

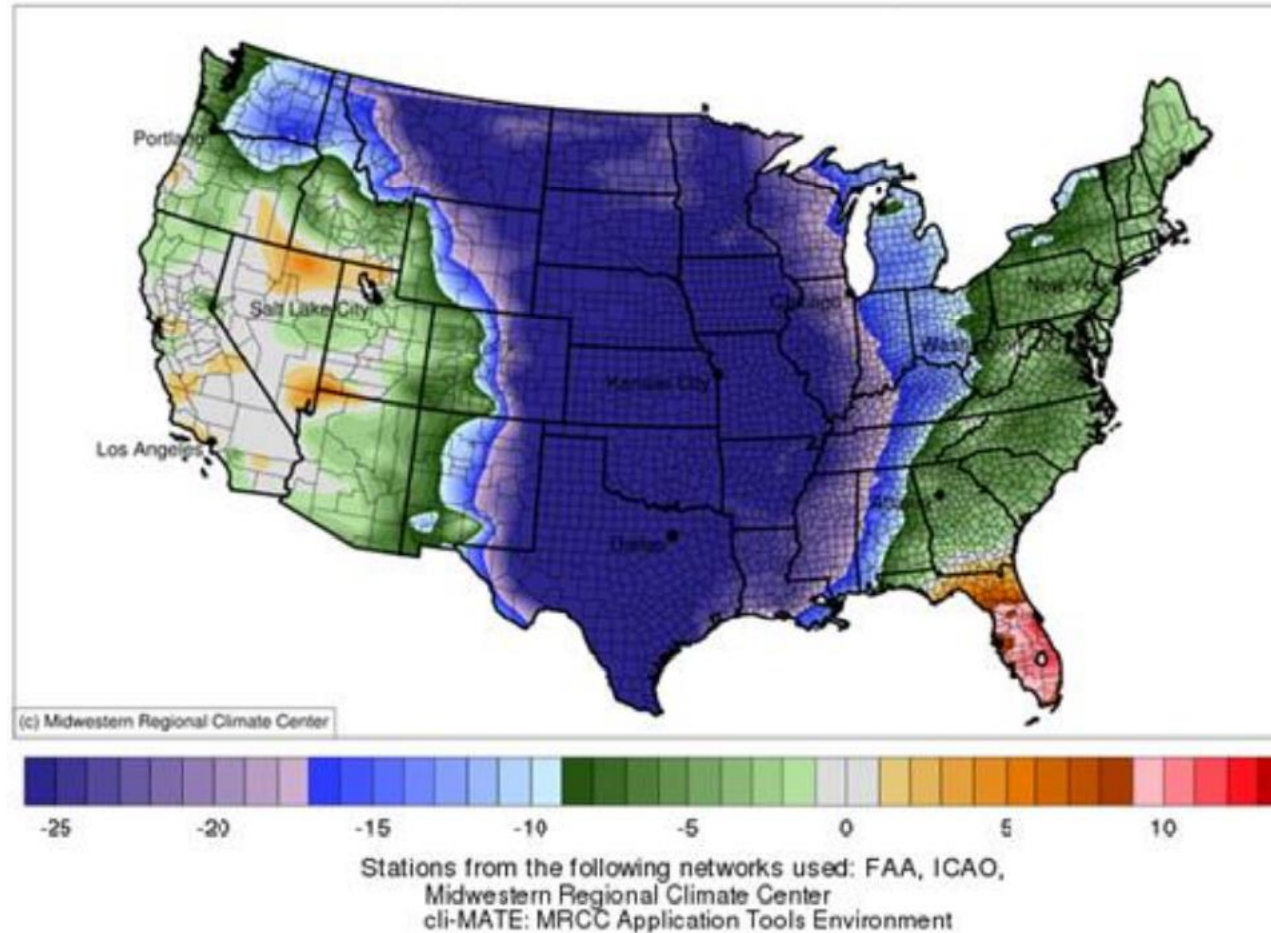
Update on Winter 2021 Event

Mark Henry

Director, Reliability Services and Registration

Extreme Winter Conditions Across the South Central US

February 12, 2021 to February 18, 2021



Extreme demand

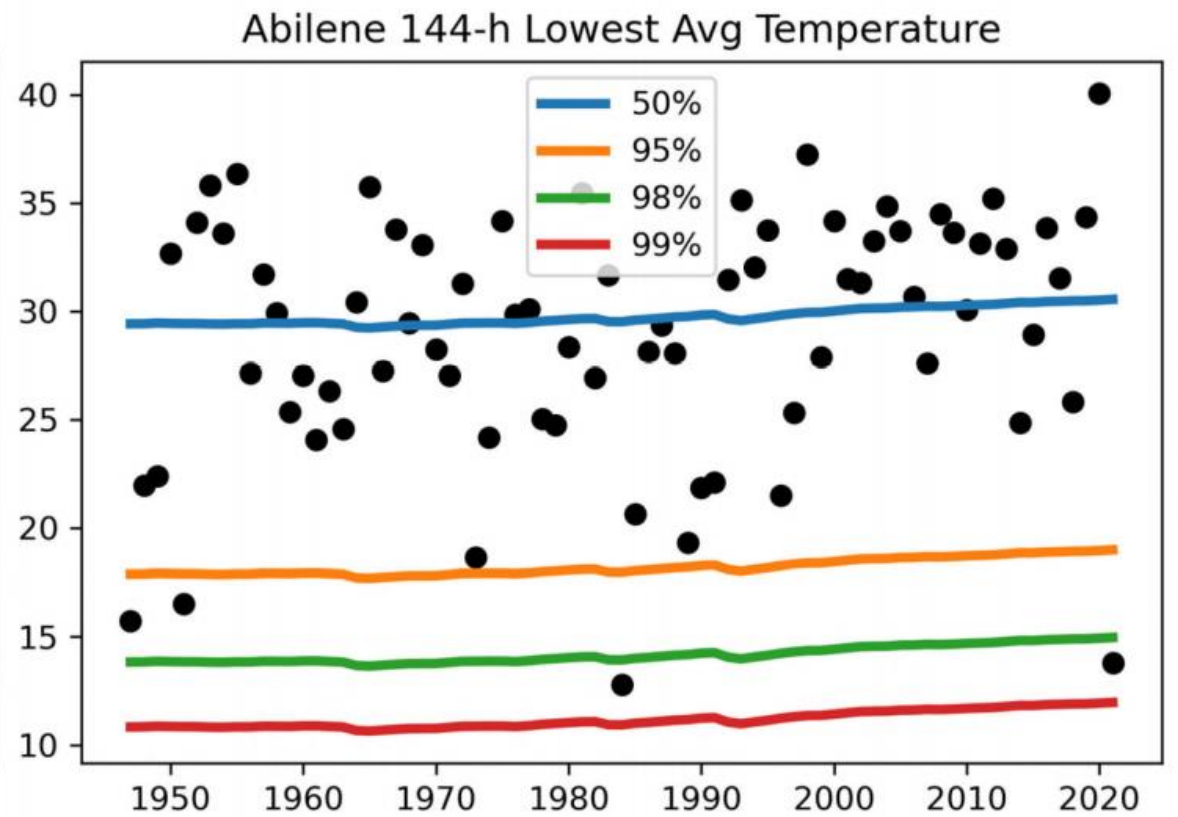
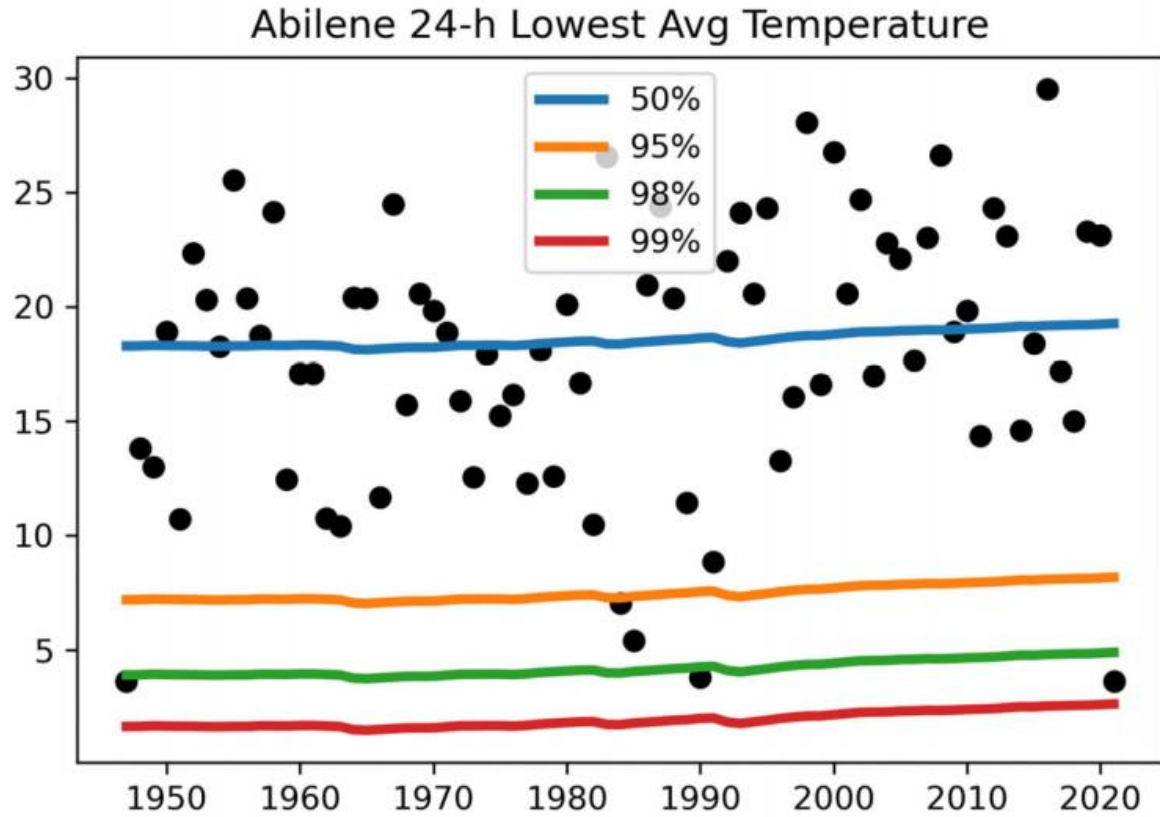
Widespread generation outages

Natural gas supply issues

Huge Eastern Interconnection import power flows

Firm load shed for transmission security and capacity adequacy

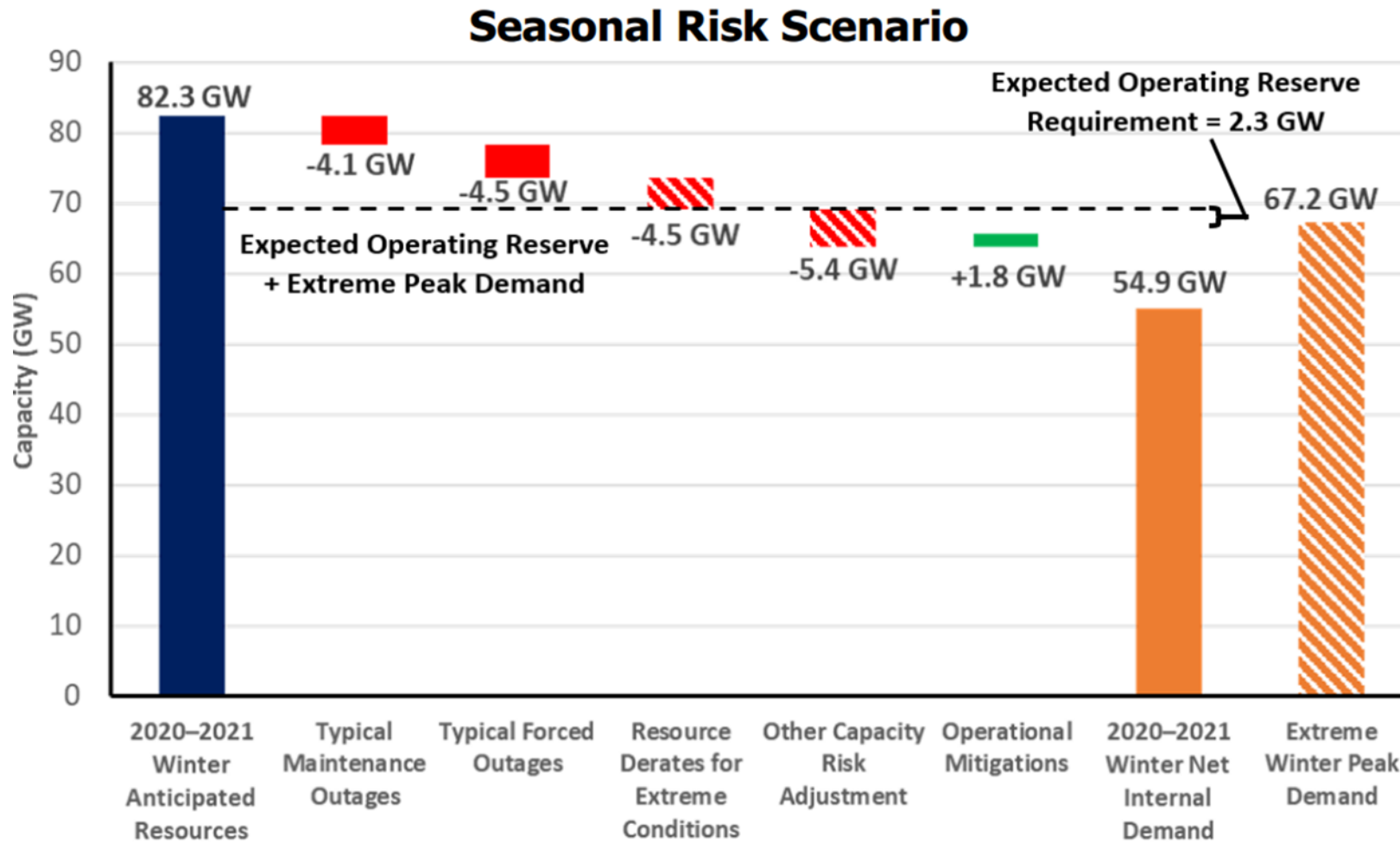
What Temperature Conditions Do We Plan For?



Office of State Climatologist, Texas A&M, presented to PUCT on August 12, 2021



How Do We Characterize Possible Risks?



Risk Drivers:

- Extreme Load
- Thermal outages
- Wind output

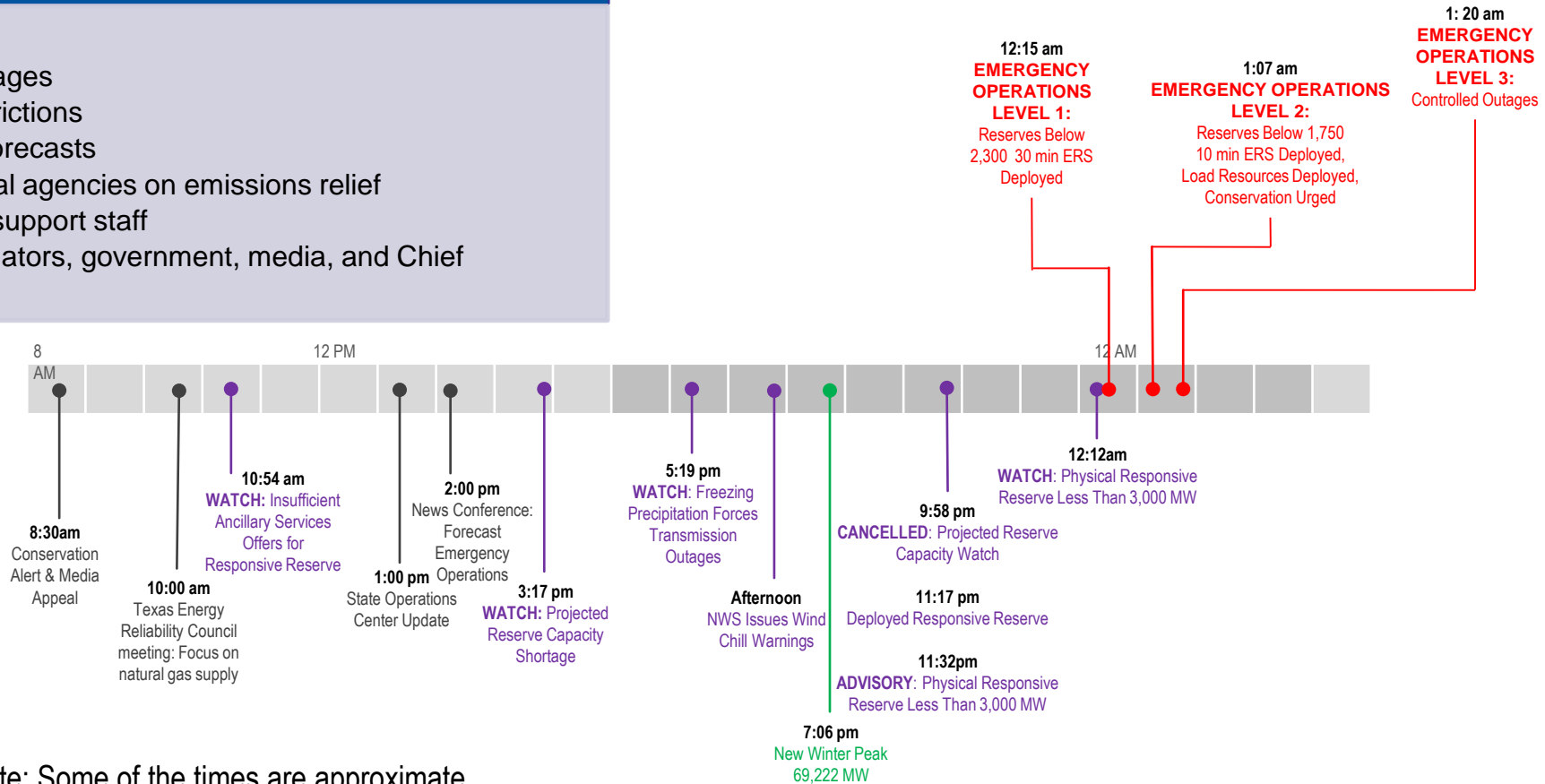
Source: NERC



Event Timeline: Sunday, Feb 14 – Early Monday, Feb 15

Prior Actions During Winter Storm Uri's Development

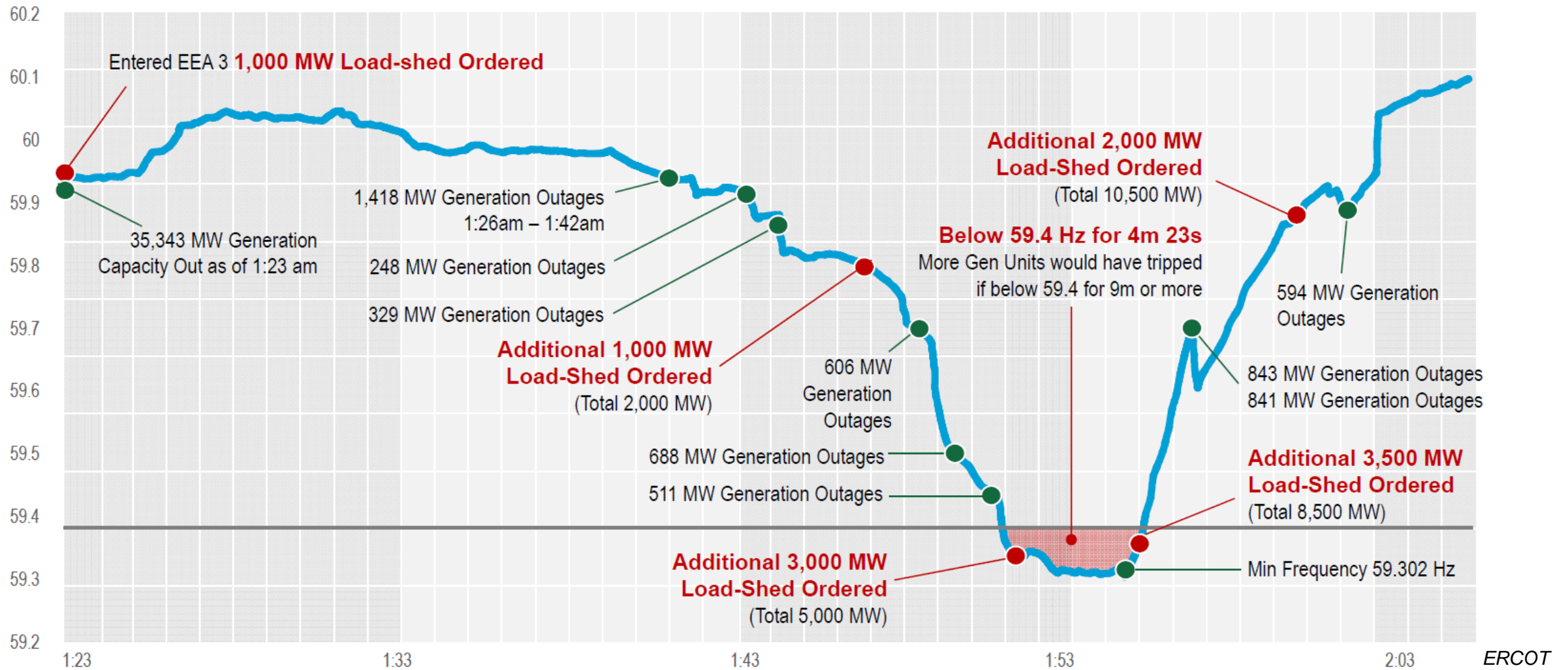
- Monitor weather
- Cancel/delay/return outages
- Check gas pipeline restrictions
- Factor in icing to wind forecasts
- Contact state and federal agencies on emissions relief
- Add onsite and remote support staff
- Communicate with regulators, government, media, and Chief Systems Operators



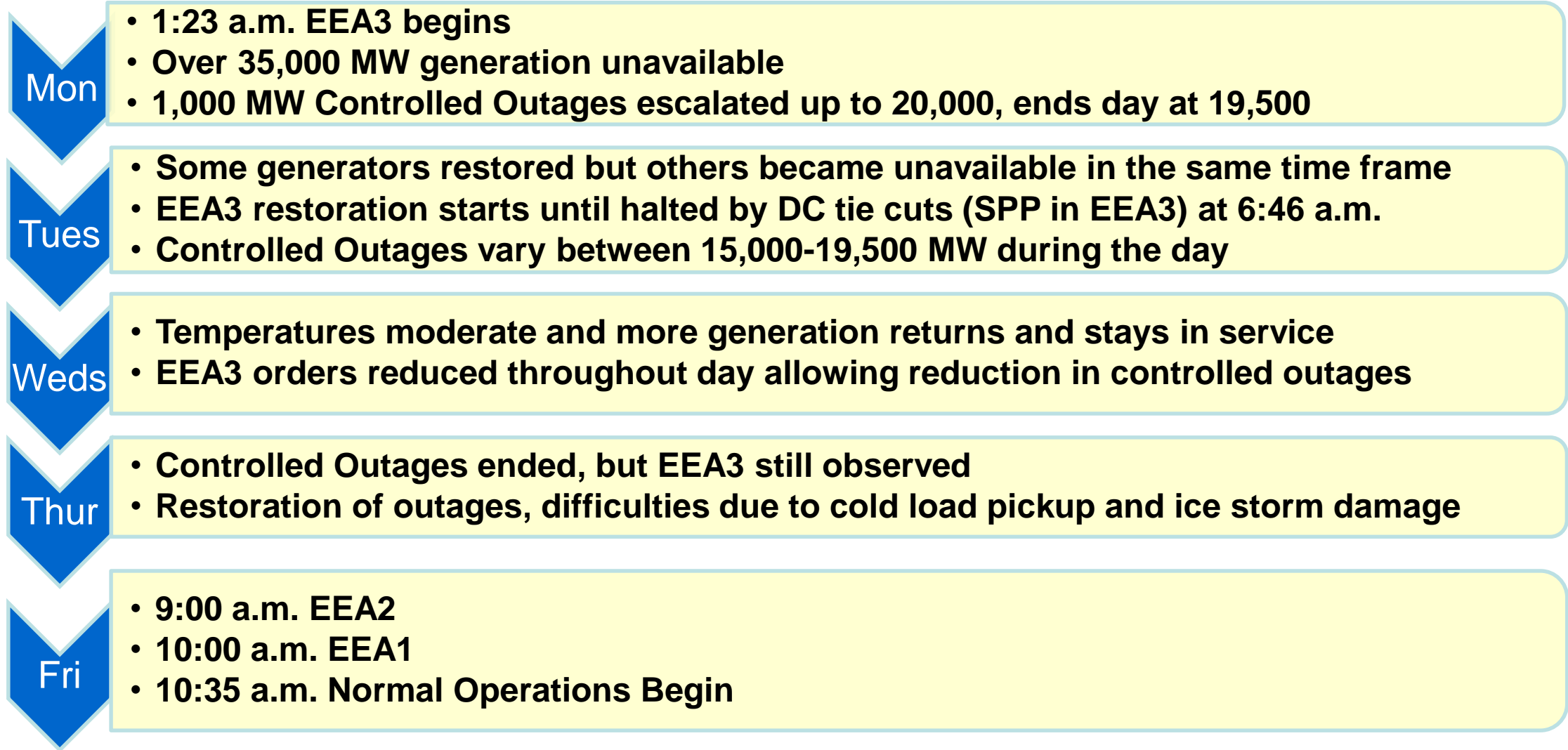
Note: Some of the times are approximate



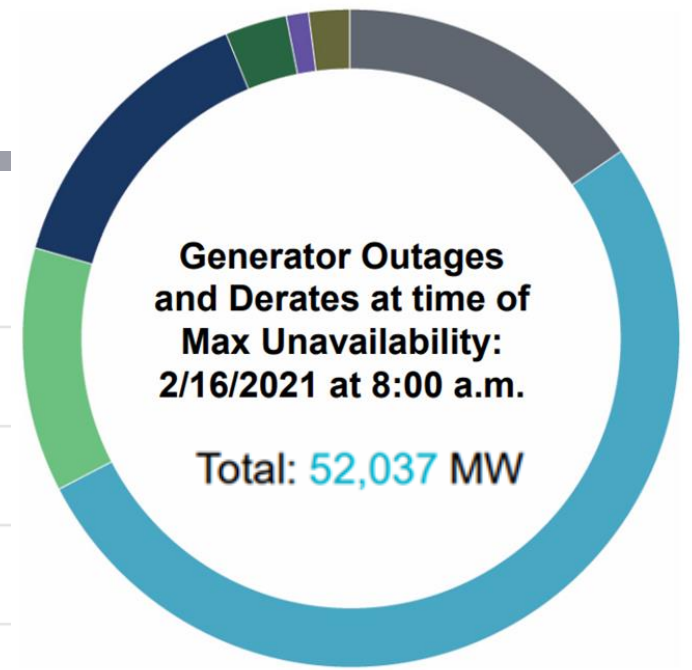
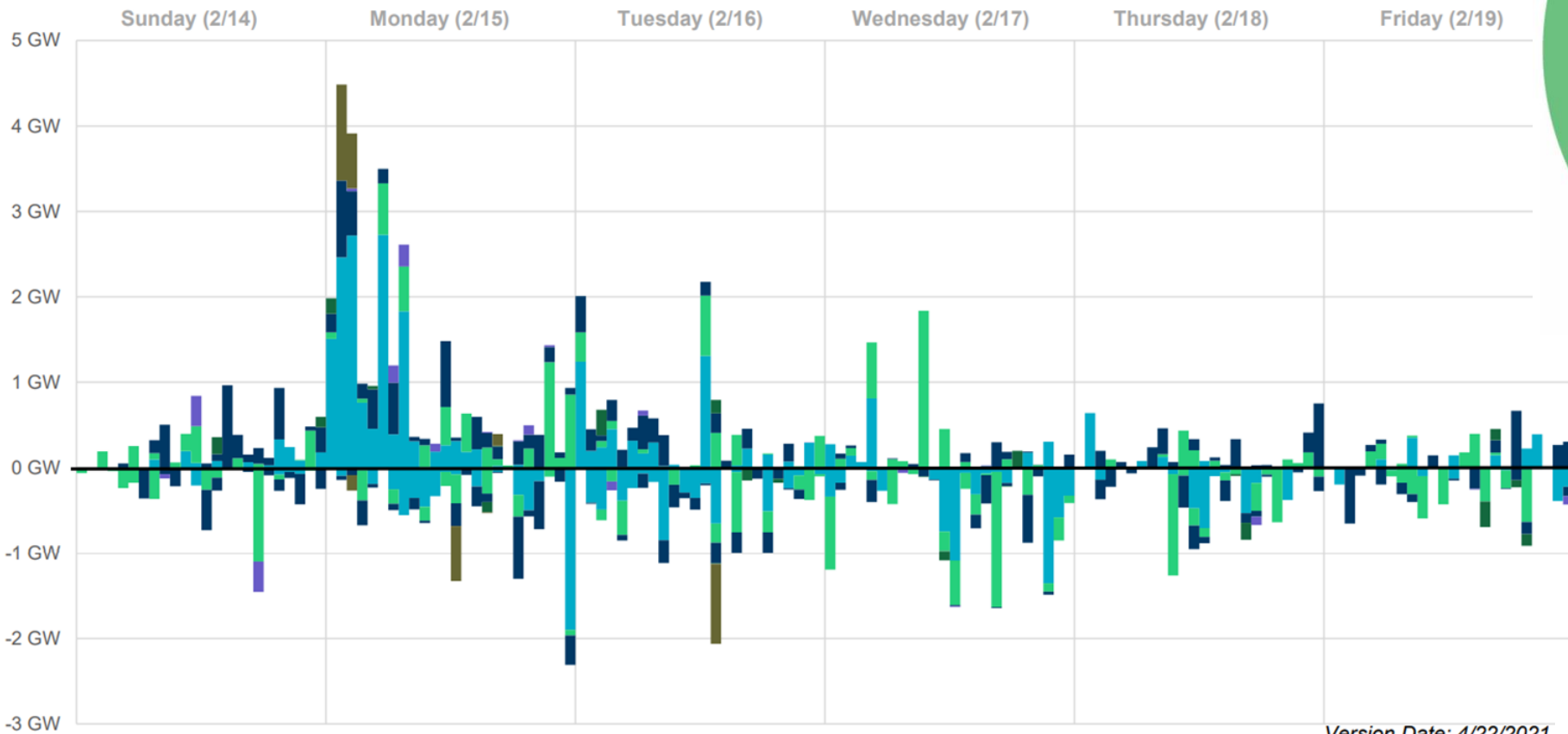
System Frequency Leading to EEA3 – 01:23 to 02:06, Feb 15



Energy Emergency Alert Level 3 (EEA3) Timeline



Hour by Hour Generation Outages and Causes

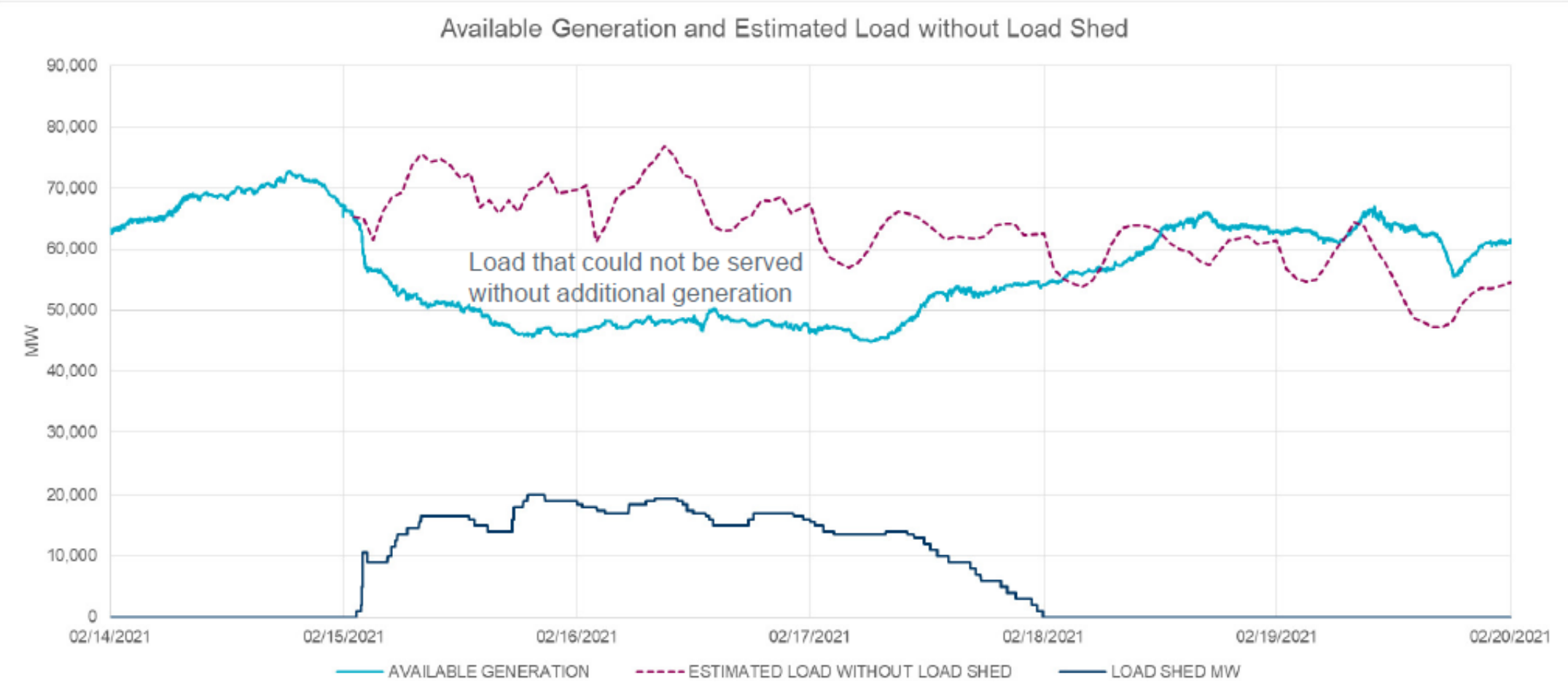


- Existing Outages (7,650 MW, 15%)
- Weather Related (27,567 MW, 53%)
- Fuel Limitations (6,130 MW, 12%)
- Equipment Issues (7,457 MW, 14%)
- Transmission Loss (1,459 MW, 3%)
- Miscellaneous (512 MW, 1%)
- Frequency Related (1,262 MW, 2%)

Version Date: 4/22/2021 ERCOT



Generation, Load and Load Shed



ERCOT



Demand Response, Load Shed, and Load Loss

ERCOT-procured demand response services – some included natural gas-related loads. Load Responsive Reserve Service and 10 and 30 minute Emergency Responsive Service.

Economic demand response (price sensitive)

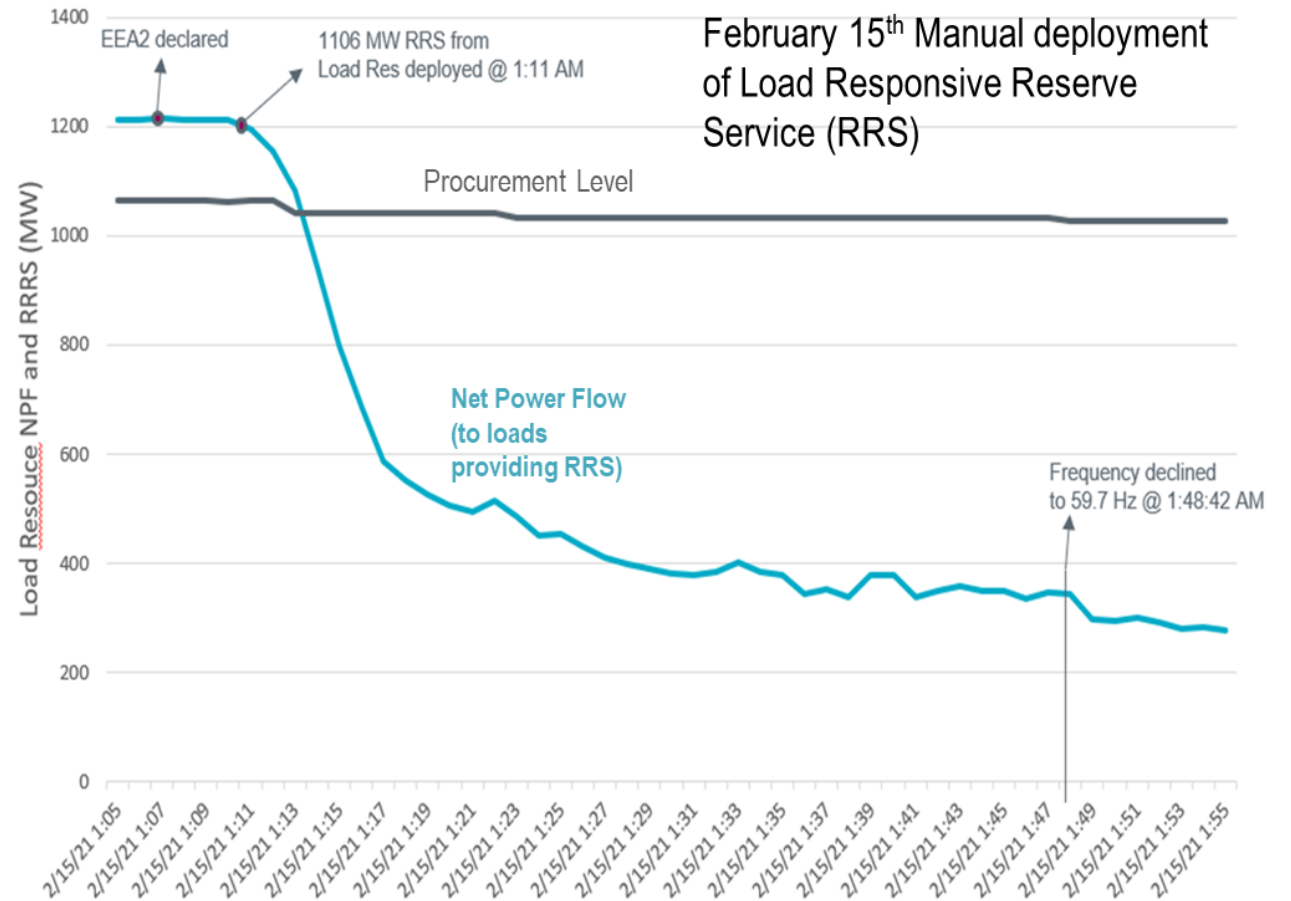
Regulatory orders and customer conservation

Distribution voltage reduction and other programs

EEA3 firm load shed (controlled outages) ordered by ERCOT. Circuits for load shed included some natural gas-related loads not previously identified

Distribution outages and customer power failures – including water and natural gas systems

Some underfrequency load shed (UFLS) due to frequency and manually deployed as backup source for EEA3 firm load shed



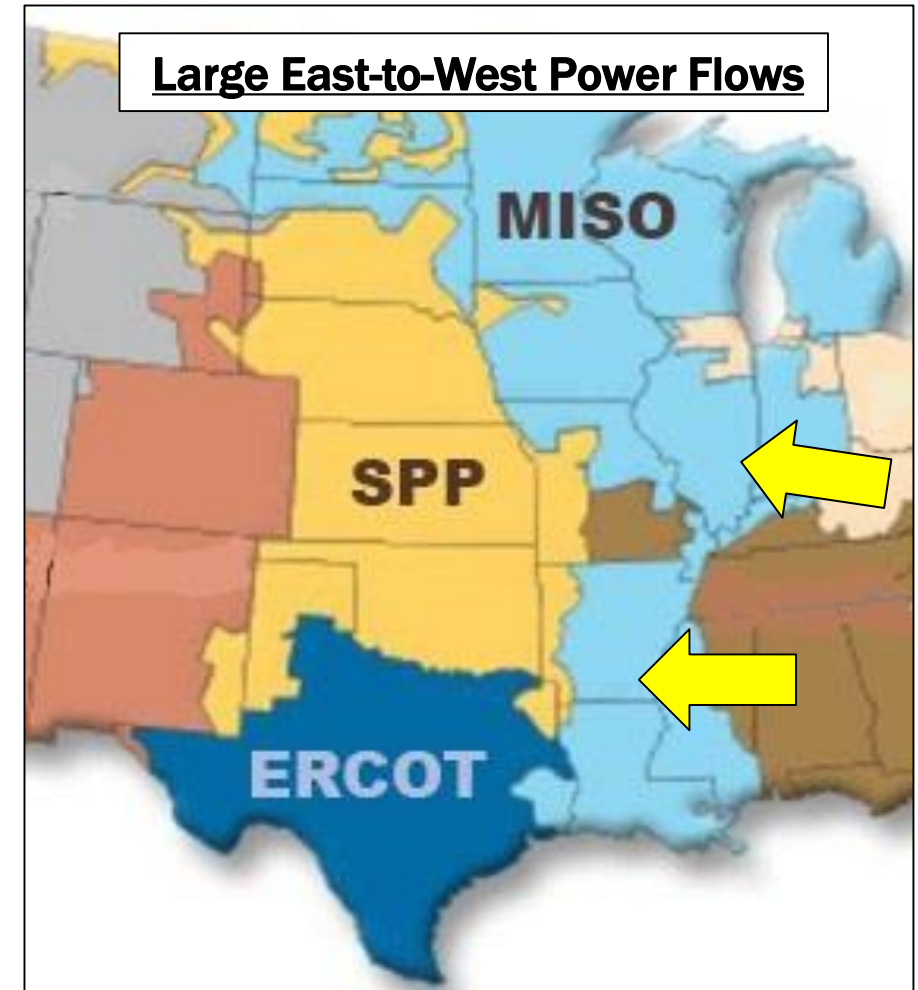
ERCOT



Transmission Emergencies

The bulk-power system was heavily constrained with large power flows

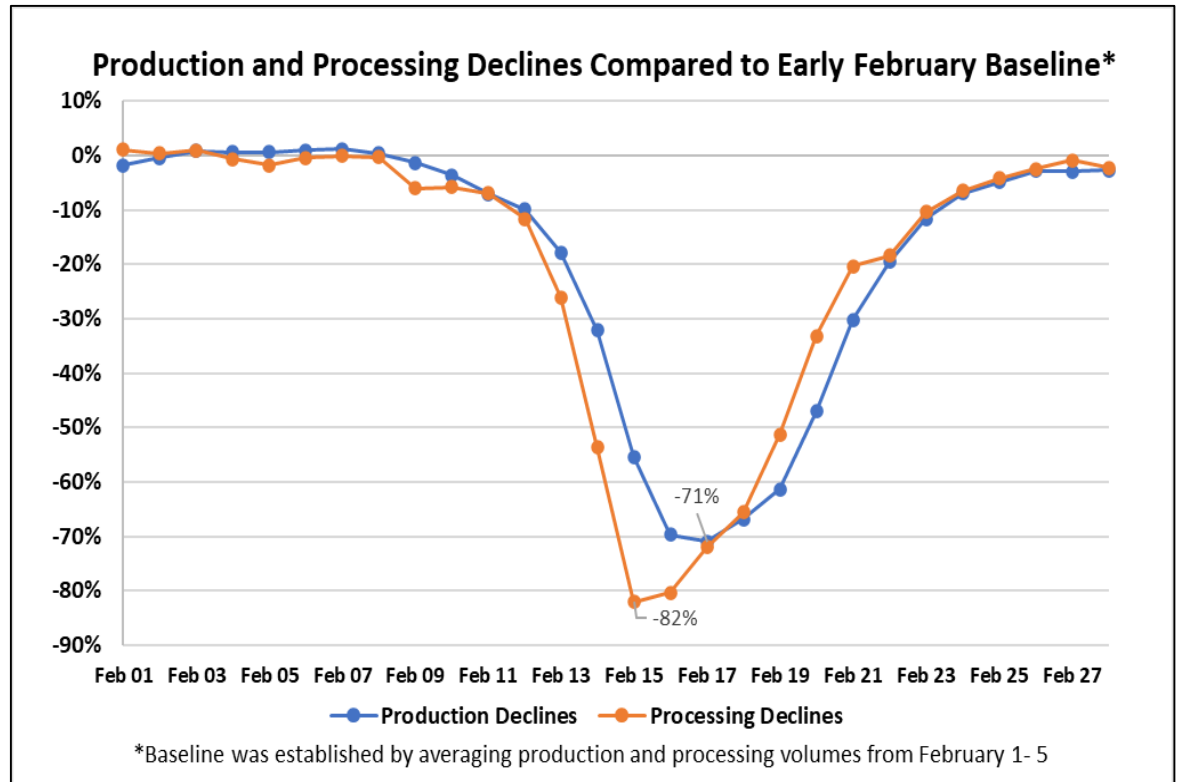
- On February 15, 2021, Eastern Interconnection east-to-west import power flows approached **13,000 MW** to help mitigate generation shortfalls and meet winter peak energy demands in MISO and SPP.
- MISO shed in total over **2,000 MW** firm load at different points in time on February 15 and 16 to avoid transmission overloads.
- ERCOT experienced a number of transmission issues but with relatively minor impact.



Natural Gas Fuel Supply Issues

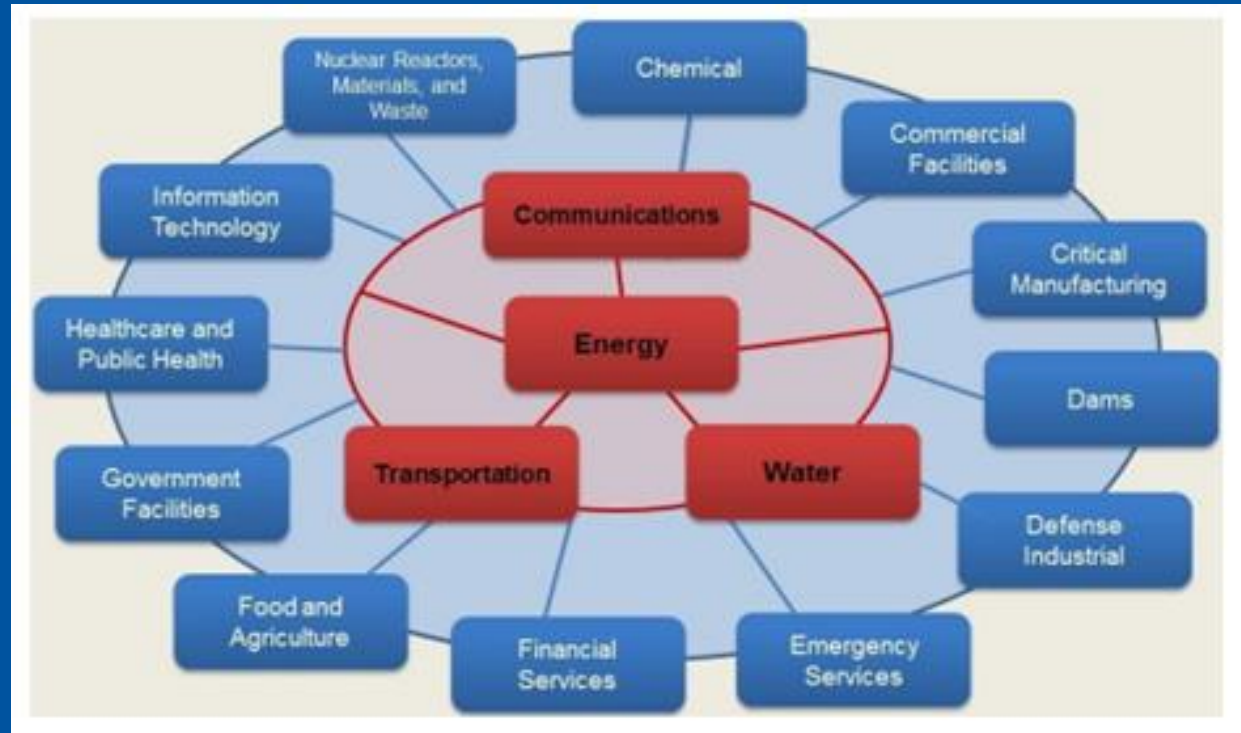
Root cause of natural gas fuel supply issues:

- Production declines
 - Wellheads, gathering facilities
 - Shut-ins
 - Freezing issues
 - Power outages
- Processing facilities
 - Supply decrease (receipts) from wells, gathering facilities
 - Mechanical failure (freezing issues)
 - Mechanical failure (other issues)
 - Power outages



Critical Infrastructure Interdependencies

Extreme conditions test the resilience of the systems we have created... and reveal the strengths and vulnerabilities in the complex relationships between our critical infrastructure elements.



EnerKnol

ERO FERC Joint Inquiry

On 2/16/2021, FERC and NERC announced a joint inquiry into Bulk-Power System operations during the extreme winter weather conditions experienced by the Midwest and Southern Central states

Team includes nearly 50 subject matter experts from FERC, NERC, and all six Regional Entities

Data requests issued to RTOs/ISOs and entities in southern parts of SPP and MISO as well as ERCOT entities and natural gas producers, processors, and pipelines

[Preliminary Findings and Recommendations](#) released at FERC open meeting on September 23rd

Final report anticipated late November 2021



Preliminary Recommendations

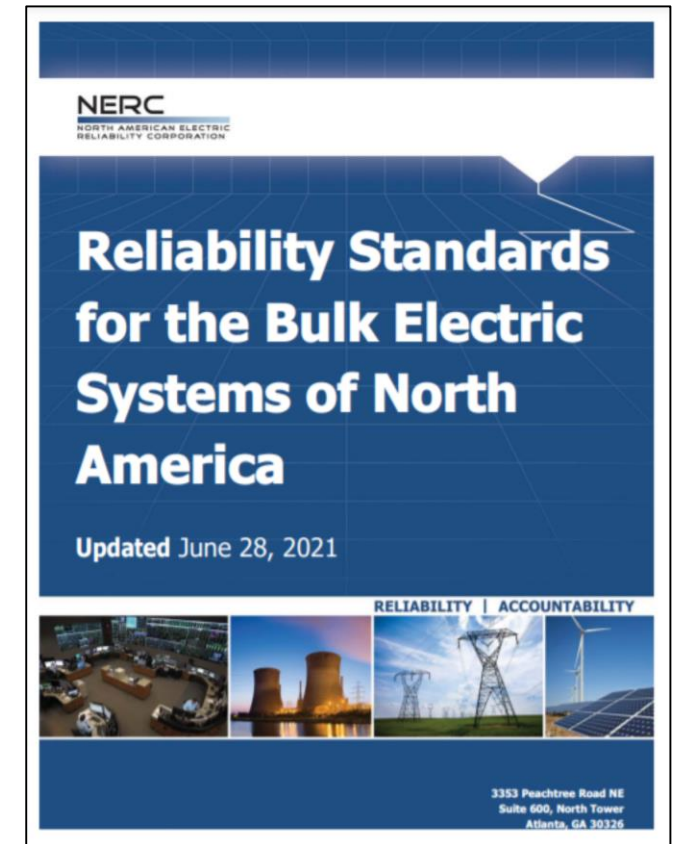
- 28 Recommendations, which include:
 - Nine key recommendations, including Reliability Standards changes
 - Five recommendations for further study
 - Each have recommended timeframes for implementation
 - before Winter 2021/2022
 - before Winter 2022/2023
 - before Winter 2023/2024
- } Most are recommended within these timeframes
- These recommendations are above and beyond the NERC Reliability Standards revisions to address cold weather. See 176 FERC ¶ 61,119 (August 2021)



Preliminary Recommendations - Reliability Standards

Generator Owners and/or Generator Operators:

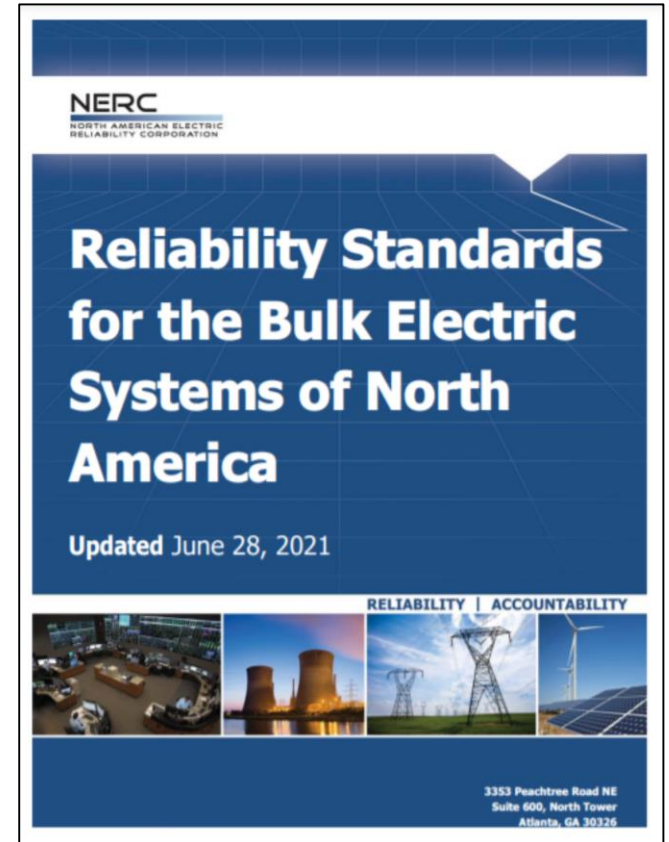
- Identify and protect cold-weather-critical components and systems
- Identify and implement freeze protection measure for the above
- Account for impact of precipitation and cooling effect of wind when providing temperature data
- Corrective Action Plans after freeze-related outages
- Annual training on winterization plans
- Build/retrofit to operate at specific ambient temperatures and weather based on extreme temperature and weather data,
- Provide Balancing Authority (BA) with percentage of total generating unit capacity that can be relied upon during “local forecasted cold weather,” including reliability risks related to natural gas fuel contracts



Key Preliminary Recommendations - Reliability Standards

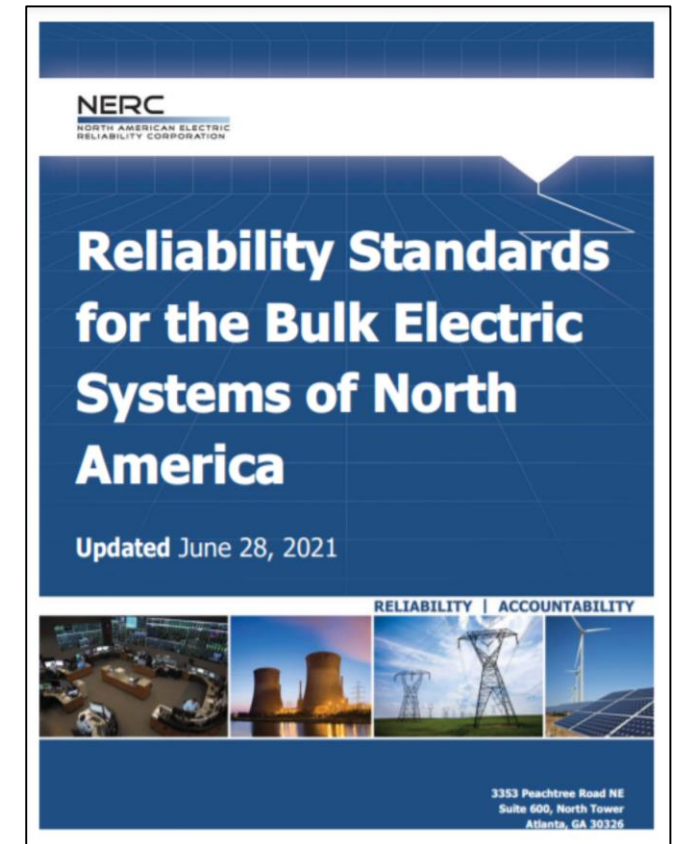
Balancing Authorities (BA)

- Use data provided by the GO/GOP, combined with its experience-based evaluation, to calculate the percentage of each individual generating unit's total capacity that it can rely upon during forecasted cold weather for its operating plans (season-ahead, day(s)-ahead) and real-time monitoring, and share with the RC
- BAs operating plans for contingency reserves and to mitigate capacity and energy emergencies to prohibit use of critical natural gas infrastructure loads for demand response
- BAs and Transmission Operators' (TOPs) manual load shed provisions to include processes for identifying and protecting critical natural gas infrastructure loads from firm load shed



Preliminary Recommendations - Reliability Standards

The load shed procedures of TOPs, Transmission Owners (TO) and Distribution Providers (DPs) should separate manual load shed circuits from underfrequency/undervoltage load shed (UFLS/UVLS) or circuits serving critical load. UFLS/UVLS circuits should be used only as a last resort, and if necessary, start with the final stage (lowest frequency) to minimize the overlap of manual and automatic load shed.





Reliability Guideline

Suggested approaches or behavior in a given technical area for the purpose of improving reliability. Guidelines are not enforceable, but may be adopted by a responsible entity in accordance with its own policies, practices, and conditions.



NERC Alert: Level 2-3

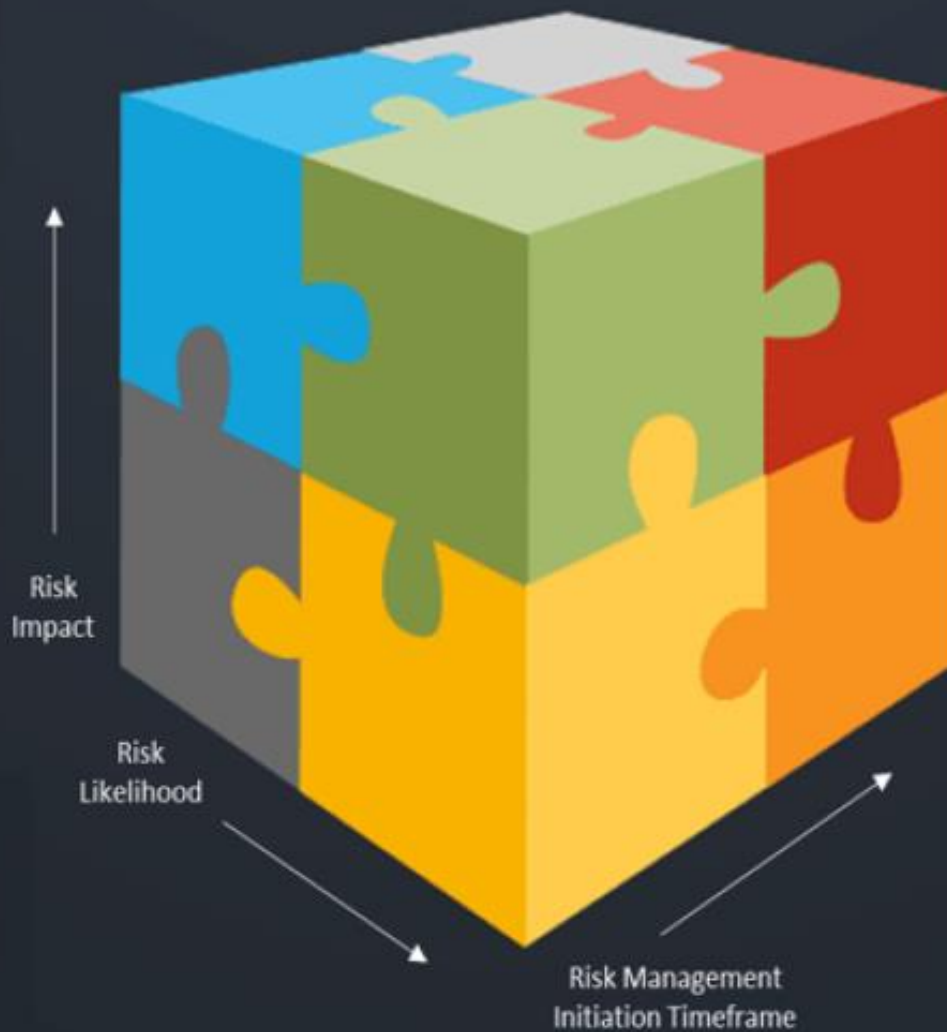
NERC alerts are divided into three distinct levels, 1) Industry Advisory, 2) Recommendation to Industry, and 3) Essential Action, which identifies actions to be taken and require the industry to respond to the ERO.



Technical Engagement

Technical Engagement is a catch-all for a variety of technical activity that is conducted between the ERO and entities. This includes, technical committee activities, technical reference documents, workshops and conferences, assist visits, joint and special studies, etc.

Electric Reliability Organization: Reliability Risk Mitigation Toolkit



Reliability Standards



NERC Reliability Standards define the mandatory reliability requirements for planning and operating the North American BPS and are developed using a results-based approach focusing on performance, risk management, and entity capabilities.

Reliability Assessment



NERC independently assesses and reports on the overall reliability, adequacy, and associated risks that could impact BPS reliability. Long-term assessments identify emerging reliability issues that support public policy input, improved planning and operations, and general public awareness.

NERC Alert: Level 1



NERC Alerts are divided into three distinct levels, 1) Industry Advisory, 2) Recommendation to Industry, and 3) Essential Action, which identifies actions to be taken and require the industry to respond to the ERO.

The background of the image features a Texas state flag on the left side, partially visible. On the right side, there is a multi-barreled cannon, possibly a mortar or a similar artillery piece, with several barrels pointing outwards. The scene is set against a clear, bright blue sky. In the center, there is a dark blue rounded rectangular box with a white border containing the text "Questions?".

Questions?