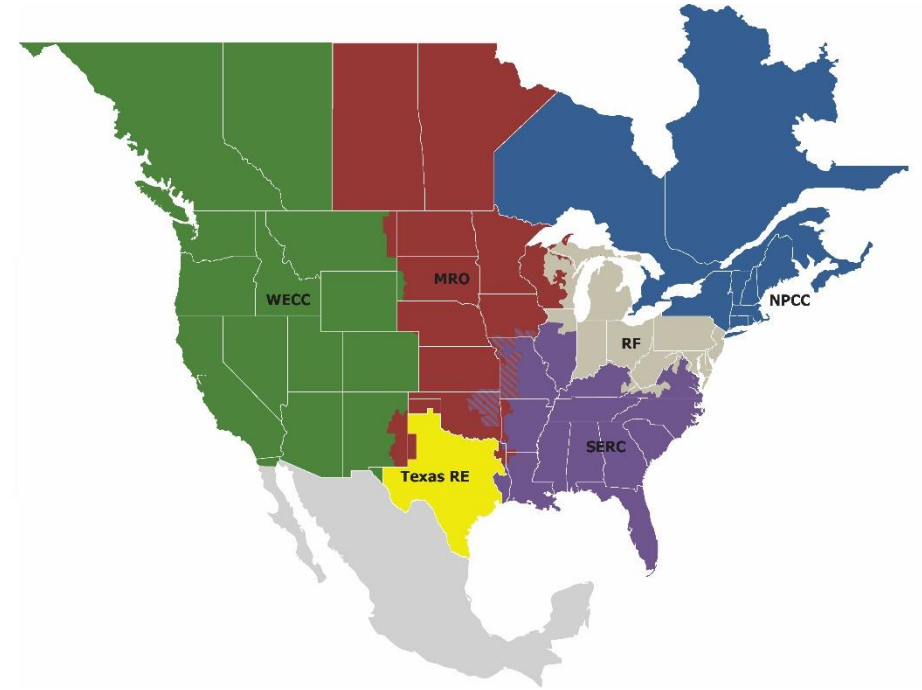




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# System Performance Review of the January 2024 Arctic Storms

Commission Open Meeting: April 25, 2024



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## Summary of Major Takeaways

- During Winter Storms Gerri and Heather, there was zero system operator initiated load shed.
- Natural gas and electric entities shared positive steps taken to improve preparation for extreme cold weather, highlighting improved communication and coordination.
- Generators reported fewer derates/outages as compared to past winter storms potentially attributed to:
  - Improved winter preparedness;
  - Proactive generator commitment;
  - Improved gas generator stability due to variable, i.e., non-ratable, fuel supply methods; and
  - Incorporating operating limitations into operating plans.
- The challenges highlighted in this presentation emphasize the need for continued implementation of recommendations from the Winter Storms Uri and Elliott reports and the recent Blackstart Availability Study.





# Scope of the System Performance Review

- The weather conditions experienced during the January 2024 winter storms;
- Natural gas system performance prior to and during the January 2024 winter storms;
- Electricity planning and operations practices, procedures, and resources used prior to and during the January 2024 winter storms; and
- Generator performance prior to and during the January 2024 winter storms.





# The January 2024 Arctic Storms Performance Review Process

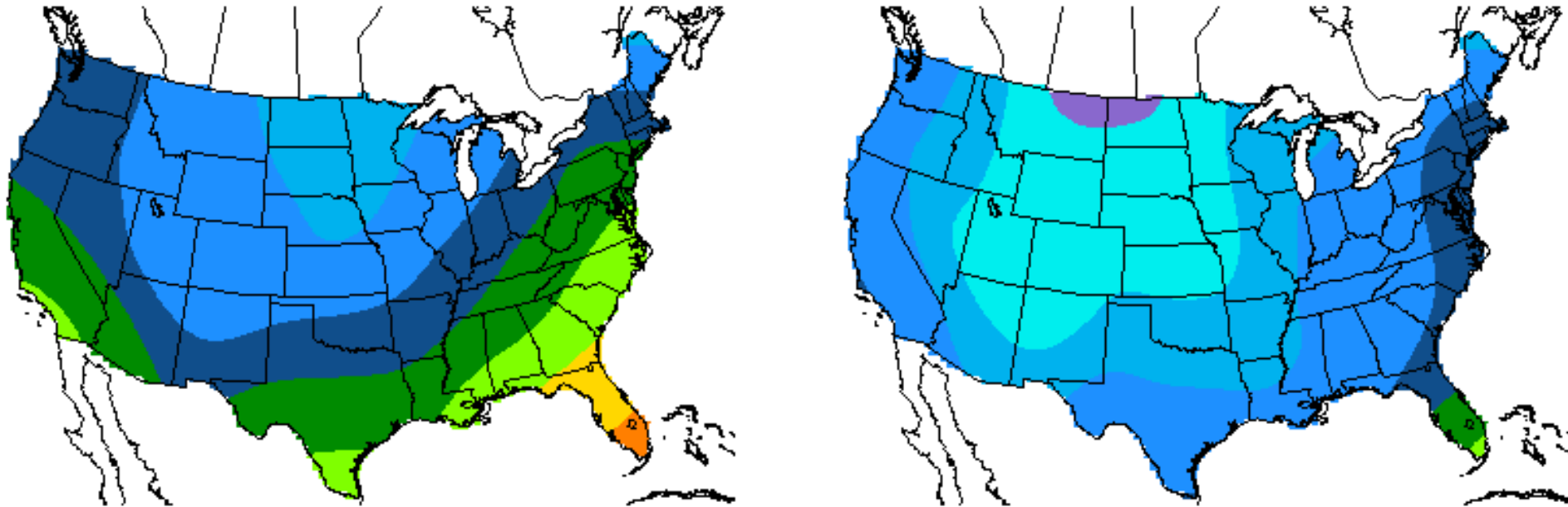
- This review comprised structured interviews with entities from the natural gas and electric industries regarding their preparation and operations during Winter Storms Gerri and Heather.
- This review differs from that of an inquiry:
  - Winter Storm Inquiries: Gather *quantitative* data and perform a comprehensive analysis of a winter storm event.
  - The January 2024 arctic storms performance review: Gather *qualitative* data and perform a limited-scope analysis.
- Staff’s references to “entities” pertain to interviewees only.





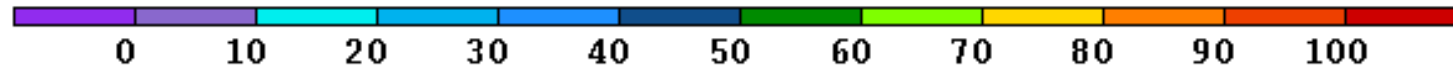
# Weather during the January 2024 arctic storms

2024-01-10



Maximum Temperature

Minimum Temperature



Source: National Oceanic and Atmospheric Administration (NOAA)

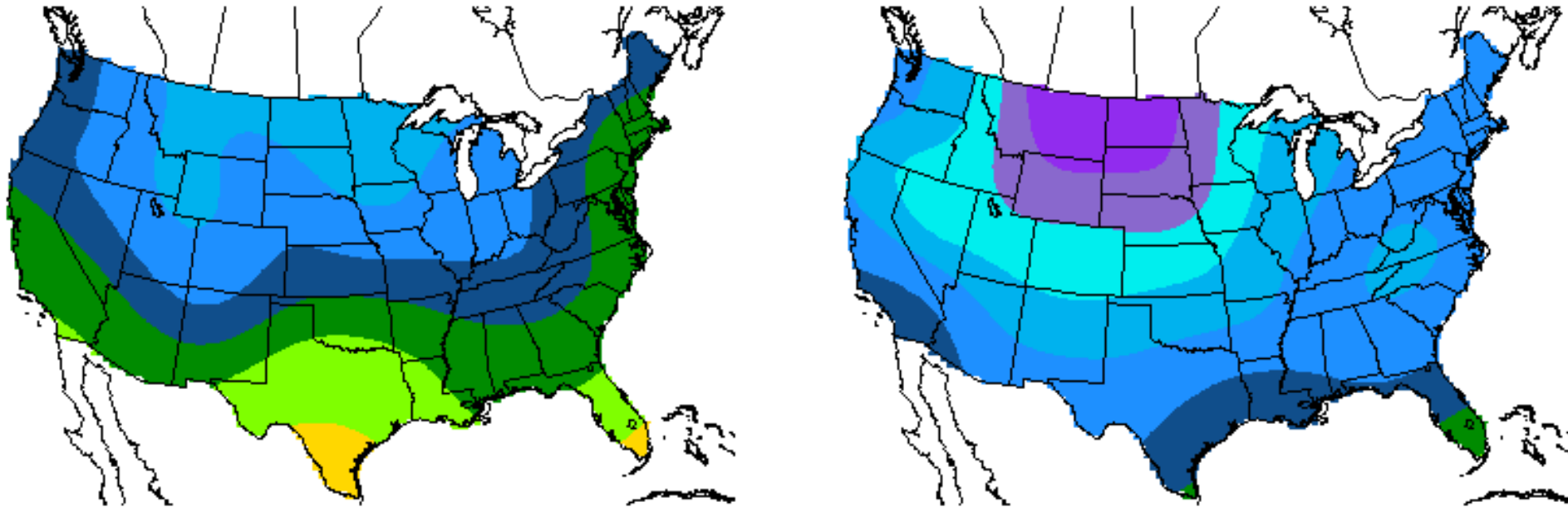


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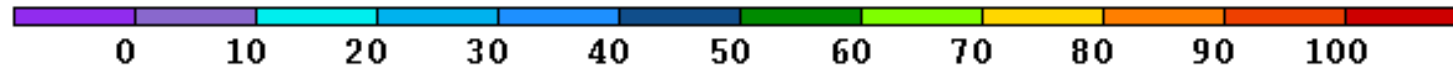
# Weather during the January 2024 arctic storms

2024-01-11



Maximum Temperature

Minimum Temperature



Source: National Oceanic and Atmospheric Administration (NOAA)

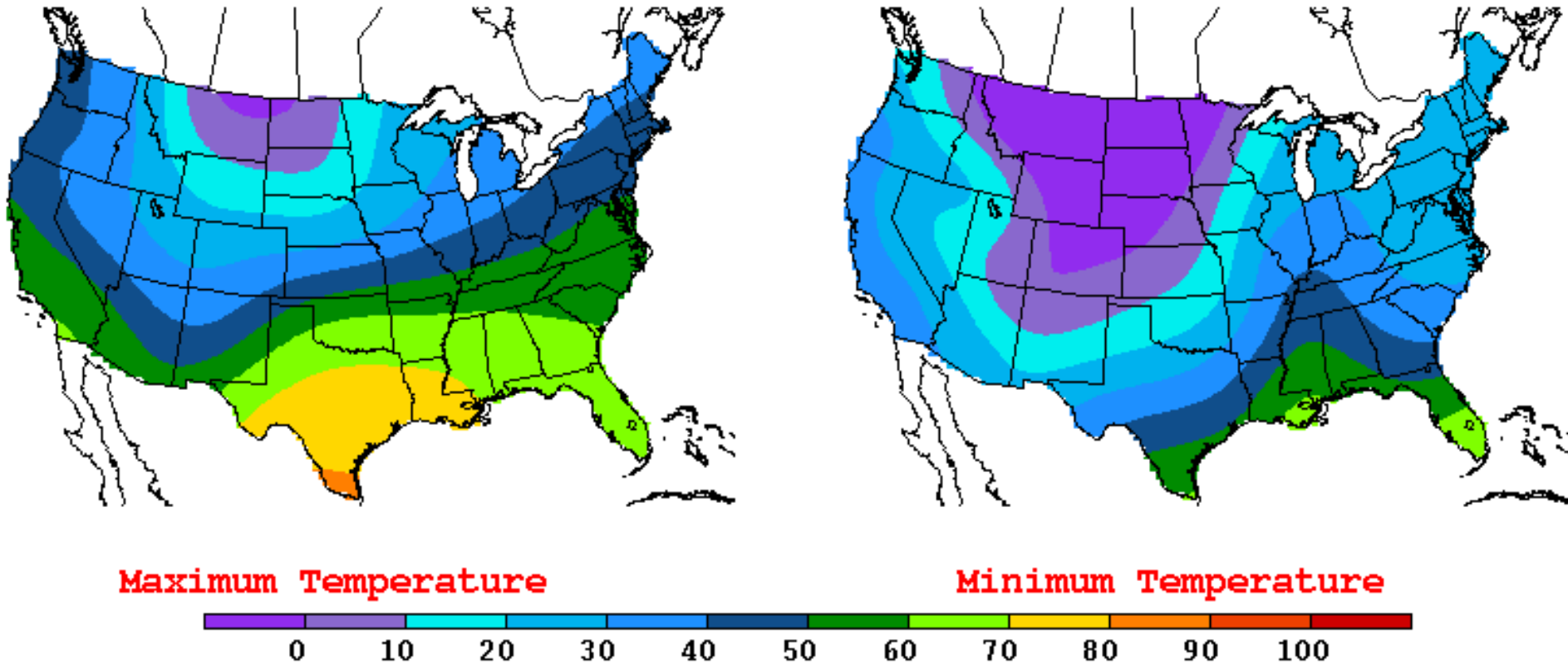


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# Weather during the January 2024 arctic storms

2024-01-12



Source: National Oceanic and Atmospheric Administration (NOAA)

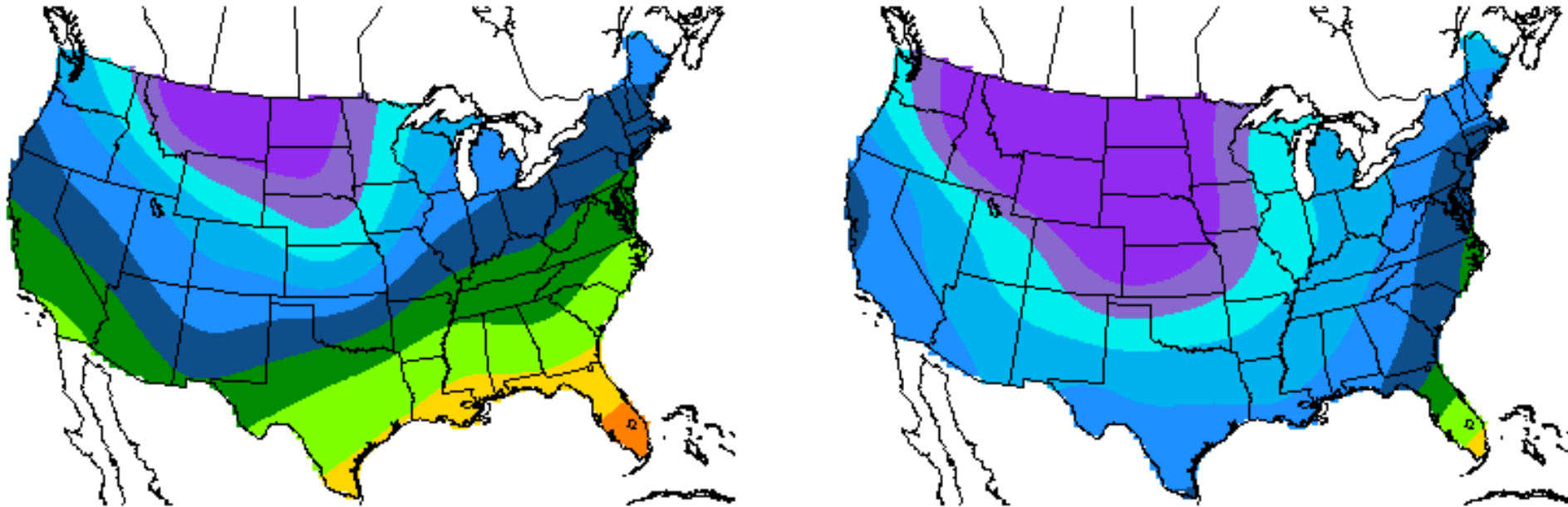


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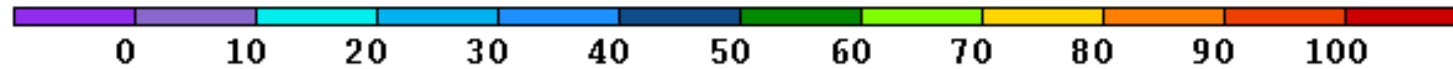
# Weather during the January 2024 arctic storms

2024-01-13



Maximum Temperature

Minimum Temperature



Source: National Oceanic and Atmospheric Administration (NOAA)



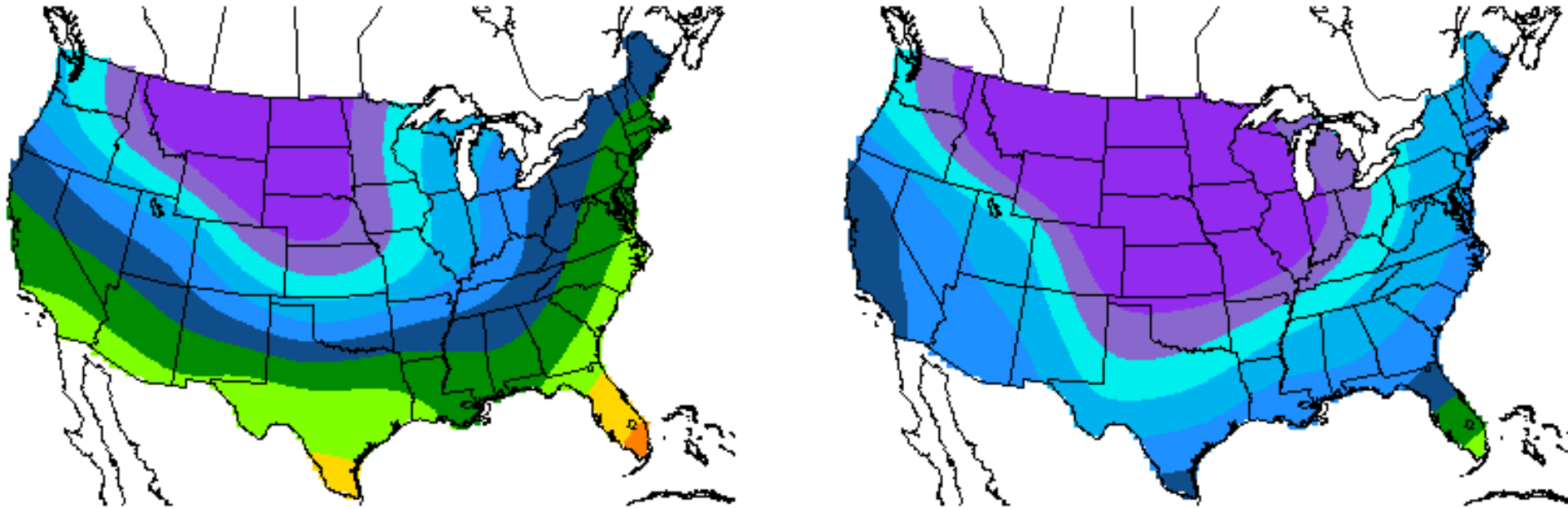
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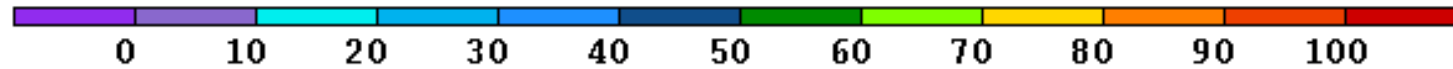
# Weather during the January 2024 arctic storms

2024-01-14



Maximum Temperature

Minimum Temperature



Source: National Oceanic and Atmospheric Administration (NOAA)

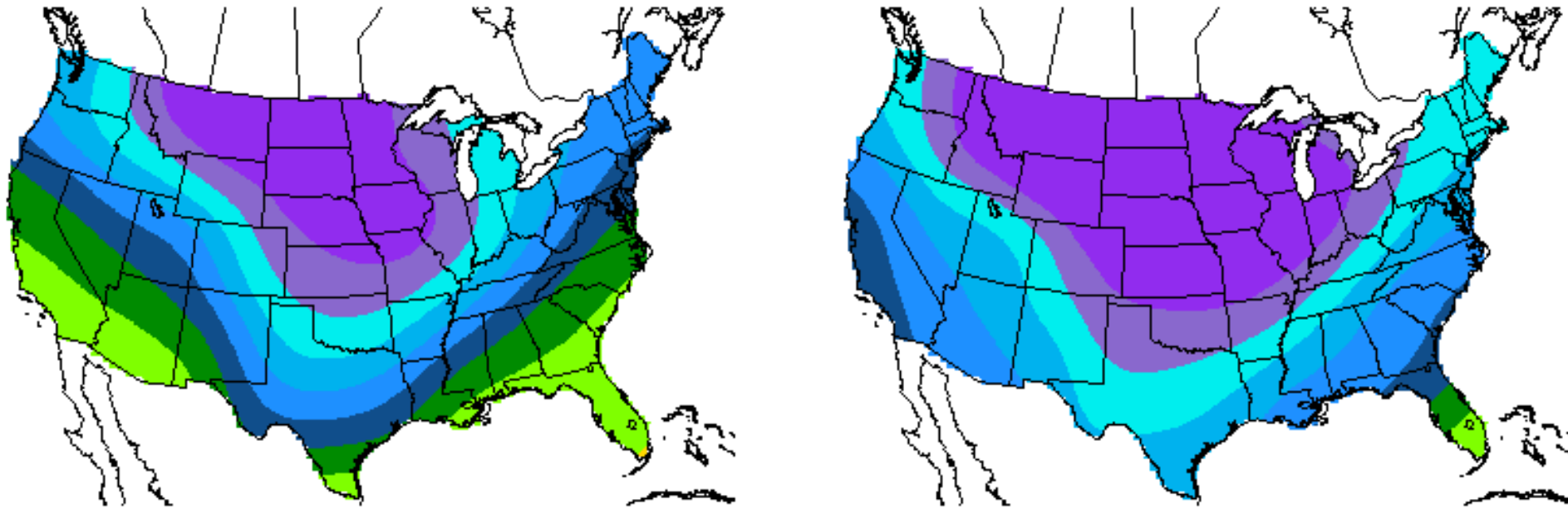


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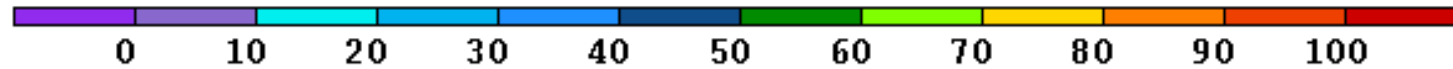
# Weather during the January 2024 arctic storms

2024-01-15



Maximum Temperature

Minimum Temperature



Source: National Oceanic and Atmospheric Administration (NOAA)

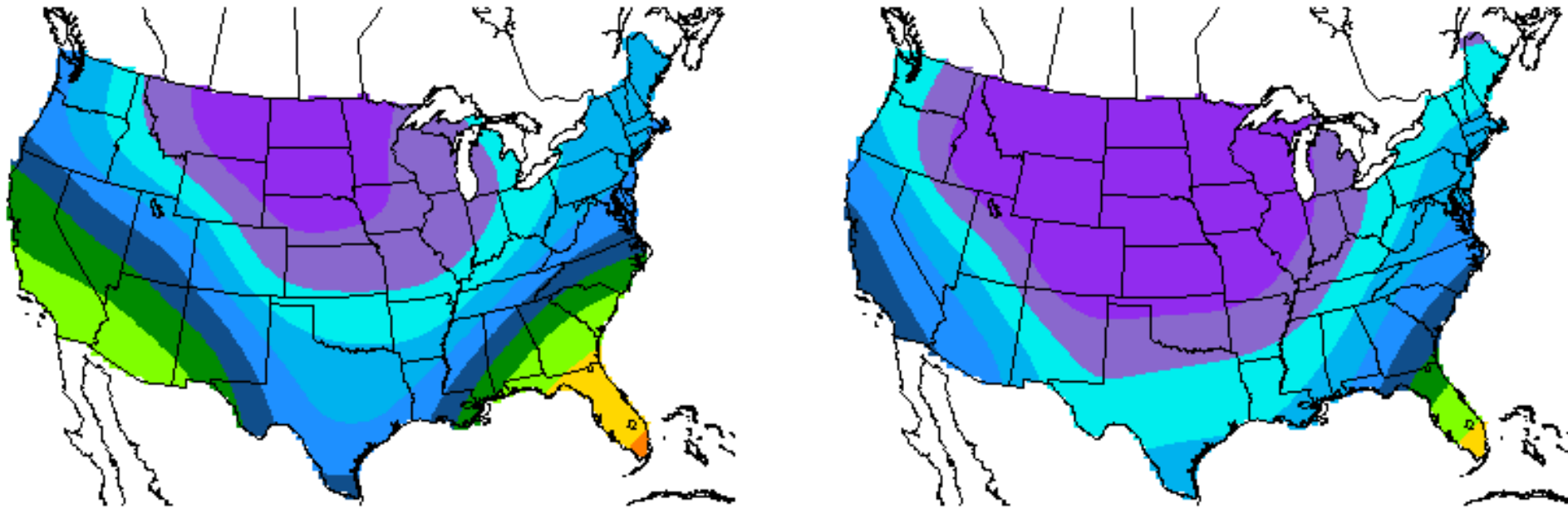


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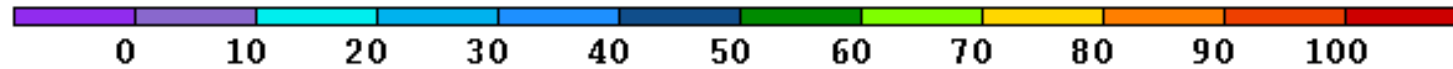
# Weather during the January 2024 arctic storms

2024-01-16



Maximum Temperature

Minimum Temperature



Source: National Oceanic and Atmospheric Administration (NOAA)

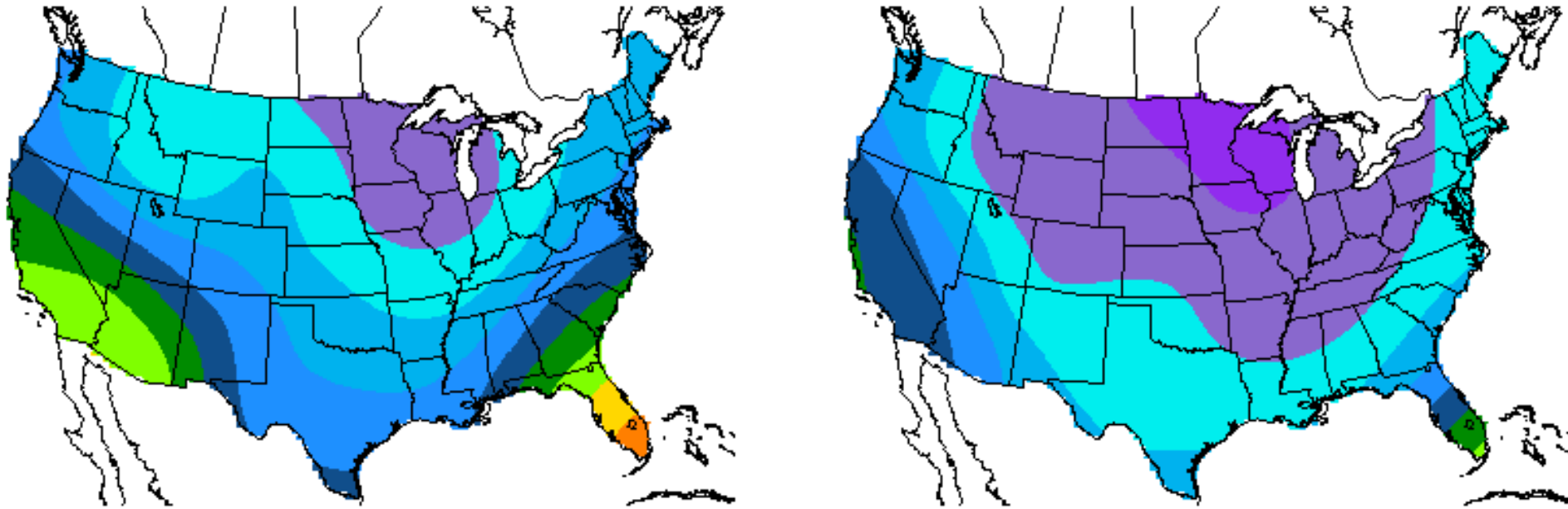


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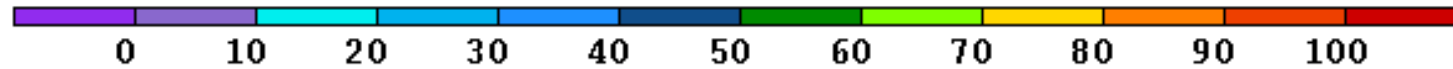
# Weather during the January 2024 arctic storms

2024-01-17



Maximum Temperature

Minimum Temperature



Source: National Oceanic and Atmospheric Administration (NOAA)

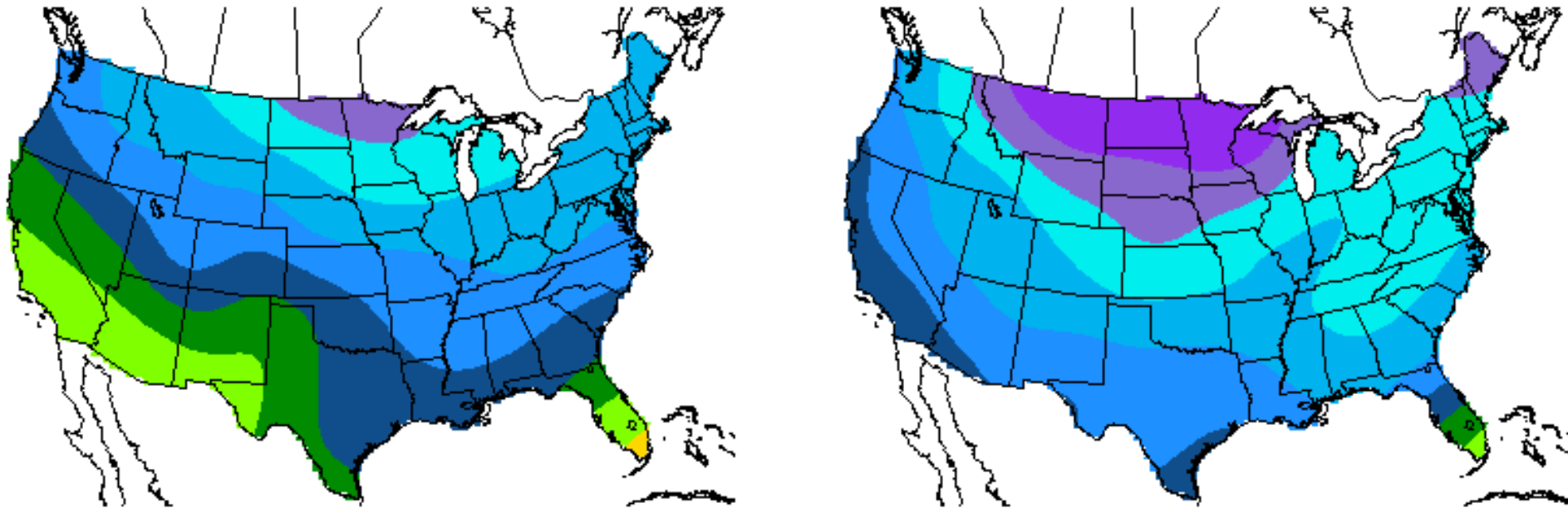


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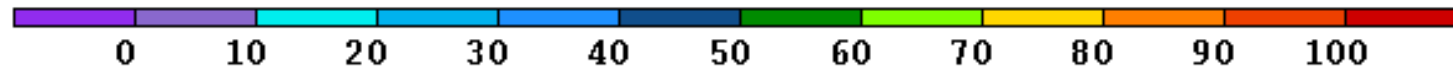
# Weather during the January 2024 arctic storms

2024-01-18



Maximum Temperature

Minimum Temperature



Source: National Oceanic and Atmospheric Administration (NOAA)



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# Natural Gas System Performance

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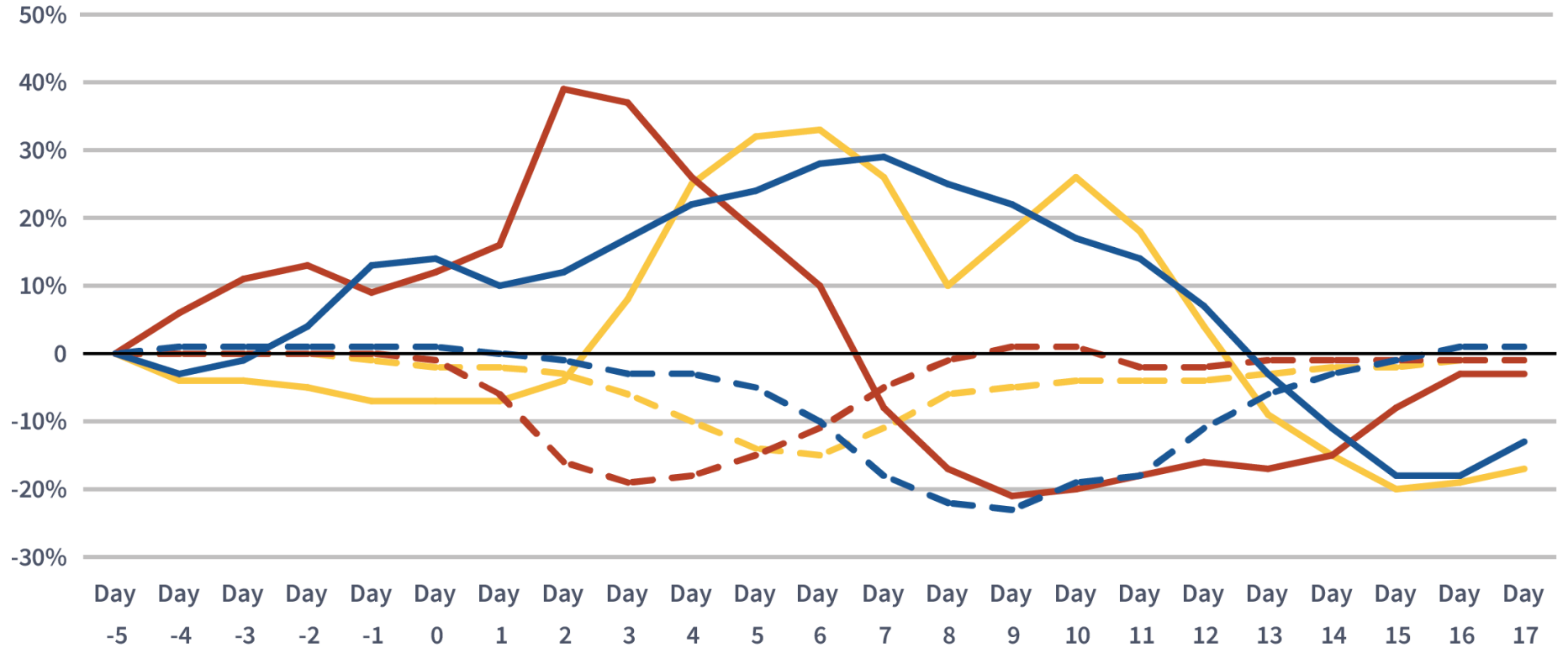


# Percent Change in Natural Gas Production and Demand

Production represents U.S. dry natural gas production.

Demand represents natural gas used for residential and commercial space heating, power generation, and industrial manufacturing.

Day 0 is the Event Start Date



Source: S&P Global PointLogic Data



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# Observations on Natural Gas System Performance

- Natural gas entities communicated system conditions ahead of and during Winter Storms Gerri and Heather throughout their organizations and to shippers.
- Natural gas entities emphasized steps they took to prepare for and operate through Winter Storms Gerri and Heather:
  - Reviewing their entire systems to determine needed enhancements and modifications to improve performance during extreme cold weather;
  - Communicating with external entities that could be impacted by operations;
  - Implementing cold weather protection measures;
  - Training staff on emergency response procedures;
  - Ensuring adequate staffing levels; and
  - Testing key compressor stations.
- Diversely routed networks could add resiliency to the vulnerabilities seen in communication networks during Winter Storms Gerri and Heather.
- Staff's observations from the natural gas entities are consistent with implementation of Recommendations 5 through 8 from the Winter Storm Uri [report](#), recommendations 4 through 7 from the Winter Storm Elliott [report](#), and recommendations 2a and 2b from the recent Blackstart Availability [Study](#).





# Electricity Planning and Operations

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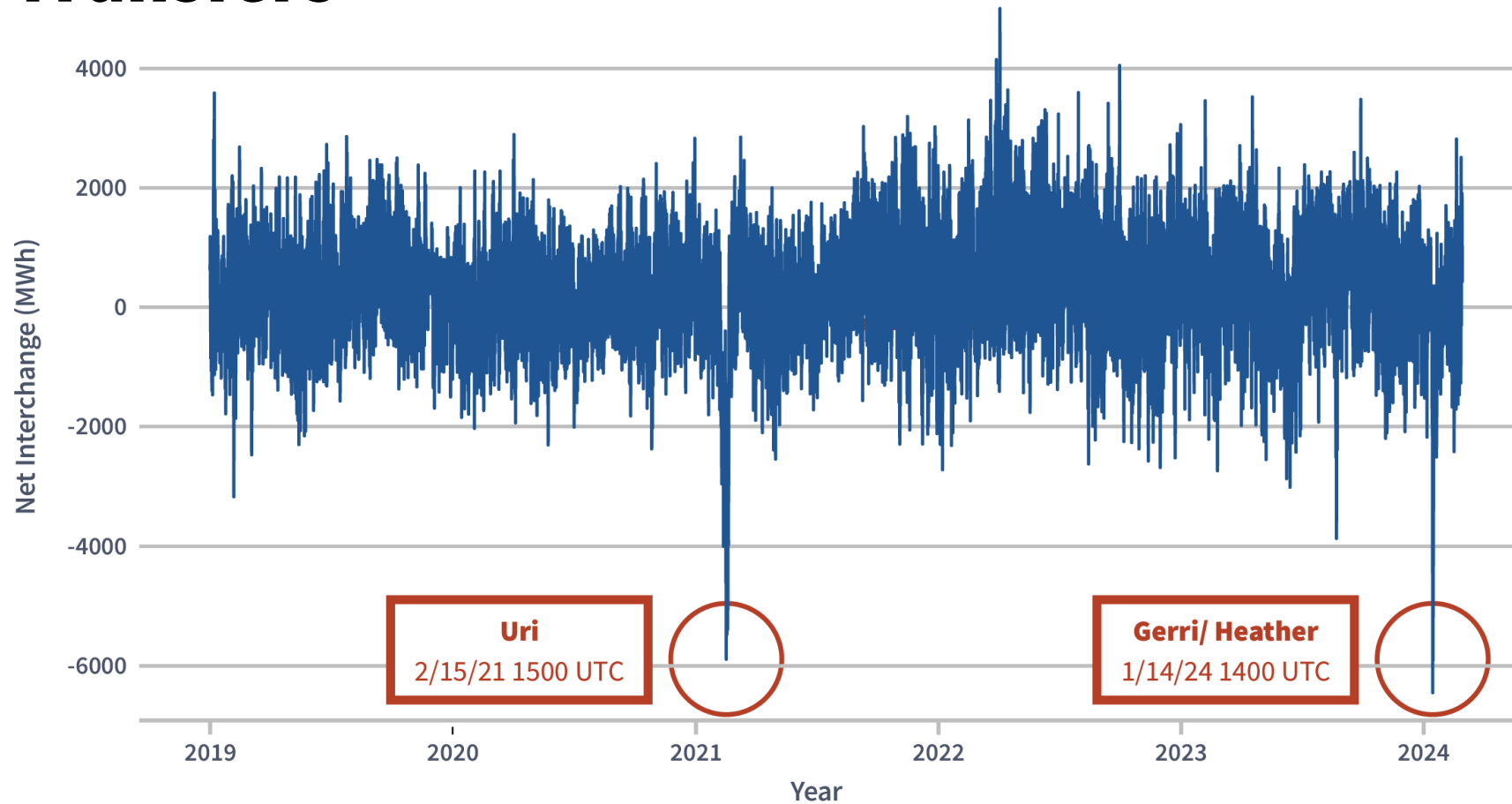
# Observations on Electricity Planning and Operations

- Grid operators reported improved communications during Winter Storms Gerri and Heather:
  - Improved coordination among neighboring reliability coordinators and balancing authorities;
  - Enhanced communication to generators regarding fuel availability; and
  - Increased internal communications.
- Other observations from entities on improvements compared to prior arctic storms:
  - More accurate and earlier weather forecasts regarding the timing and the magnitude of the weather conditions brought on by Winter Storms Gerri and Heather;
  - Grid operators issued winter advisories farther in advance than prior winter storms; and
  - Improved load forecasting and robust wind forecasting for some entities interviewed, but more improvements could be made.
- The actions taken during these arctic storms indicate that the entities interviewed have started to or have implemented recommendation 5 from the Winter Storm Uri report, recommendations 4, 5, and 6 from the Winter Storm Elliott report, and recommendations 2a and 2b from the recent Blackstart Availability Study. Improvements to near-term load forecasting highlights the importance of recommendation 9 from the Winter Storm Elliott report. Vigilance in implementing these recommendations should be continued.





# One Balancing Authority in the Eastern Interconnection with Notable Interregional Transfers



Source: U.S. Energy Information Administration (EIA)-930 data

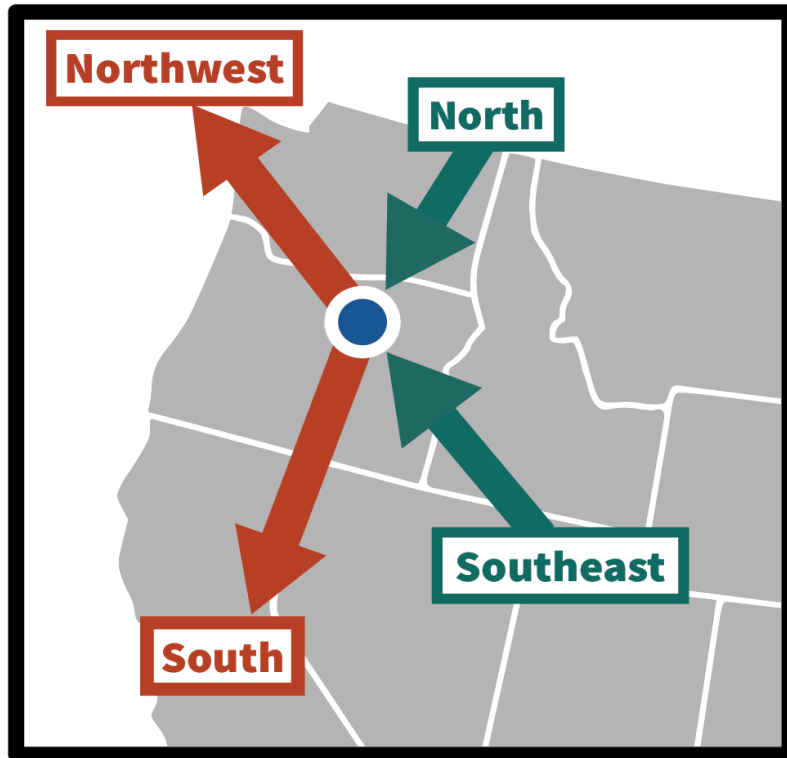


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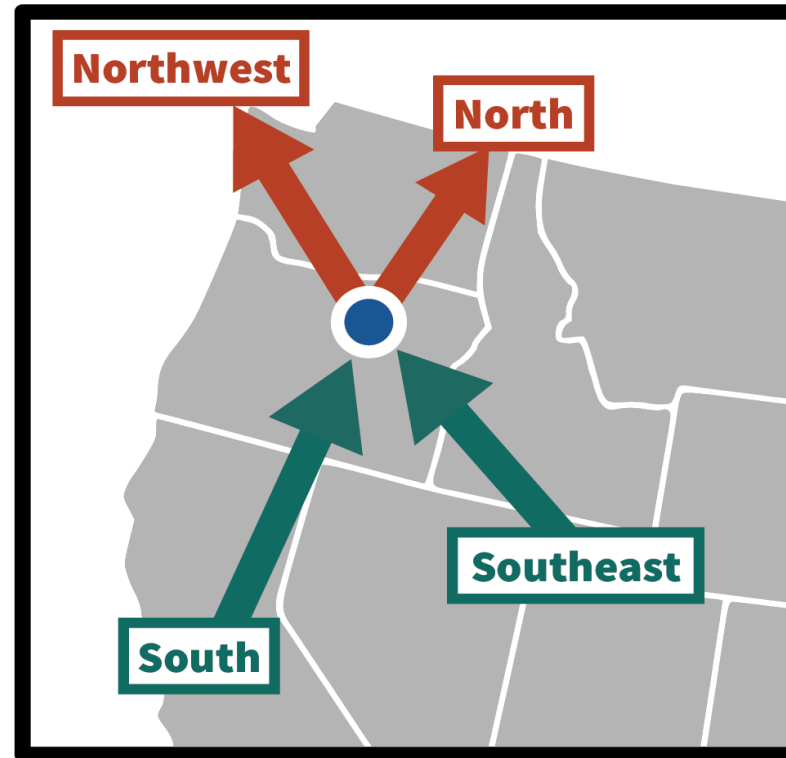


# Atypical Northwest Power Flows: Switched to South-to-North During Gerri and Heather

Average Energy Flows



Gerri/Heather



Source: EIA-930 data



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## One Energy Emergency Alert 3 (EEA-3)

- An EEA is an emergency status used to communicate the energy condition of a balancing authority. An EEA-3 indicates the most serious of energy deficient conditions.\*
- During Winter Storms Gerri and Heather operators declared one EEA-3 because minimum contingency reserve obligations could not be met. Nevertheless, no load was shed.

\*EEA definition provided in NERC Reliability Standard EOP-011-4





# No Reported System Operator Initiated Load Shed During Winter Storms Gerri and Heather

- System Operator Initiated Load Shed Comparison\*
  - Winter Storm Uri: Over 23,000 MW of system operator initiated load shed
  - Winter Storm Elliott: Over 5,400 MW of system operator initiated shed (at different points in time)
  - Winter Storms Gerri and Heather: The ERO received no reported system operator initiated load shed (zero MW of firm load shed)

\*October 2023 Winter Storm Elliott [Report](#) (p. 14)



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# Generator Performance

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# Observations on Generator Performance

- Quantitative data regarding generator outages during Winter Storms Gerri and Heather are not yet available.
- Generators stated that outages during Winter Storms Gerri and Heather were due to plant equipment freezing, mechanical issues, a lack of fuel availability, and other unknown issues still being analyzed.
- Grid operators reported that the unplanned outages of blackstart resources that occurred during Winter Storms Gerri and Heather were due to equipment issues or a lack of fuel availability.
- The reported generator performance reinforces recommendations 1a through 1g outlined in the Winter Storm Uri report and recommendations 1a through 1g, 2, and 3 from the Winter Storm Elliott report as well as recommendations 1a, 1b, and 1c from the recent Blackstart Availability Study.

For purposes of this presentation, entities refer specifically to the entities interviewed by the team.







# Operators Took Steps to Improve Availability of Generators

- A grid operator stated that it committed more generators to offset and account for unplanned generator outages.
- Another grid operator committed more reserves in the day-ahead market so that more generation was available to mitigate against the potential for unplanned outages, including pre-starting units.
- A different grid operator secured capacity contracts for generators outside of its footprint to increase overall reserves.
- A grid operator incorporated fuel survey results from generators into its operational plans to better account for uncertainties.





# Generator Winterization Measures

- Multiple generator owners and generator operators stated that they have developed cold weather checklists. These help them review the status of their freeze protection measures, fuel availability, and supplies of needed consumables.
- A grid operator stated that since Winter Storm Uri, a significantly higher percentage of its generators can operate below freezing temperatures.
- A grid operator stated that the Public Utility Commission of Texas's generator winterization rules have been a strong driver of improved generator performance during cold weather events including during Winter Storms Gerri and Heather.
- A grid operator stated that it observed a ten-fold reduction in outages as compared to Winter Storm Elliott and attributed it to implementing lessons learned, its after-action review process, and completing thousands of winter readiness activities.
- The above winterization measures taken prior to and during the January arctic storms are consistent with and strengthen the importance of recommendations 1b, 4, and 8 from the Winter Storm Uri report and recommendations 1c, 1e, and 1g from the Winter Storm Elliott report.





## Summary of Major Takeaways

- During Winter Storms Gerri and Heather, there was zero system operator initiated load shed.
- Natural gas and electric entities shared positive steps taken to improve preparation for extreme cold weather, highlighting improved communication and coordination.
- Generators reported fewer derates/outages as compared to past winter storms potentially attributed to:
  - Improved winter preparedness;
  - Proactive generator commitment;
  - Improved natural gas generator stability due to variable, i.e., non-ratable, fuel supply methods; and
  - Incorporating operating limitations into operating plans.
- The challenges highlighted in this presentation emphasize the need for continued implementation of recommendations from the Winter Storms Uri and Elliott reports and the recent Blackstart Availability Study





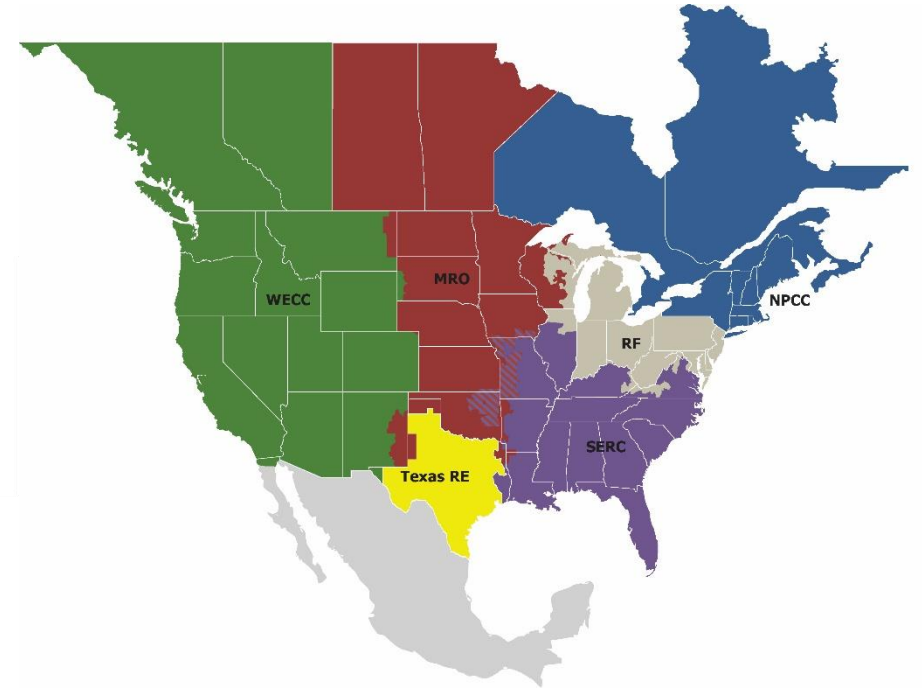
# Winter Storms Uri and Elliott: Report Recommendation Updates

- FERC and NERC are working together to establish a website dashboard to track the status of the Winter Storm Uri and Elliott Recommendations.
- For grid reliability during extreme cold weather, FERC and NERC jointly proposed 39 recommendations (28 from the Winter Storm Uri report, and 11 from the more recent Winter Storm Elliott Report)
  - Of the **39** total recommendations, progress has been made on **two-thirds** of them. This progress includes completing development of the generator cold weather reliability standards initially recommended by the Uri Report.
  - Of the remaining **one-third** of the recommendations that still need attention, most require more work to be done to improve natural gas cold weather preparedness and improvements to gas-electric coordination to reliably support the bulk-electric system.





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