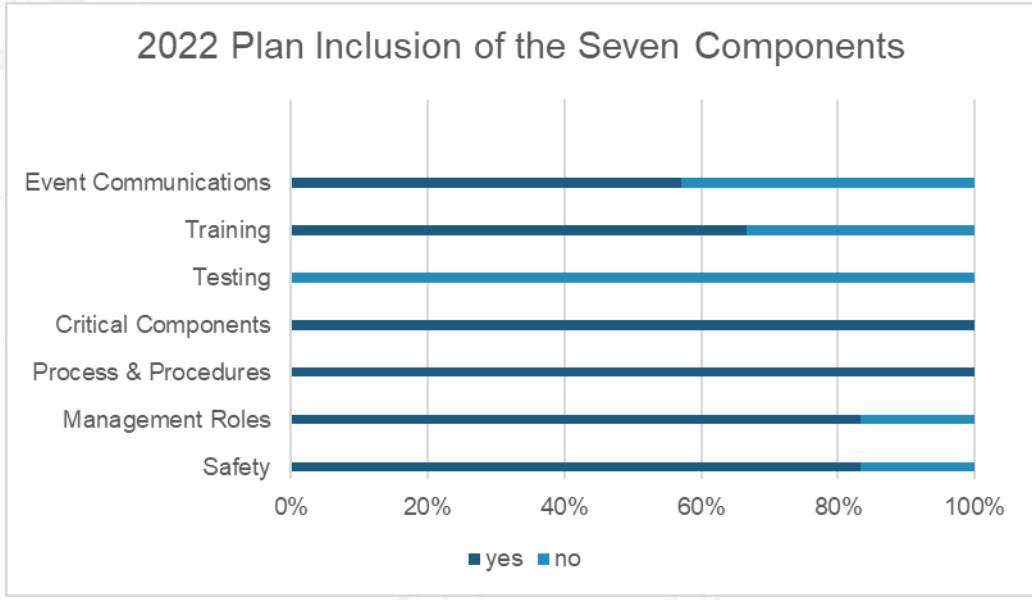
What Have We Found So Far?

- **NERC's Generating Unit Winter Weather Readiness Guideline**
  - Safety
  - Management Roles and Expectations
  - Processes and Procedures
  - Evaluation of Potential Problem Areas with Critical Components
  - Testing
  - Training
  - Communications



What Have We Found So Far?





A Few Best Practices:

- Enclose, insulate, and heat critical equipment
- Maintain and test equipment regularly
- Prepare cold weather tools before the cold hits
- Construct windbreaks when possible
- Incorporate lessons learned into winter preparedness program

Unique and Interesting Observations

- Creative solutions for removing frost/ice build up on air-intake screens
- Cooling tower safety decking, structural upgrades, wind screens
- Variety of heat trace monitoring solutions
- If it's critical, enclose and heat!

Upcoming MRO Outreach

- MRO Readiness Assessment for EOP-012-1, R2 Webinar – Thursday, September 21, 2023
- MRO Cold Weather Workshop – October 26, 2023

MRO's Generator Winterization Program

For more information, please contact:

Jake Bernhagen, Manager of Reliability Performance
Jake.Bernhagen@mro.net

Questions?

Wrap Up

SurveyMonkey®

Talk with Texas RE IROL Report

September 28, 2023

Fall Standards, Security, & Reliability Workshop

October 25, 2023