Natural Gas Readiness Forum

December 16-17, 2024
Atlanta, GA

AGA
American Gas Association

Natural Gas Readiness Forum

Weather & Energy Outlook

AGA
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Georgia Emergency Management & Homeland Security Agency

2024-2025 Winter Seasonal Outlook

Will Lanxton

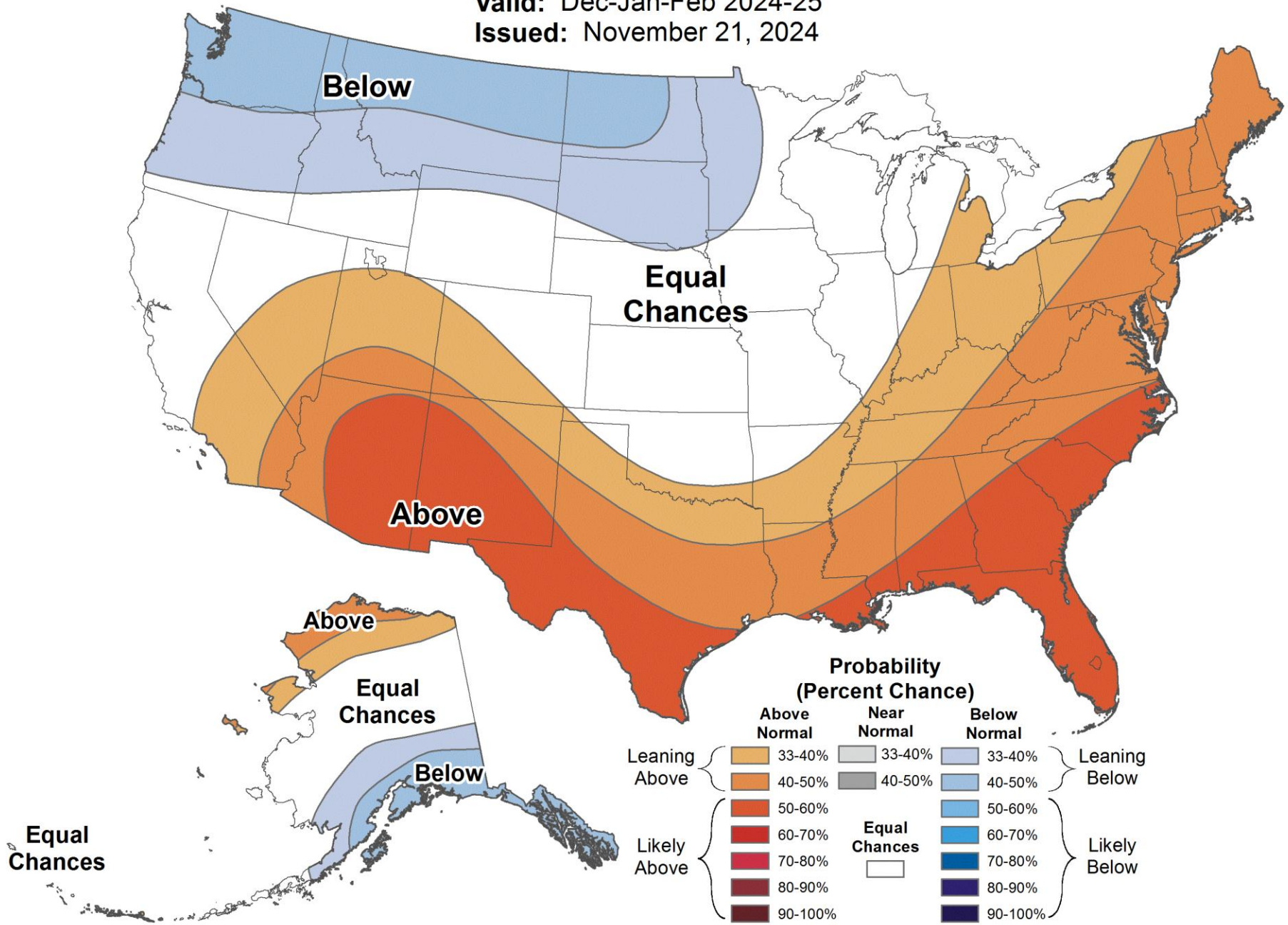
State Meteorologist

Winter Seasonal Outlook

- Seasonal Temperature Outlook
- Seasonal Precipitation Outlook
- El Niño–Southern Oscillation (ENSO)
- Arctic Oscillation
- North Atlantic Oscillation

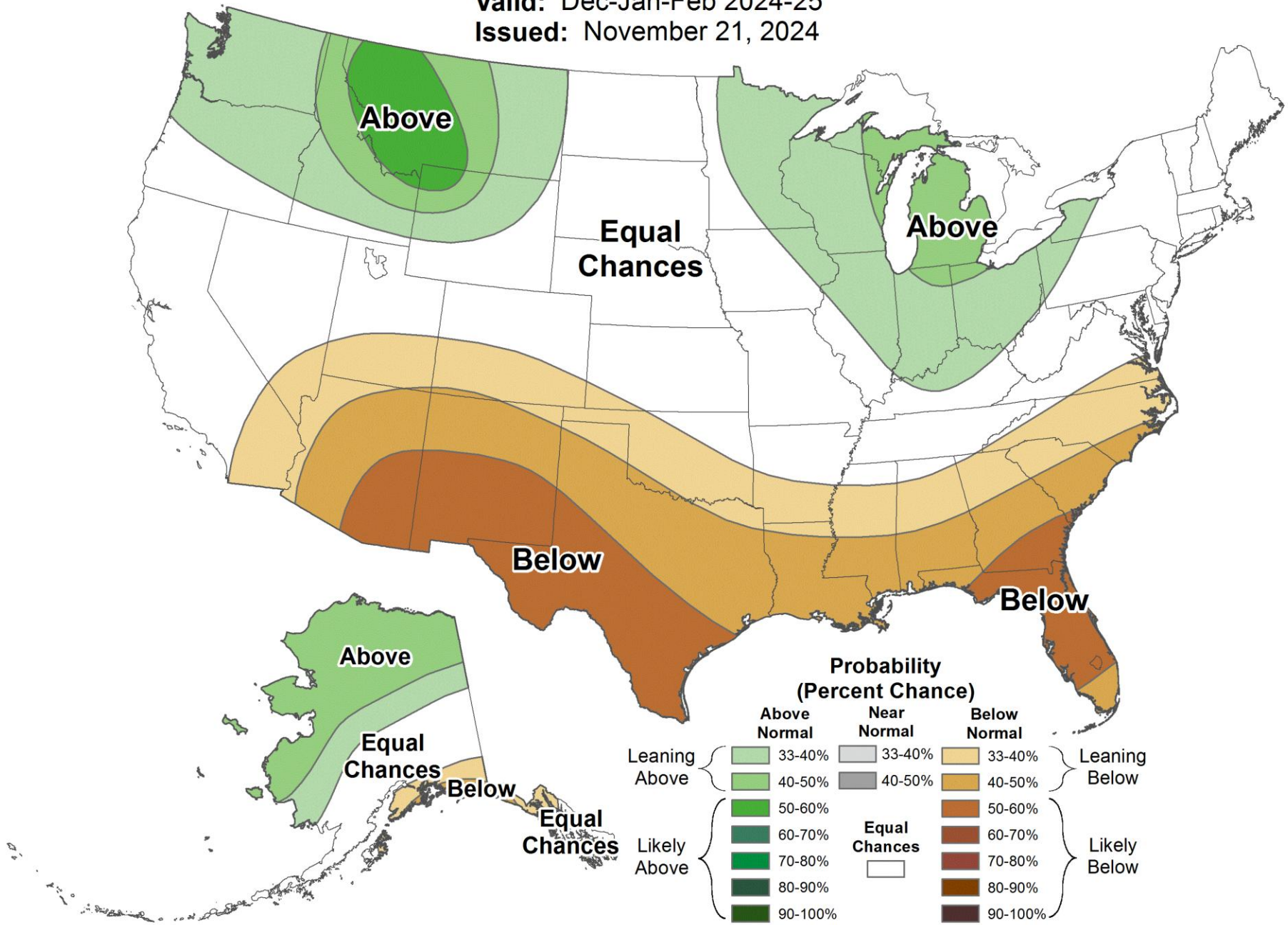
Seasonal Temperature Outlook

Valid: Dec-Jan-Feb 2024-25
Issued: November 21, 2024

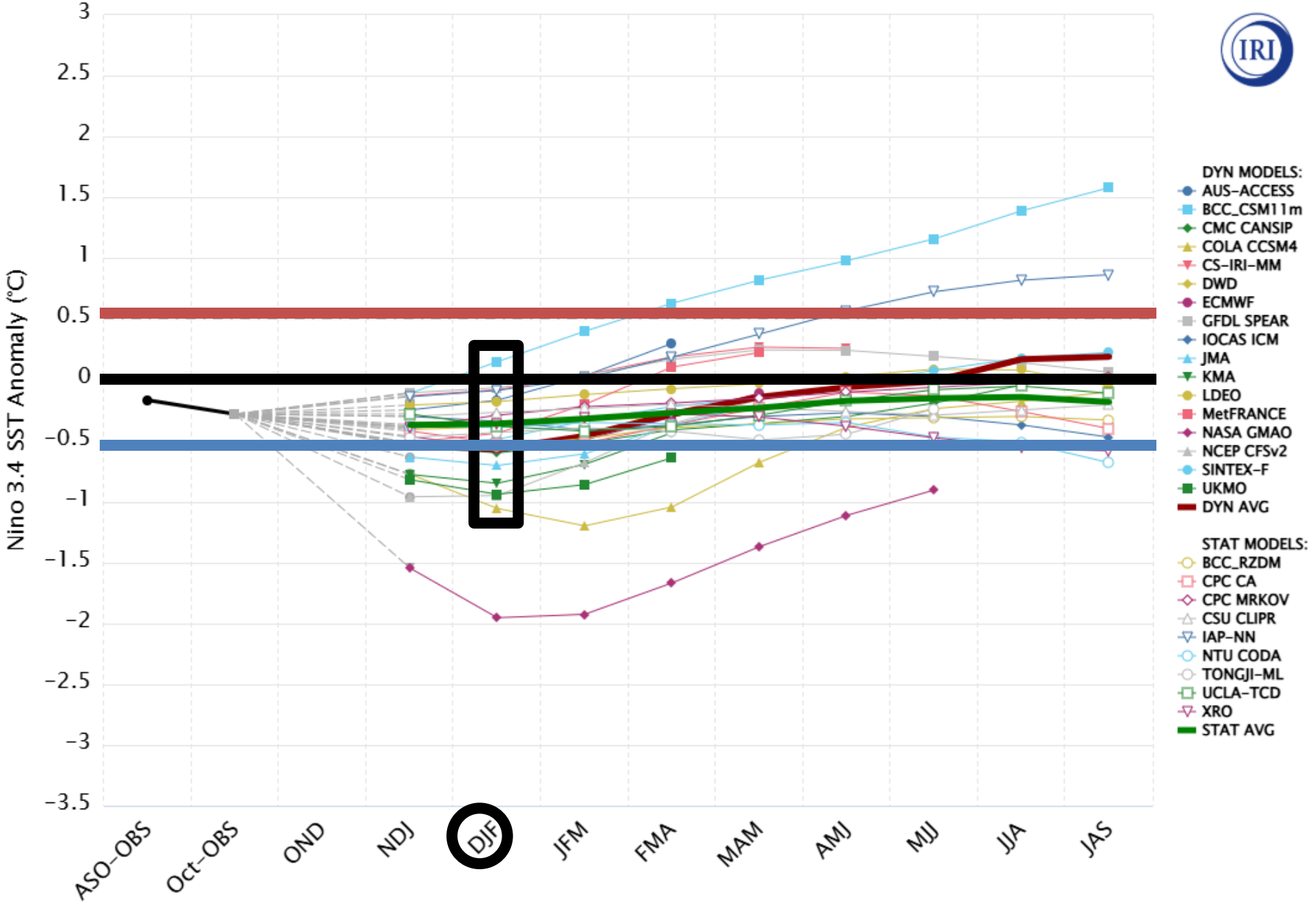


Seasonal Precipitation Outlook

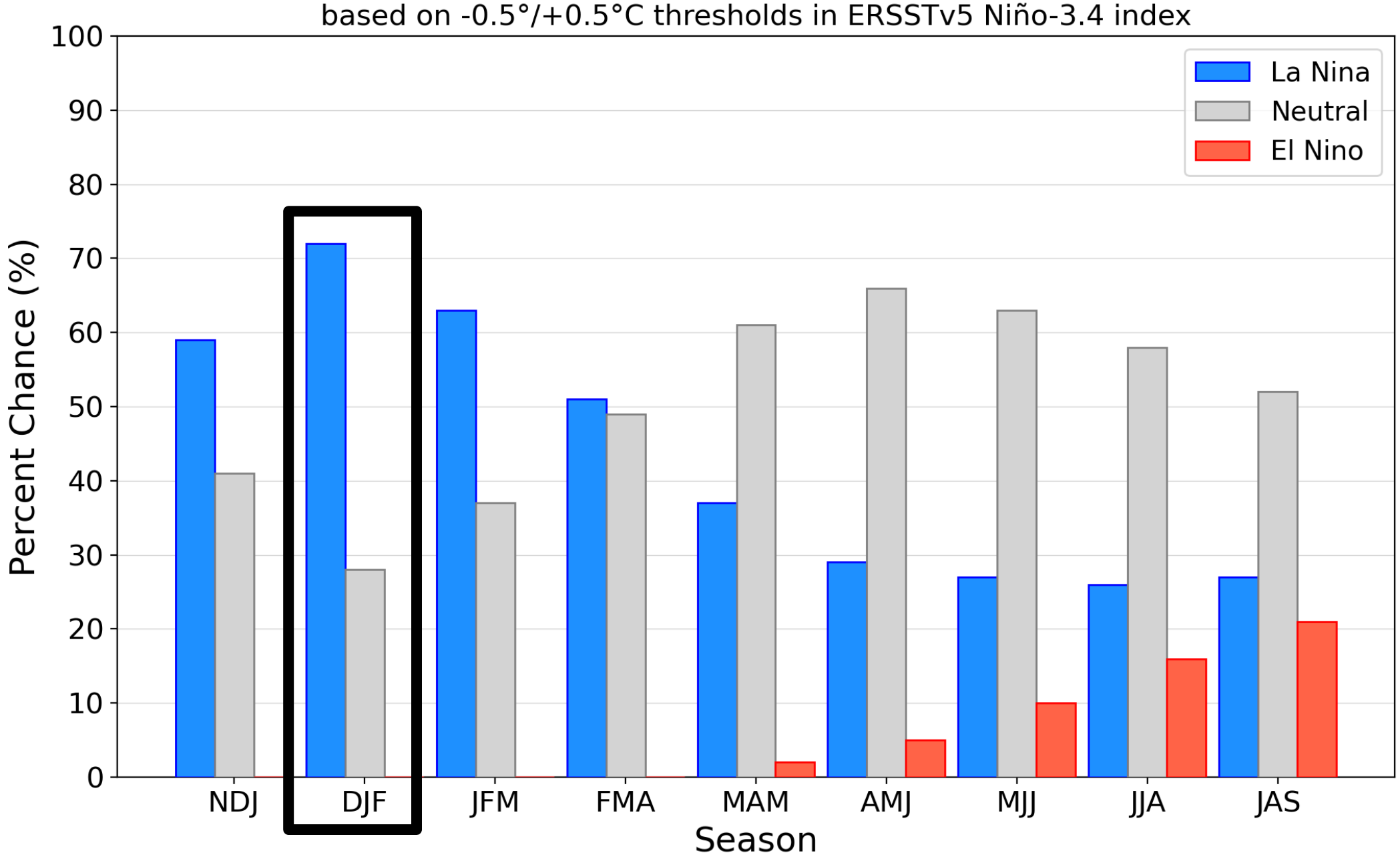
Valid: Dec-Jan-Feb 2024-25
Issued: November 21, 2024

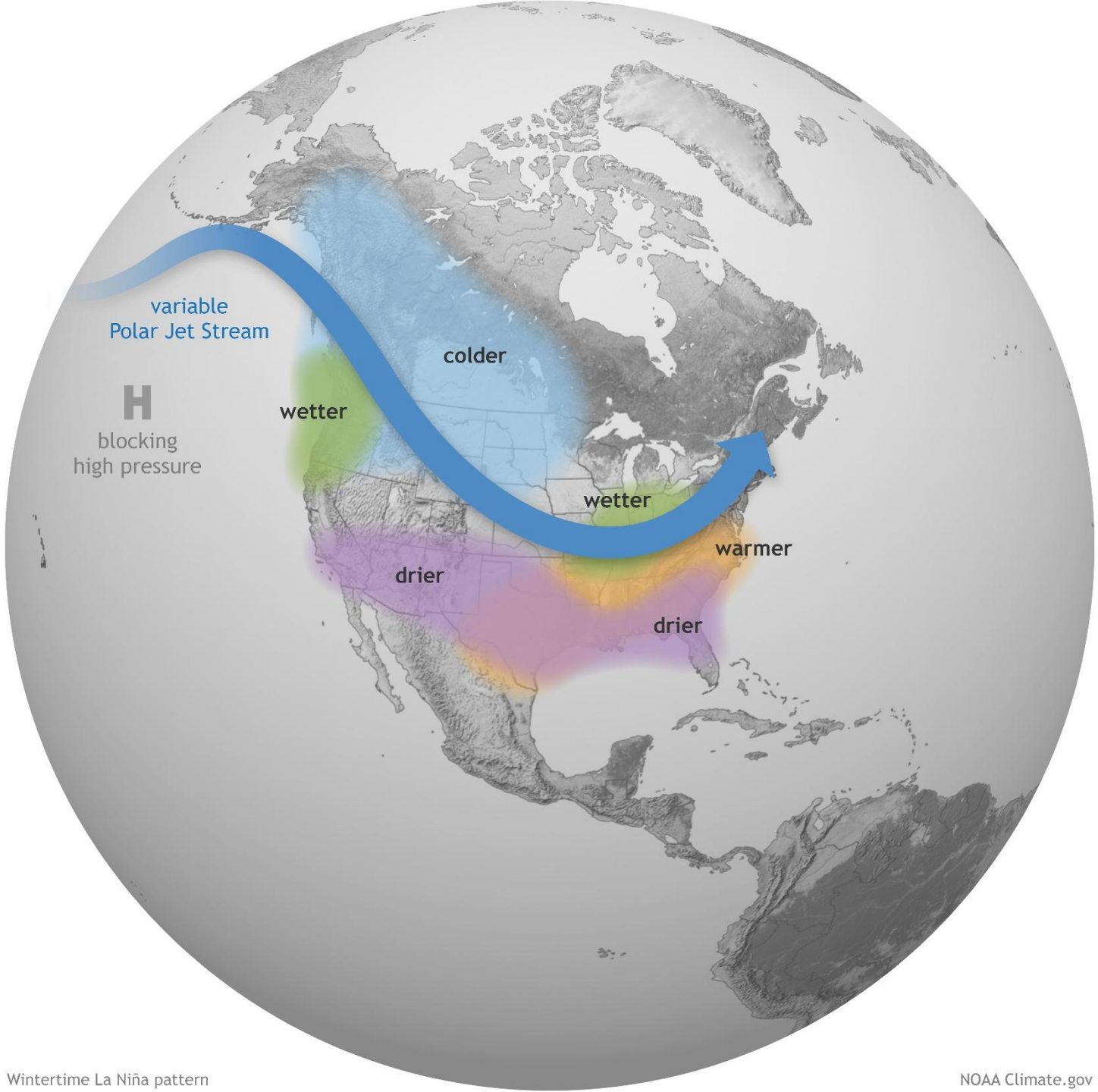


Model Predictions of ENSO from Nov 2024



Official NOAA CPC ENSO Probabilities (issued December 2024)



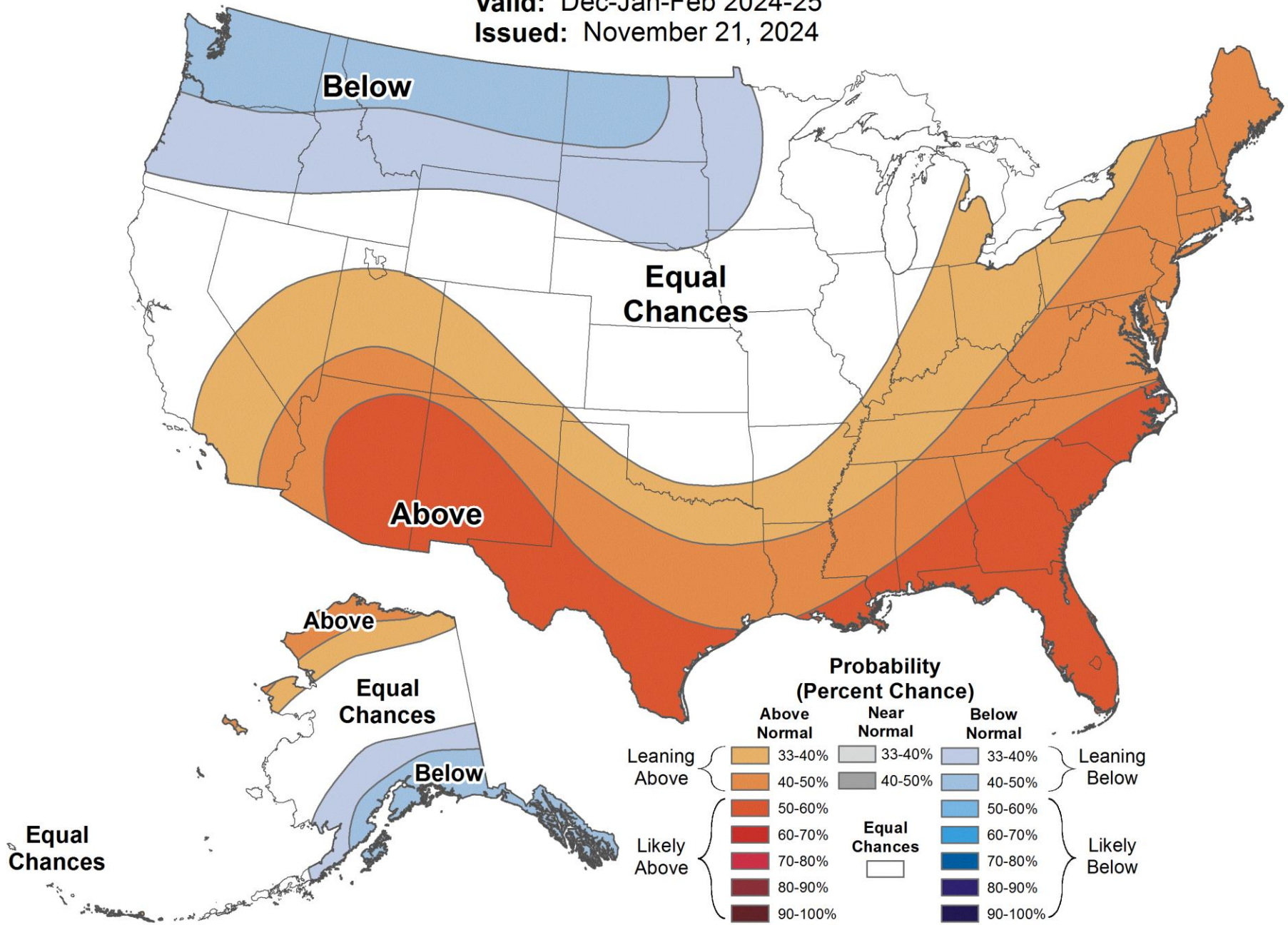


Wintertime La Niña pattern

NOAA Climate.gov

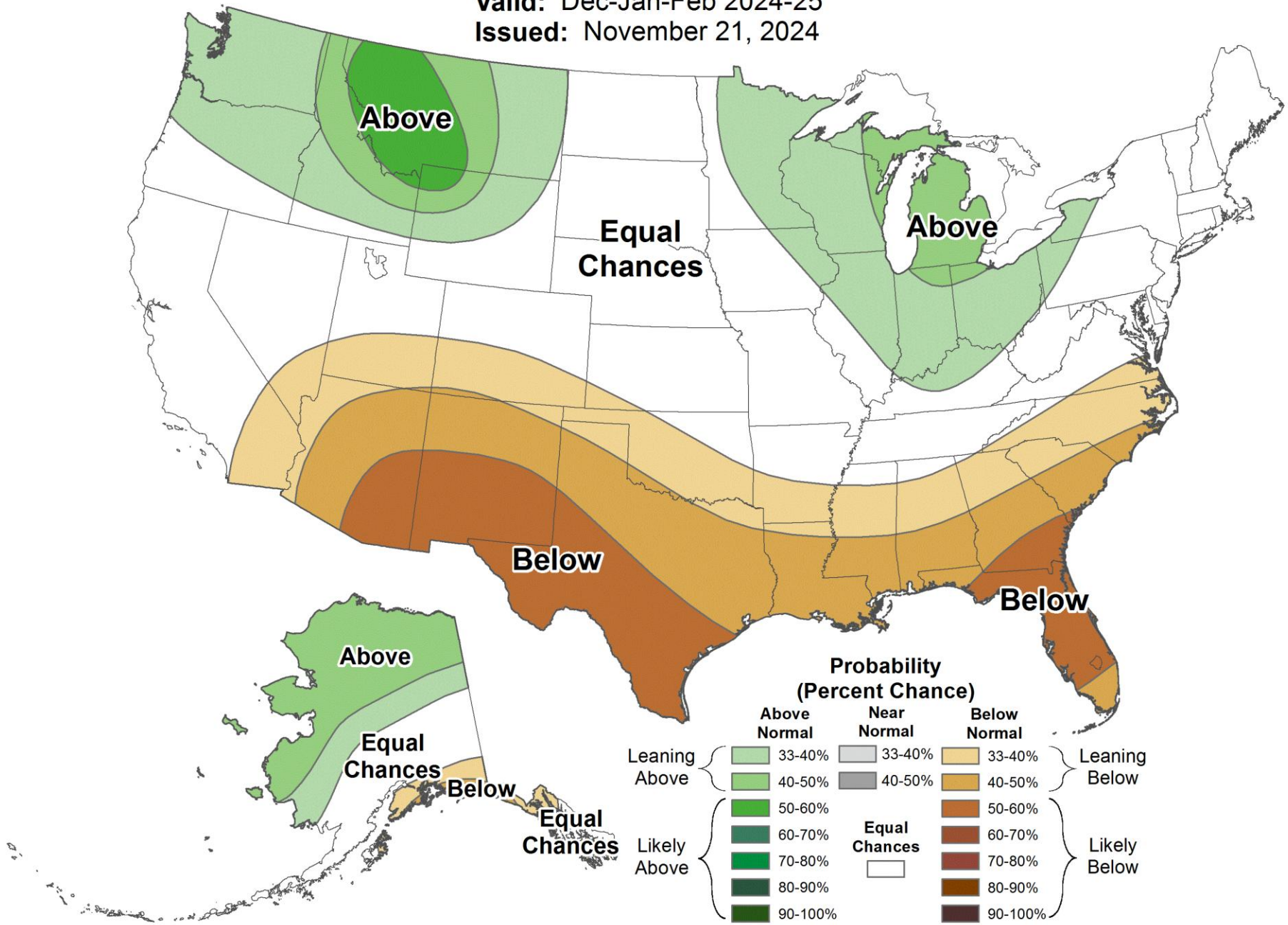
Seasonal Temperature Outlook

Valid: Dec-Jan-Feb 2024-25
Issued: November 21, 2024



Seasonal Precipitation Outlook

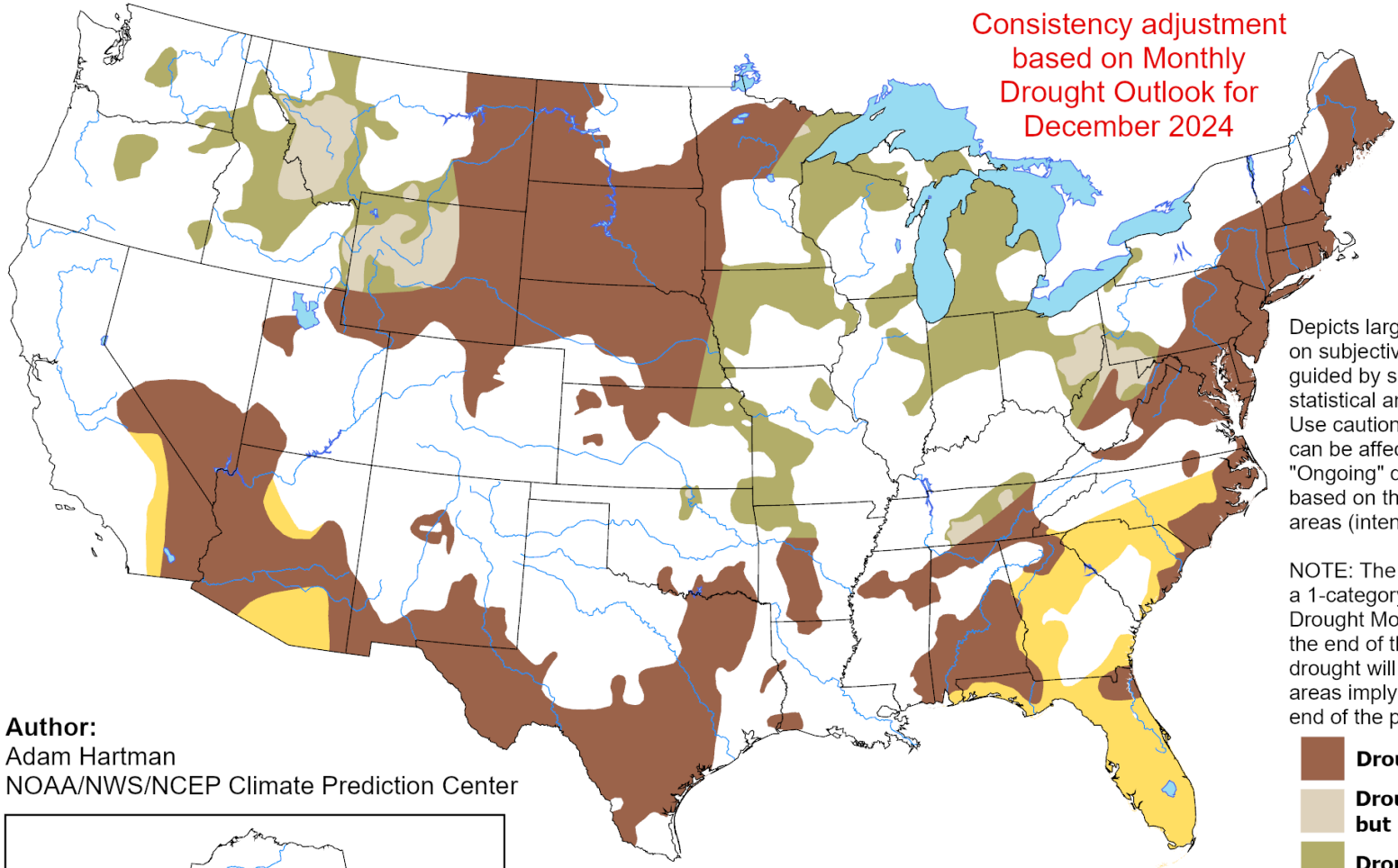
Valid: Dec-Jan-Feb 2024-25
Issued: November 21, 2024



U.S. Seasonal Drought Outlook

Drought Tendency During the Valid Period

Valid for December 1, 2024 - February 28, 2025
Released November 30, 2024

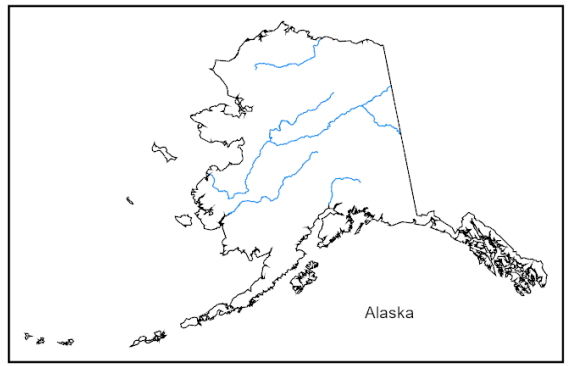


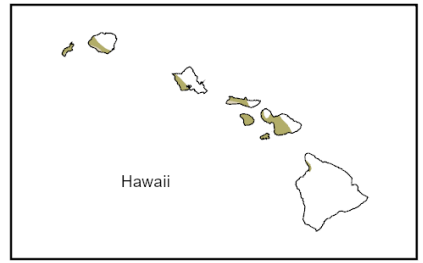
Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Use caution for applications that can be affected by short lived events. "Ongoing" drought areas are based on the U.S. Drought Monitor areas (intensities of D1 to D4).

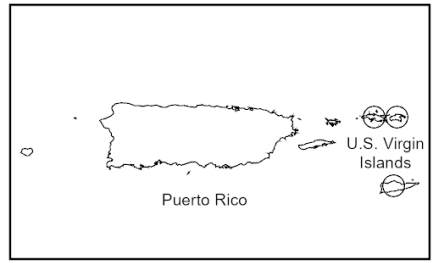
NOTE: The tan areas imply at least a 1-category improvement in the Drought Monitor intensity levels by the end of the period, although drought will remain. The green areas imply drought removal by the end of the period (D0 or none).

- **Drought persists**
- **Drought remains, but improves**
- **Drought removal likely**
- **Drought development likely**
- **No drought**

Author:
Adam Hartman
NOAA/NWS/NCEP Climate Prediction Center

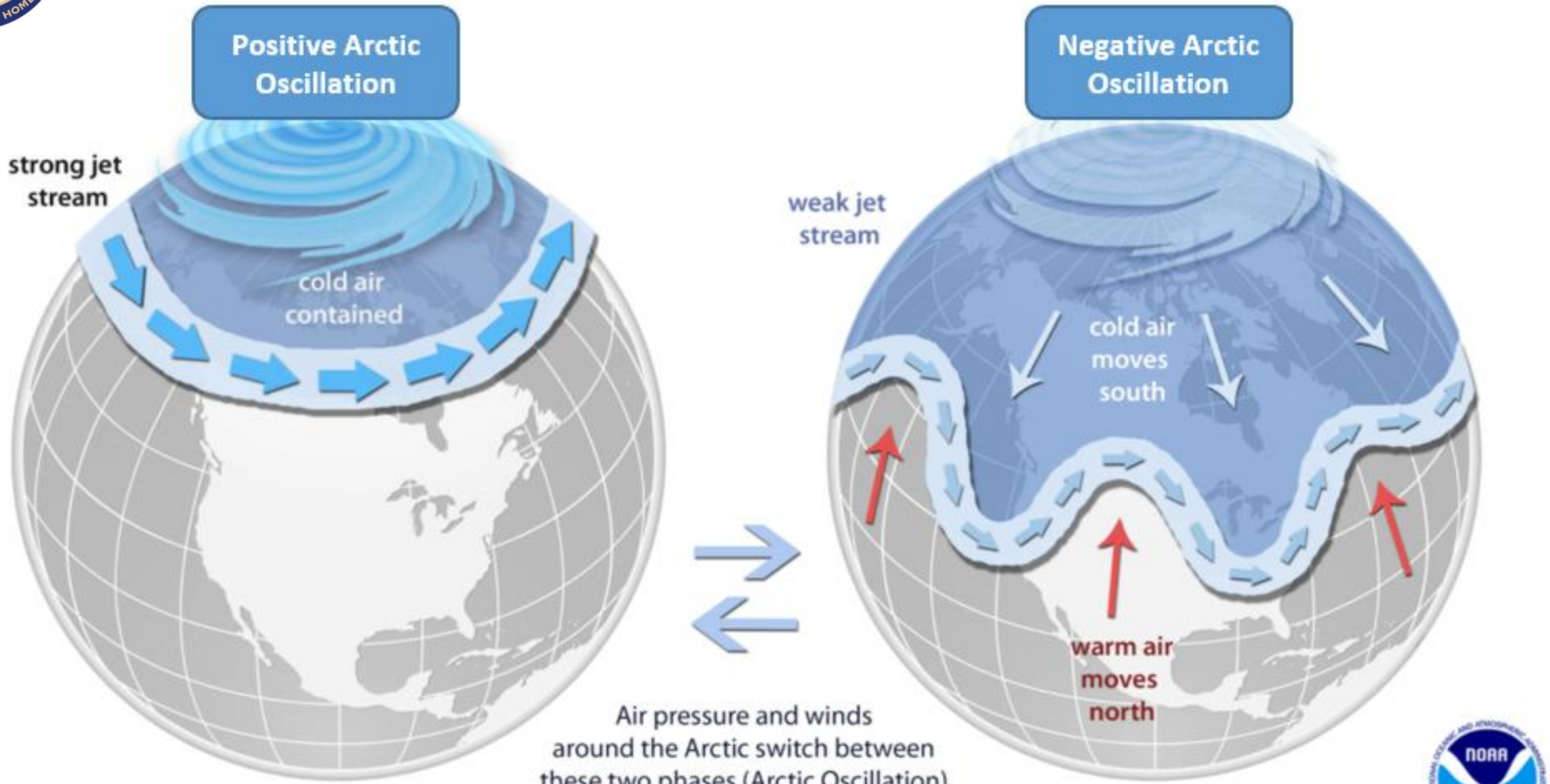






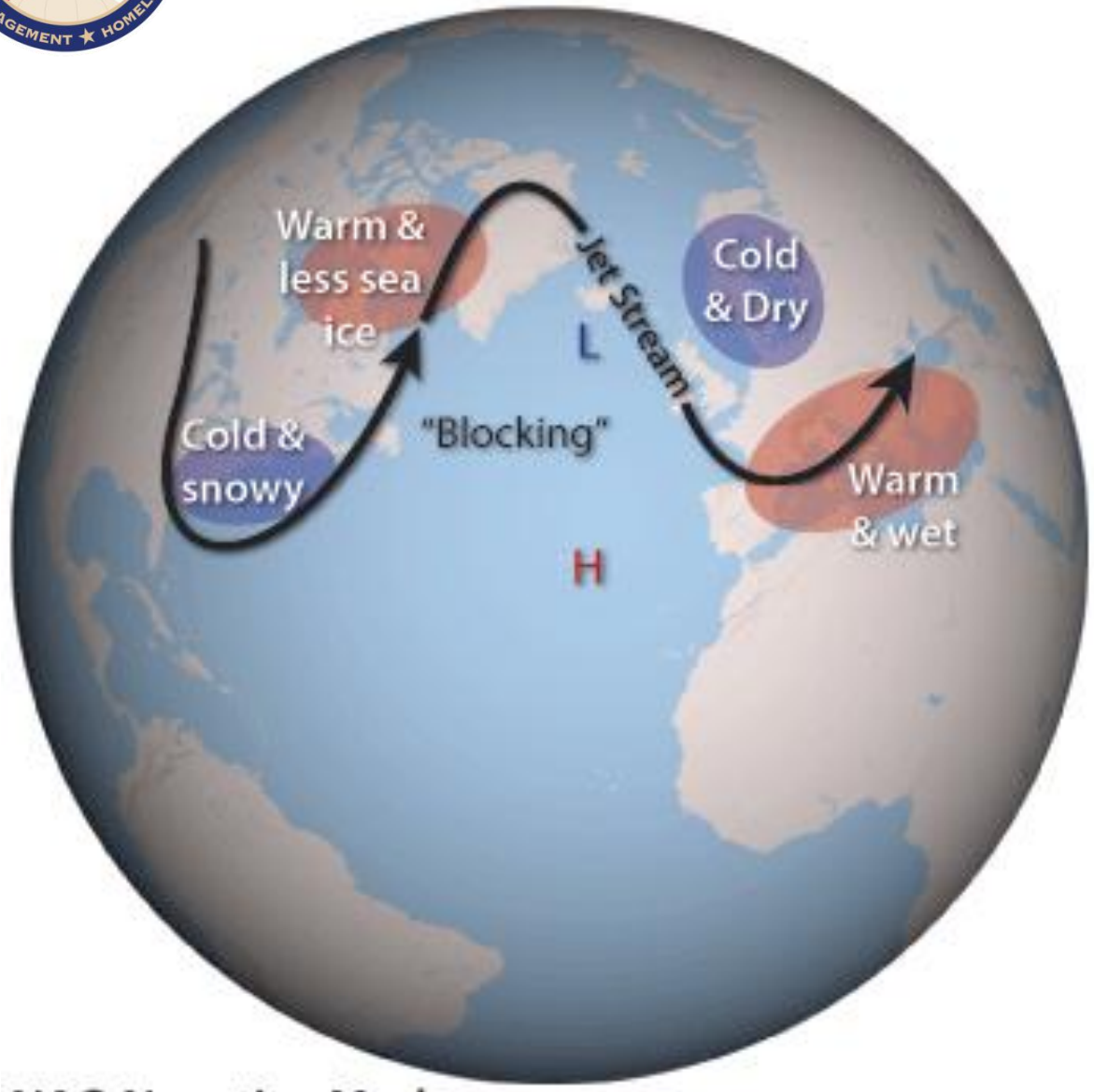
https://go.usa.gov/3eZ73

Arctic Oscillation

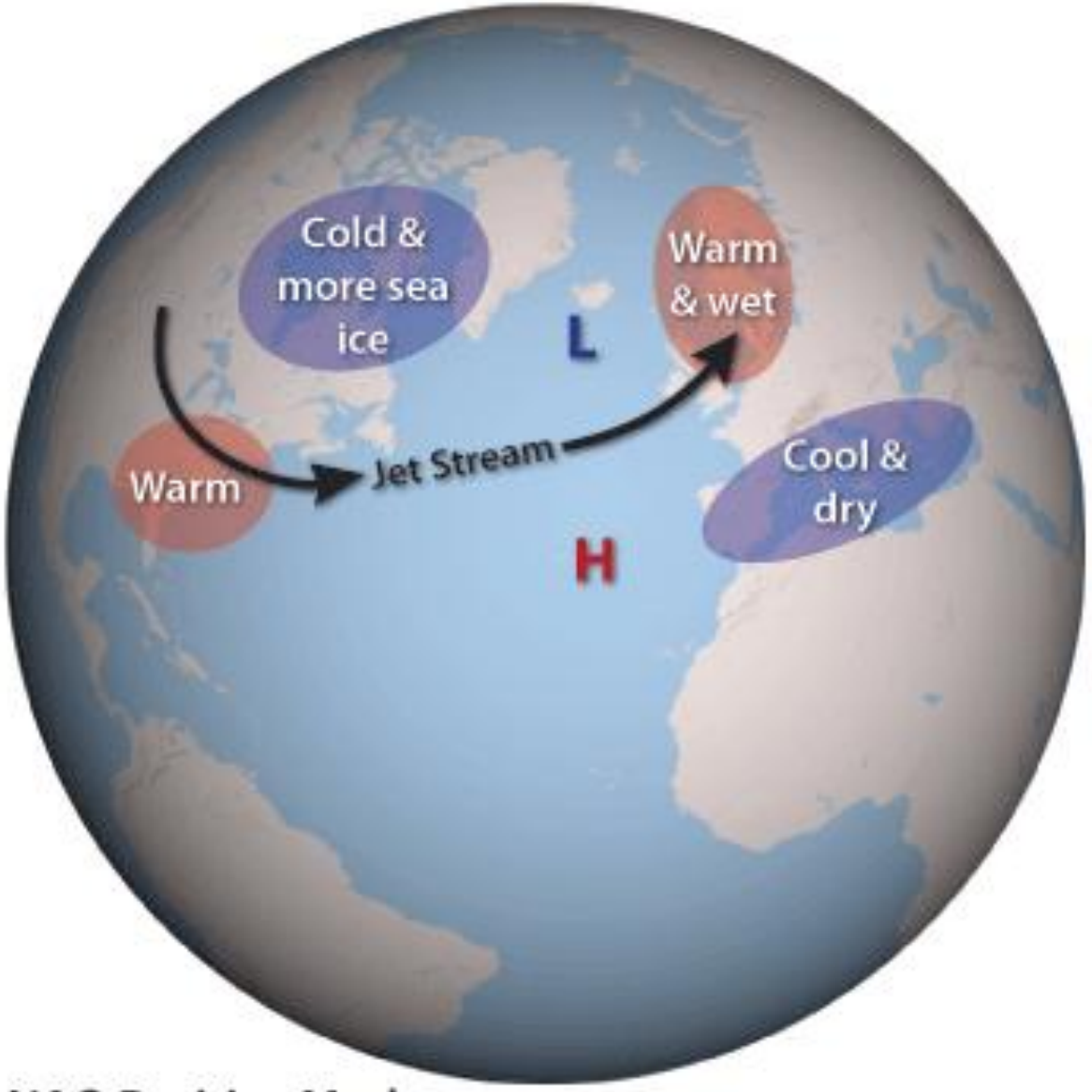


Air pressure and winds around the Arctic switch between these two phases (Arctic Oscillation) and contribute to winter weather patterns.

North Atlantic Oscillation

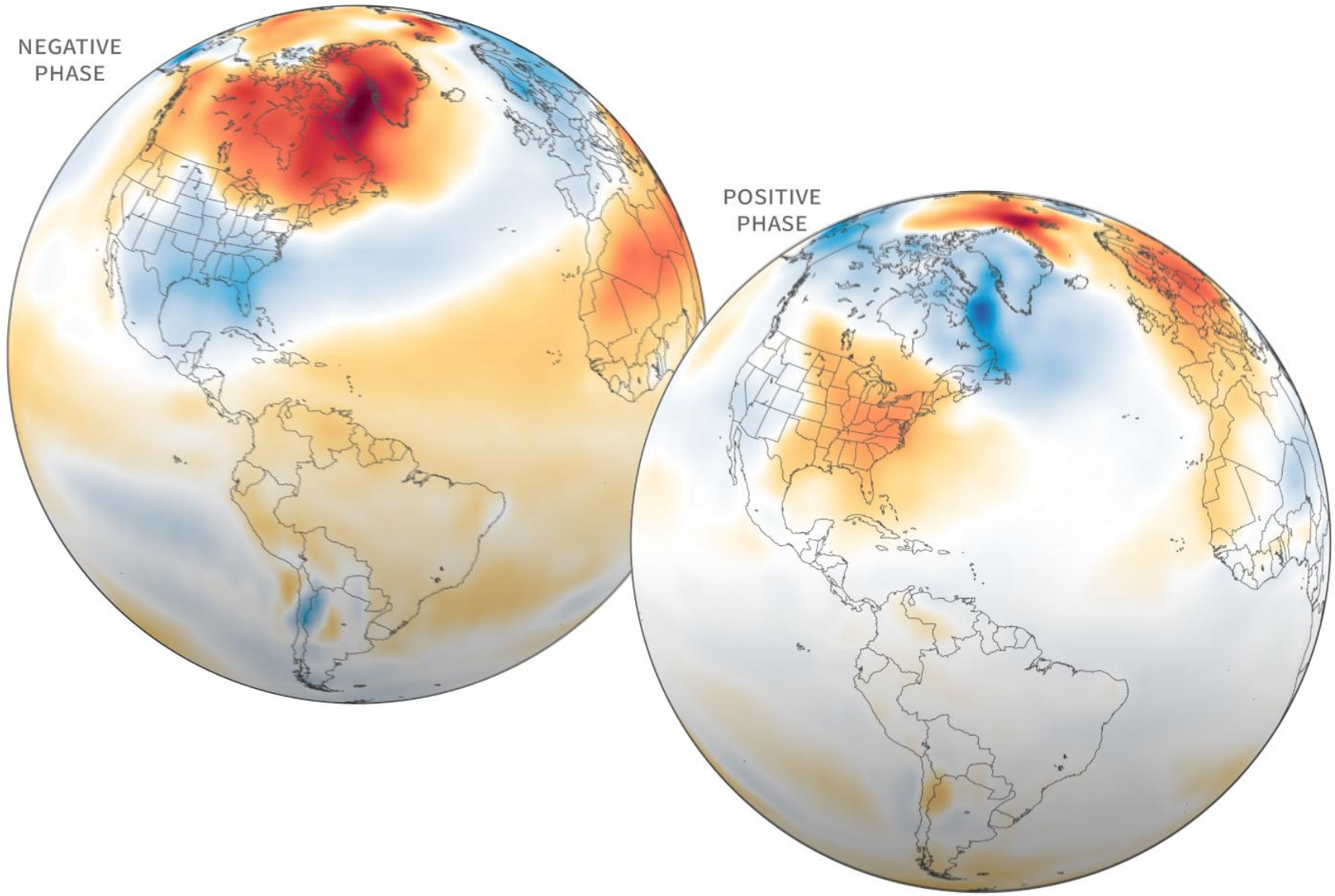


NAO Negative Mode



NAO Positive Mode

NAO TEMPERATURE PATTERNS

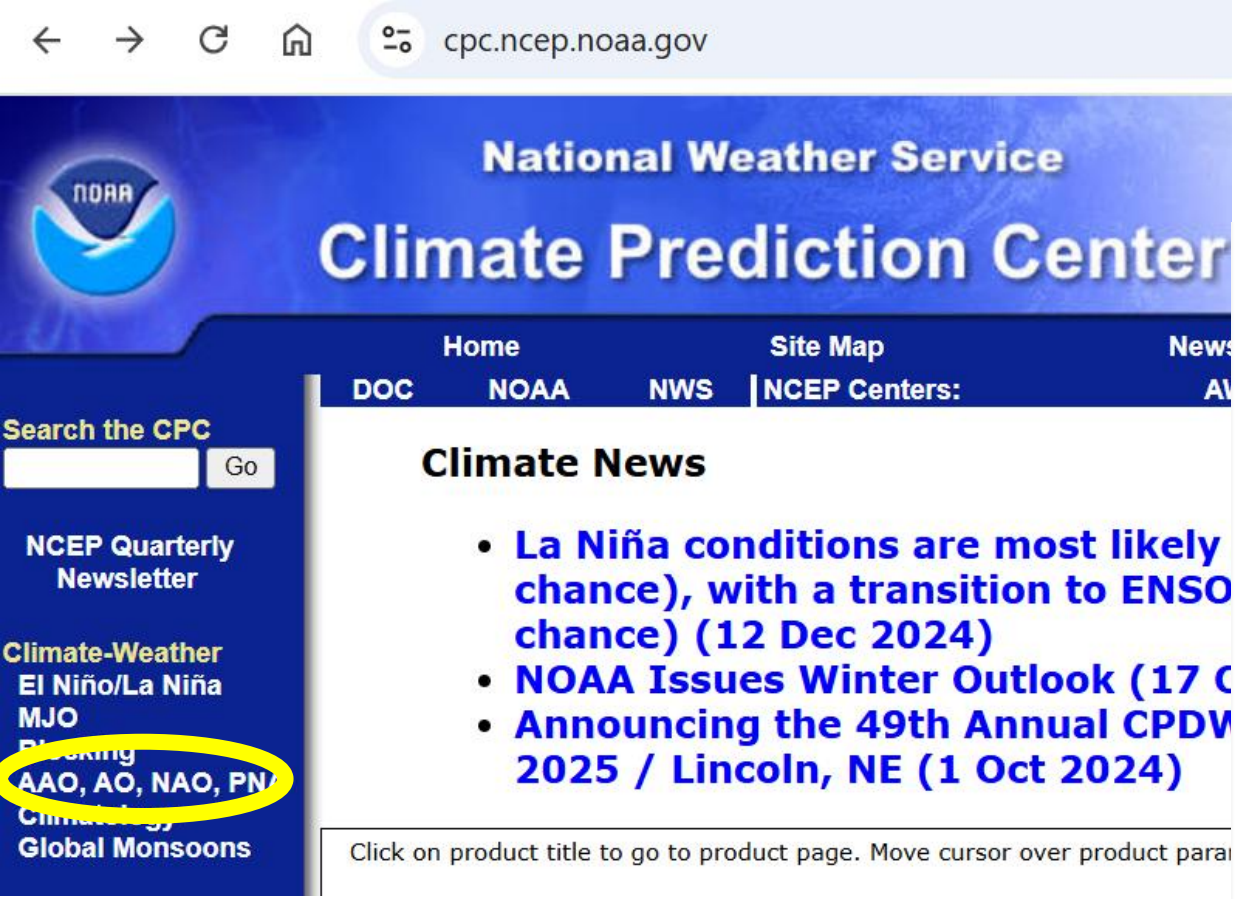


Jan-Mar 2010 (left)
Jan-Mar 1990 (right)

Difference from average temperature (°C)

-10 0 10

NOAA Climate.gov
Data: NCEP/NCAR



cpc.ncep.noaa.gov

AAO, AO, NAO, PNA

On February 16, 2023, several updates were made to the CPC Monthly Teleconnections products. The updates primarily include changes to filenames and formats. The graphics quality have also been improved. Learn more »

On March 3, 2022, several updates were made to the CPC Daily Teleconnections products. While the methodology used to calculate the teleconnection indices is unchanged, the statistics displayed in these graphics have changed slightly due to script updates and the utilization of the full ensemble size. Furthermore, filenames and formats have been updated and graphics quality has been improved. Learn more »

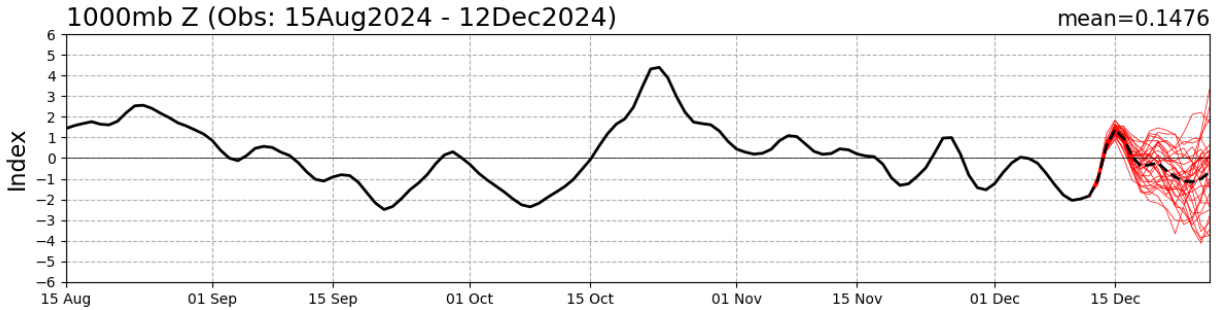
- AO (Arctic Oscillation)
- NAO (North Atlantic Oscillation)
- PNA (Pacific-North American Pattern)
- AAO (Antarctic Oscillation)

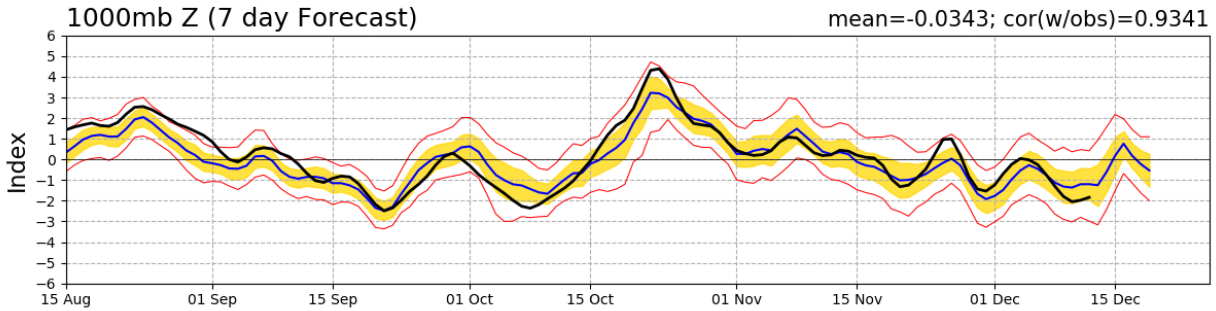
- Archive of Daily Indices
- Monthly Teleconnection Indices

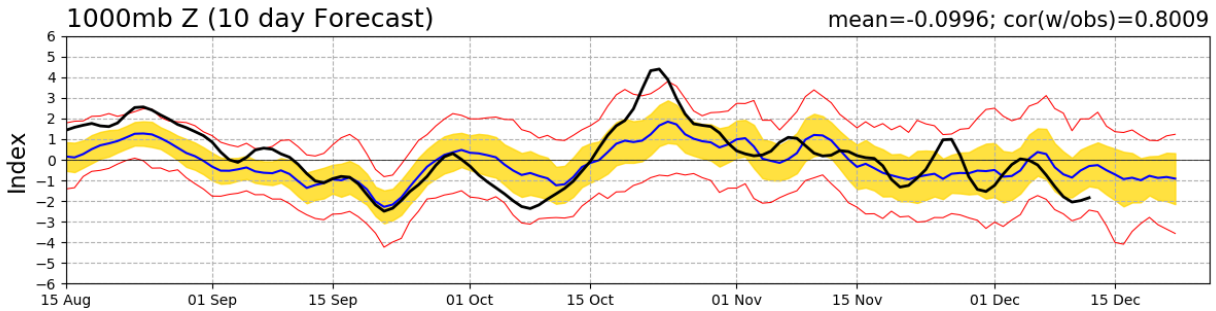
Click on product title to go to product page. Move cursor over product parameter nam display the gr -- click to enlarge. Links to these same products are also available below.

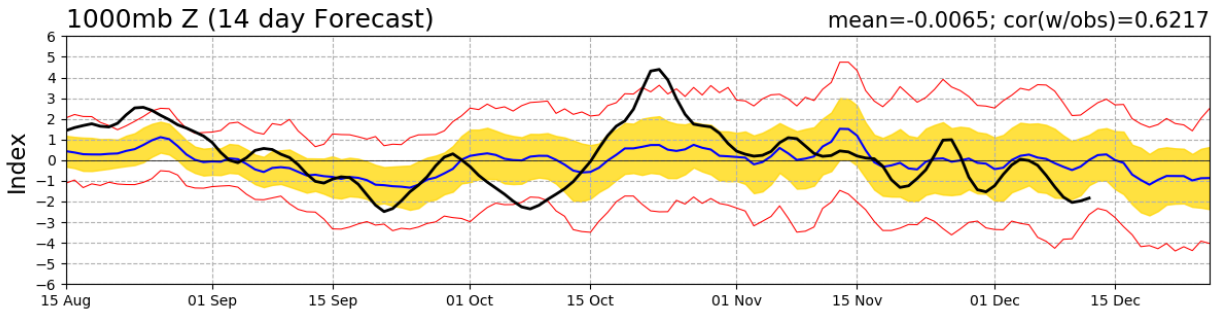
AAO		NAO	
GFS Outlooks	Ensemble Mean Outlooks	GFS Outlooks	Ensemble Mean Outlooks
PNA		AO	
GFS Outlooks	Ensemble Mean Outlooks	GFS Outlooks	Ensemble Mean Outlooks

AO Index: Observed & GEFS Forecasts

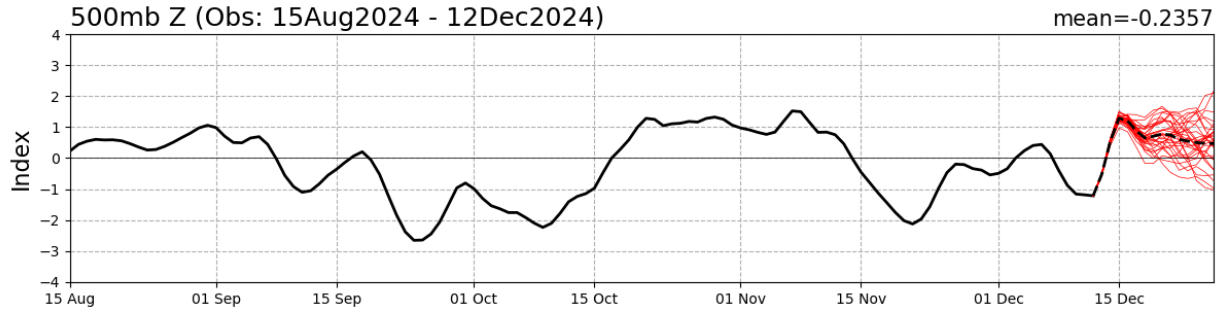


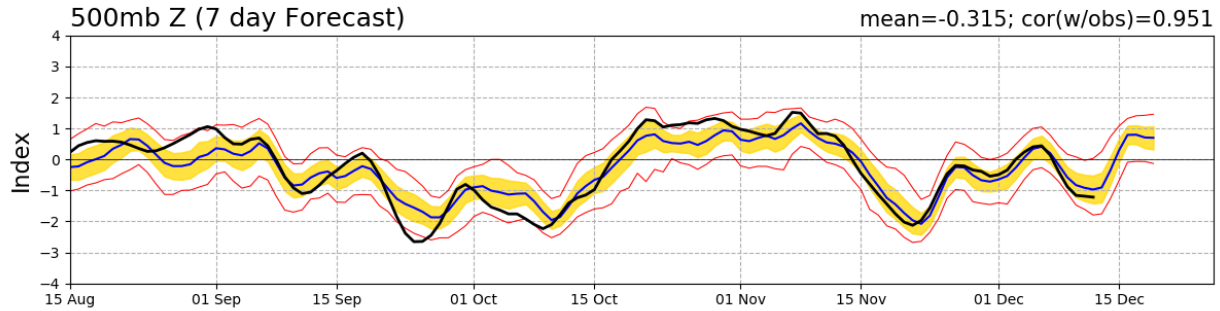


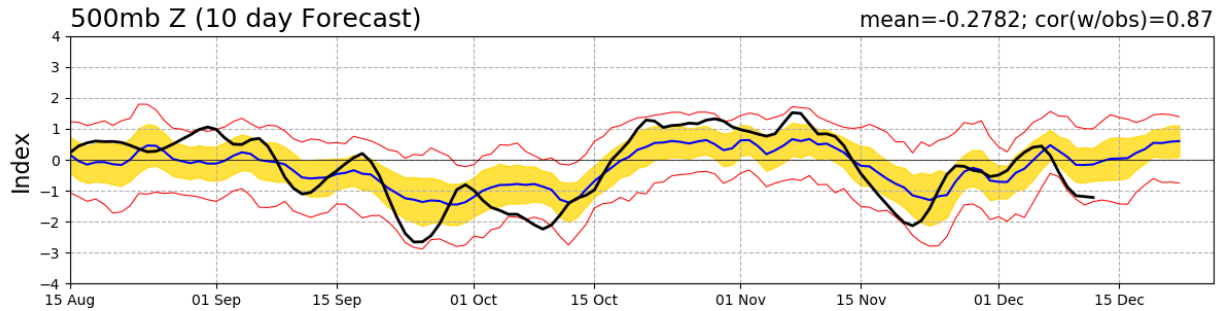


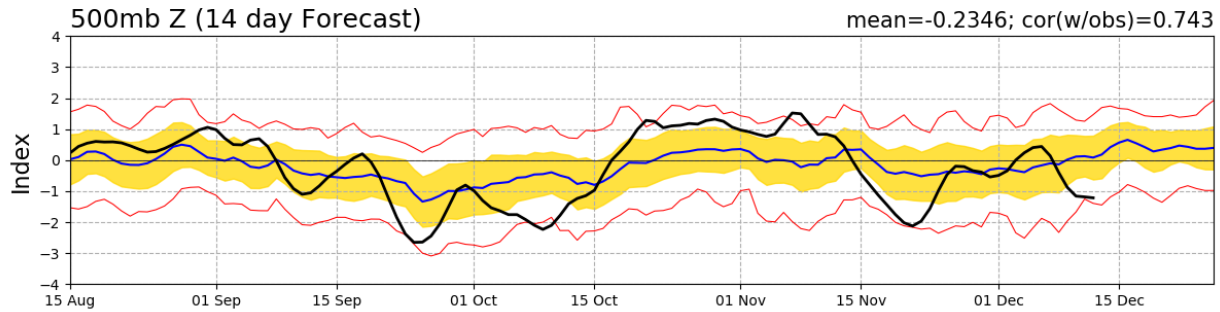


NAO Index: Observed & GEFS Forecasts









A final word of caution on weather models…

- “Live by the model, die by the model”
- Be extremely wary of model output more than 5 days out…
  - Use ensemble models (many runs producing a range of possible outcomes) more than 3 to 5 days out
  - Only use deterministic models (single solutions of single runs) within a few days to refine details

Questions?

U.S. Natural Gas Market Fundamentals and Outlook

Natural Gas Readiness Forum | December 16, 2024

Richard Meyer
Vice President, Energy Markets, Analysis, and Standards

AGA
American Gas Association

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State of Play

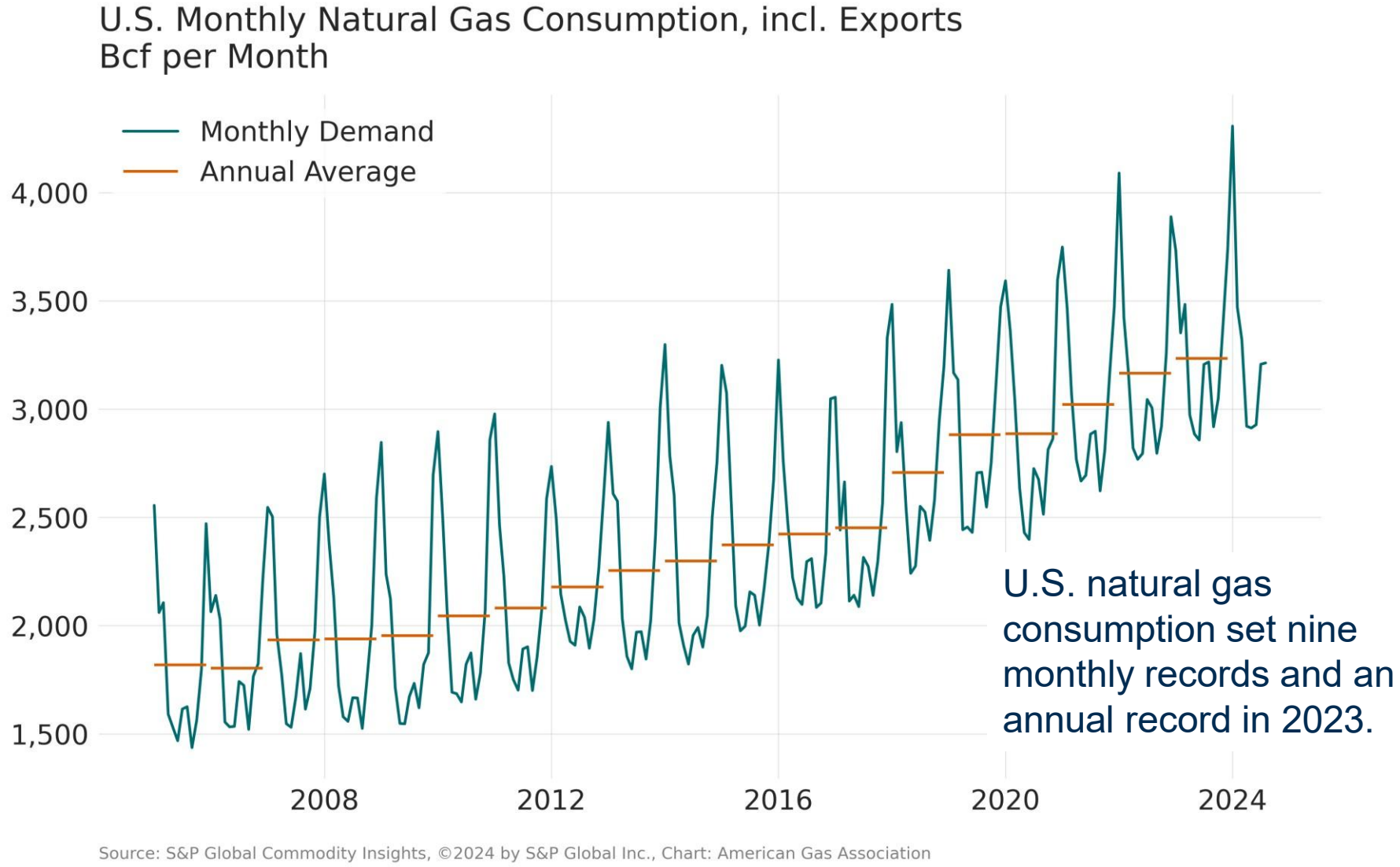
Growing Demand
Industrial reshoring, growing electric power requirements, and new consumers

Lower Prices
Return to historical natural gas pricing trends

Exports poised to climb
New LNG export terminals and infrastructure to serve them

Readiness
Gas industry planning and preparedness for the winter heating season

Average and peak demand growth continues to grow

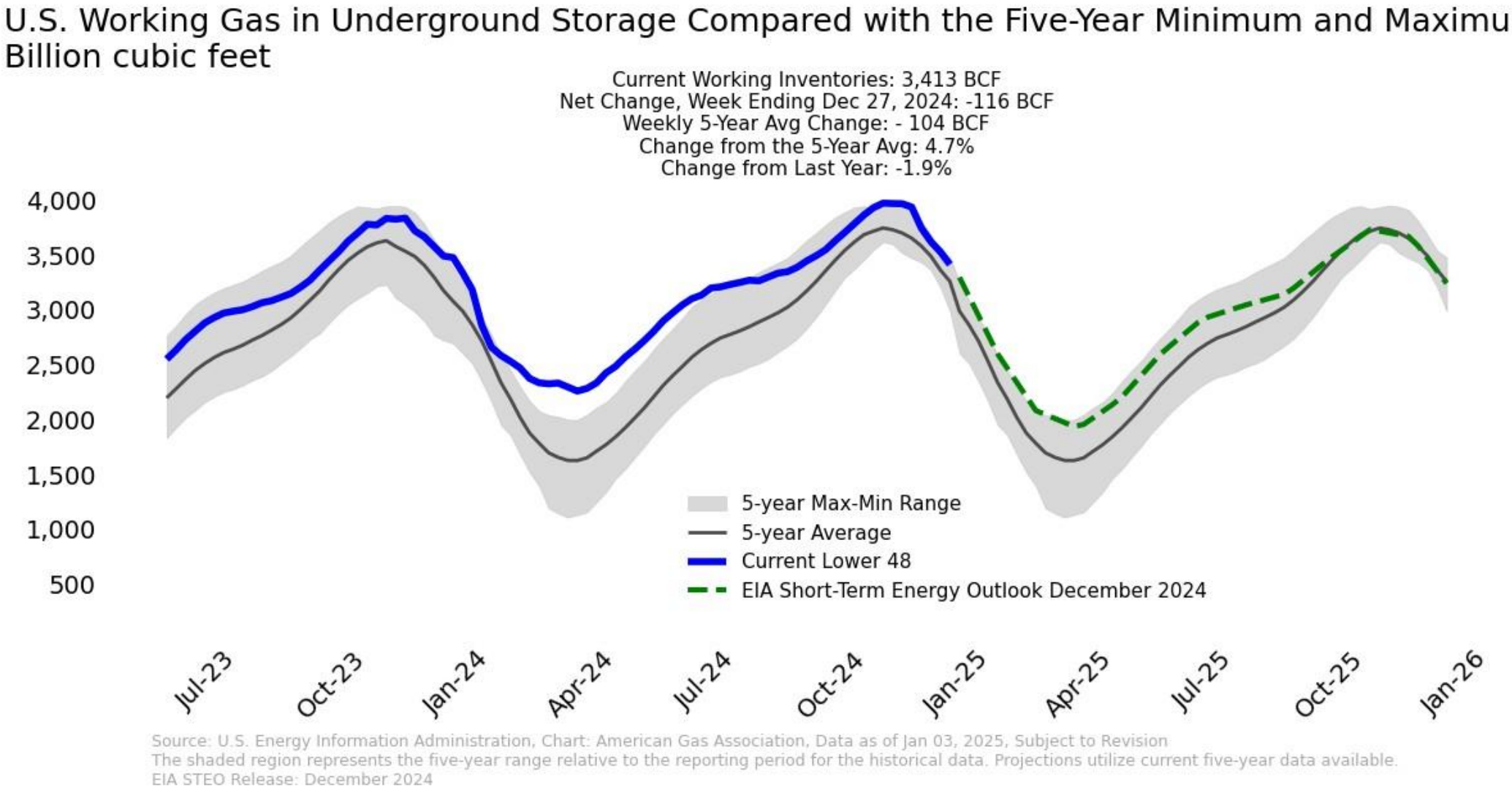


Source: S&P Global Commodity Insights

Chart: American Gas Association

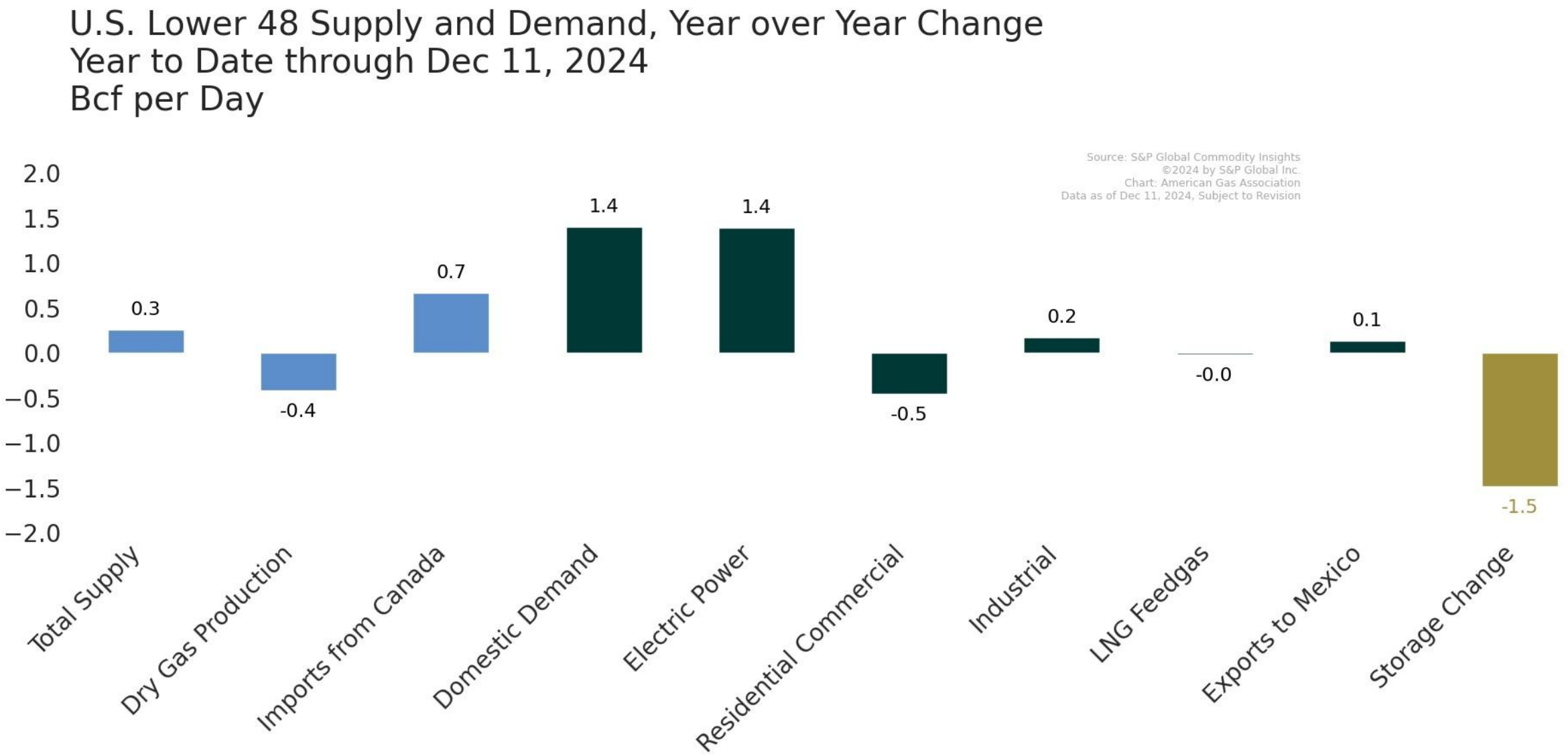
AGA American Gas Association

Storage inventories remain above the five-year average even as storage injections slowed this summer

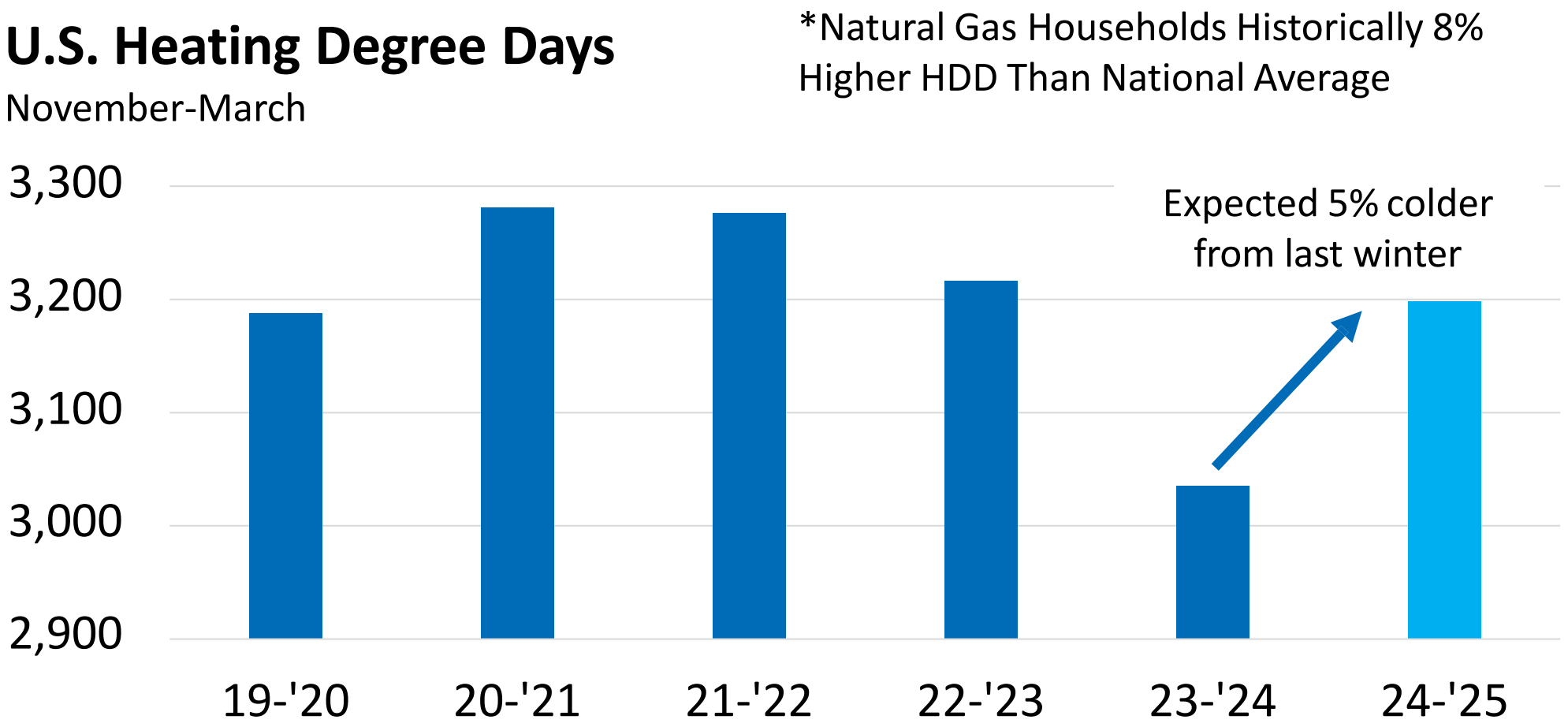


Source: U.S. Energy Information Administration | Chart Updated 1/3/2025

Natural gas demand is outpacing supply growth year to date given strong storage inventories and relatively low prices.



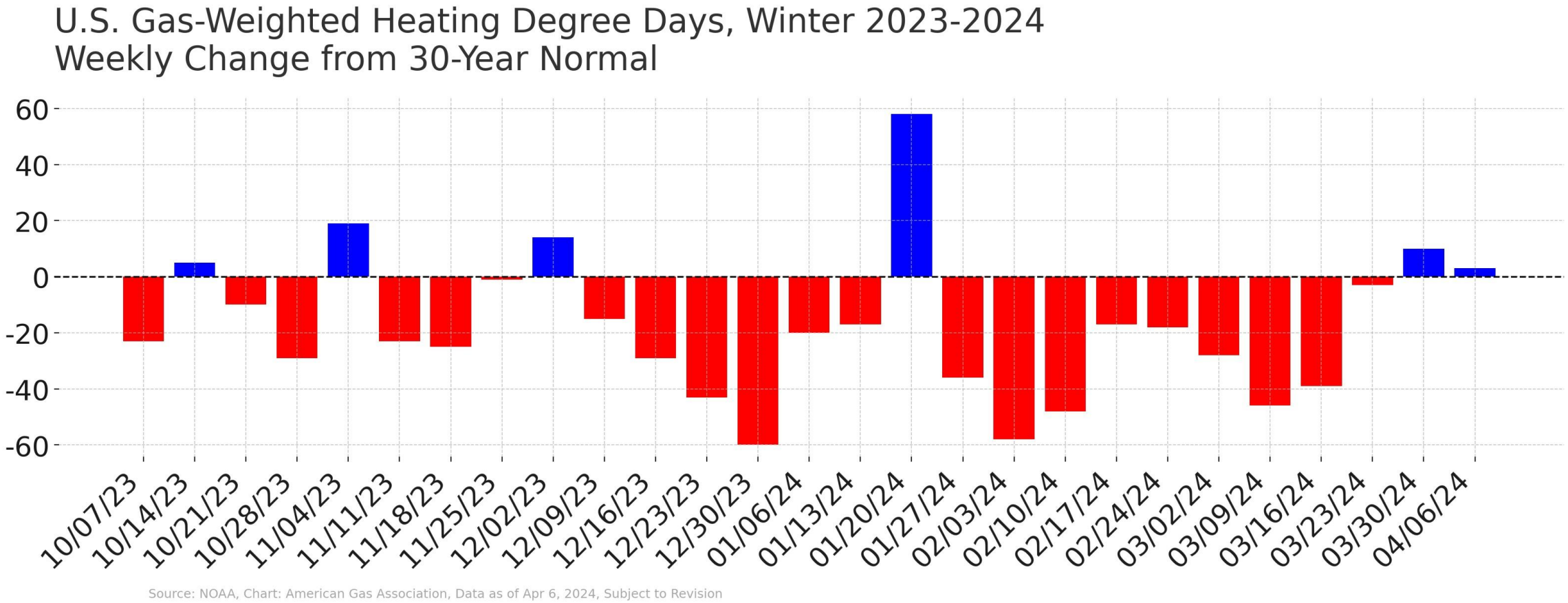
NOAA forecasted 2024-2025 winter temperatures expected to be 5% colder than last year



EIA Winter Fuels Outlook 2024-2025, Oct 8, 2024
**Based on NOAA Utility Weighted HDD Data versus Population WeightedAverages*

AGA American Gas Association

Last winter (2023-2024) was generally warmer than normal with short-term cold events.



The regional degree day statistics are weighted by gas home heating customers instead of by population.
A heating degree day measures the coldness of the weather, based on the extent to which the daily mean temperature falls below 65 degrees Fahrenheit. A daily mean temperature represents the sum of the high and low readings divided by two.
Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration

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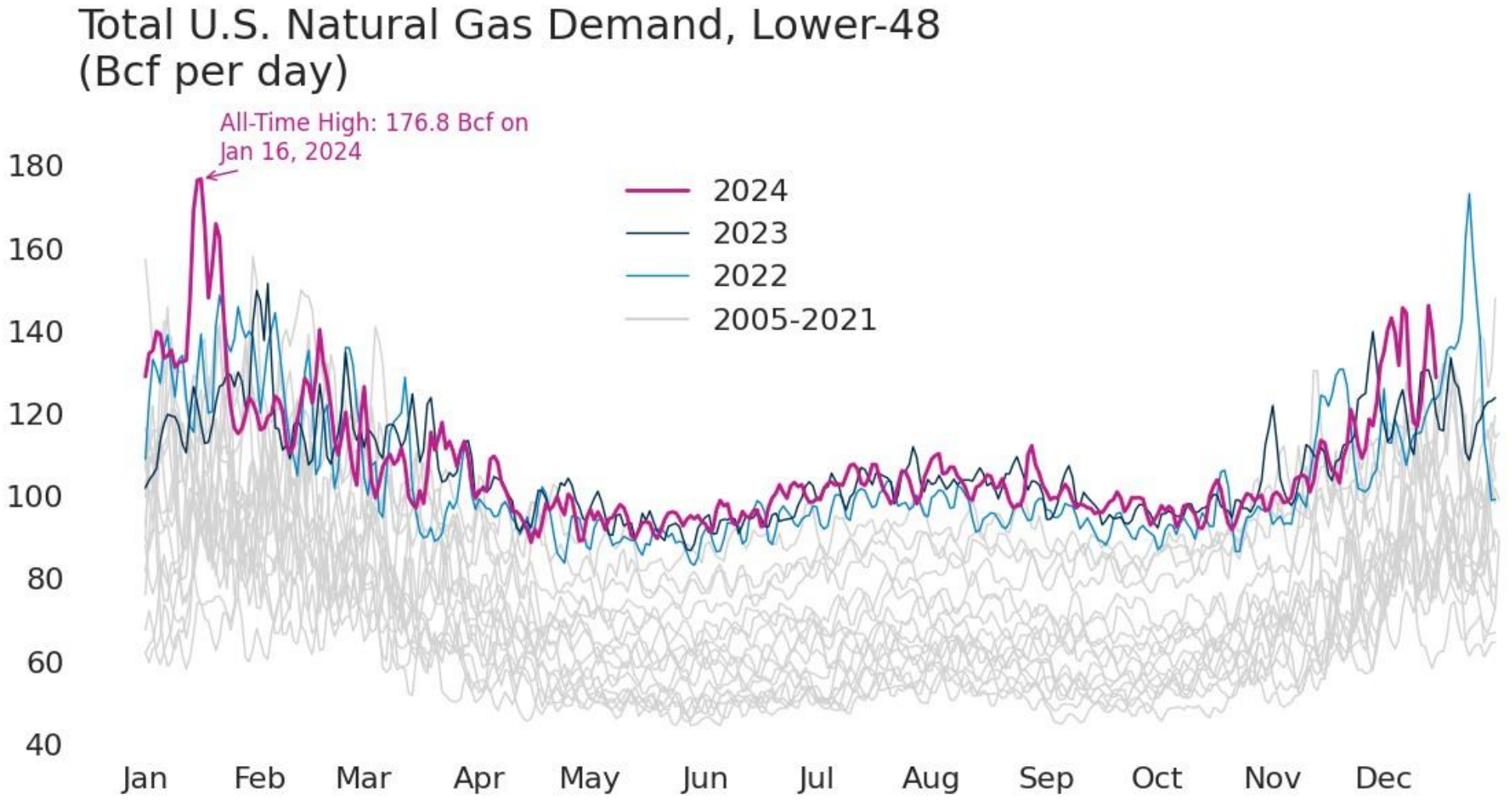
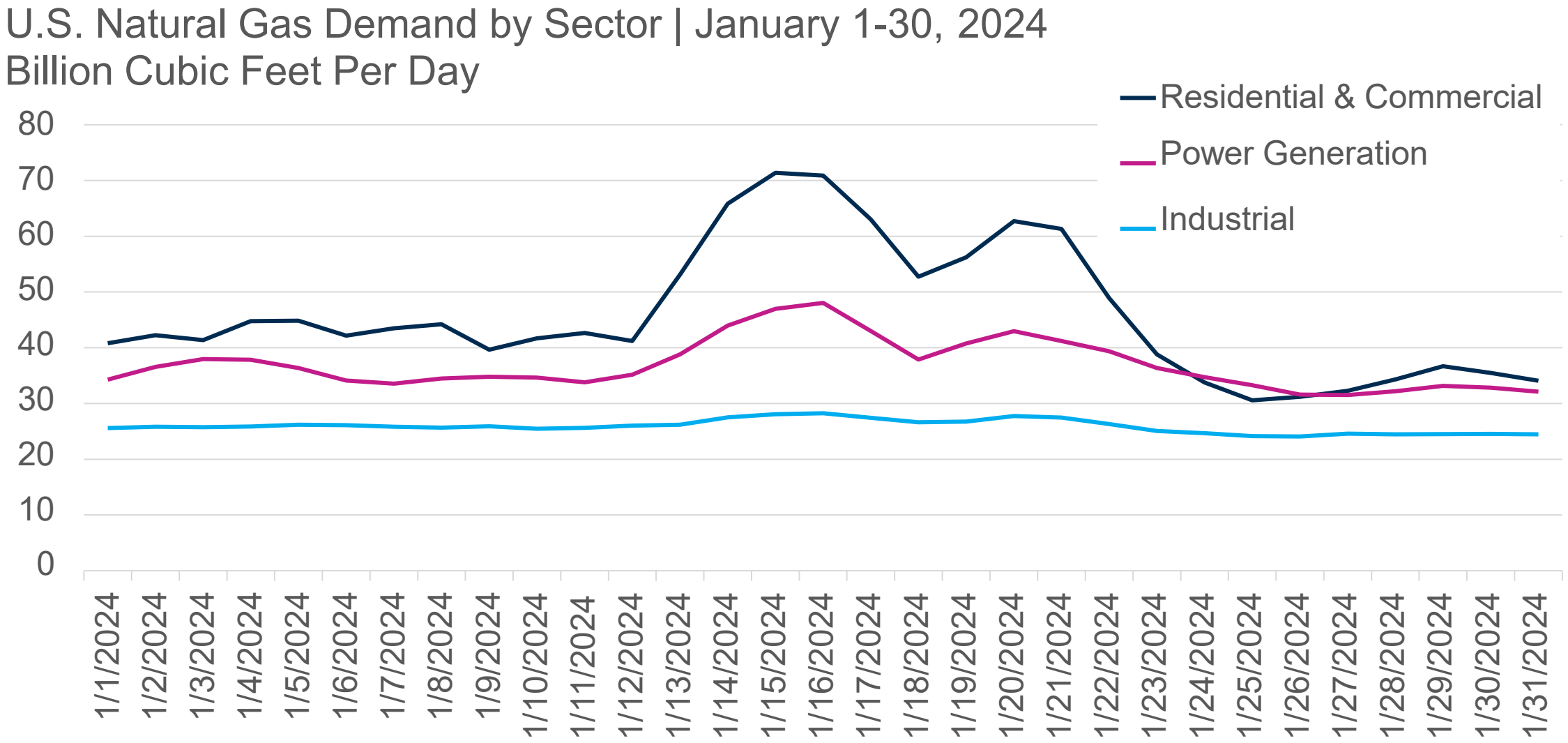
American Gas Association

U.S. natural gas demand set a new daily record during Winter Storm Heather (Jan 2024)



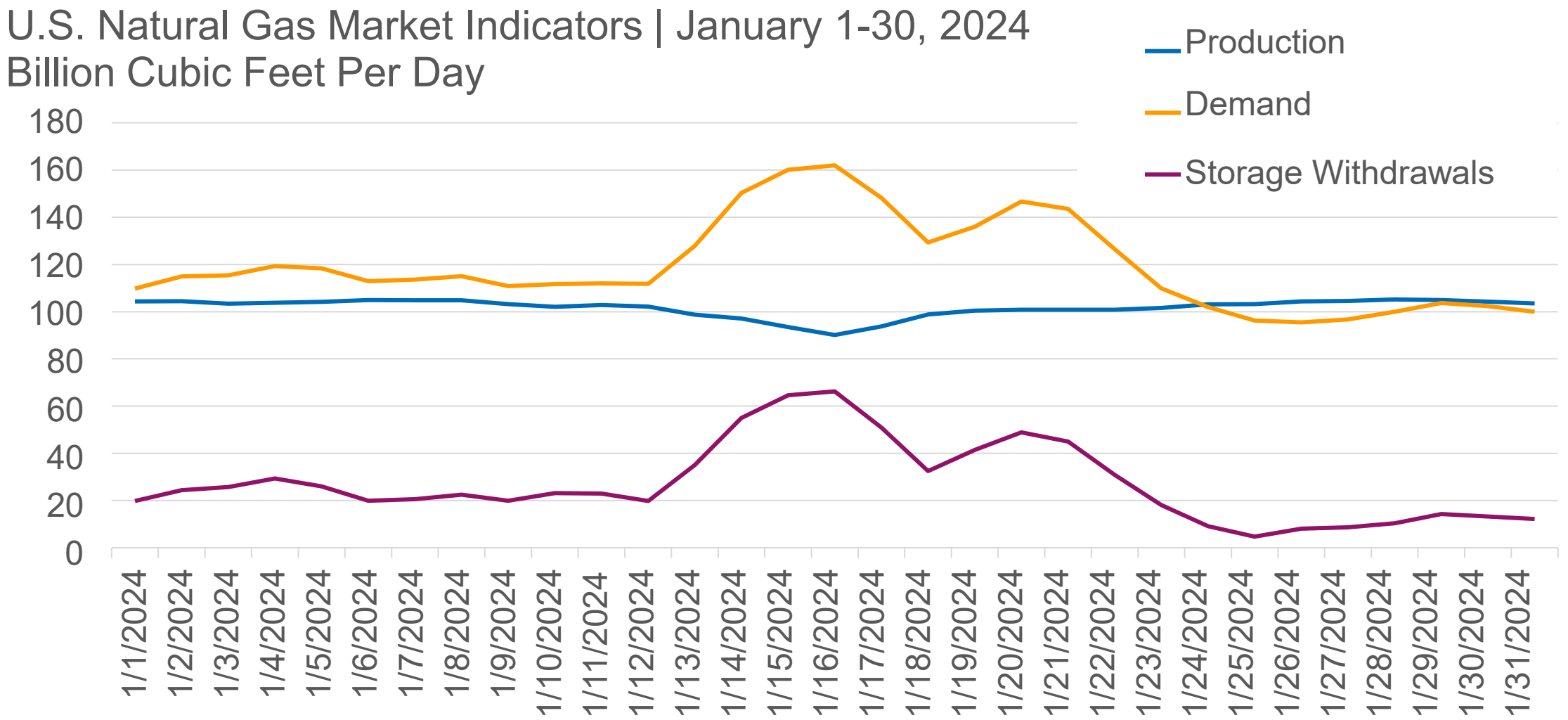
Source: S&P Global Commodity Insights, ©2024 by S&P Global Inc., Chart: American Gas Association, Data as of Dec 14, 2024, Subject to Revision

Domestic sector demand increases during Winter Storm Heather (Jan 2024)



Source: S&P Global Commodity Insights, ©2024 by S&P Global Inc., Chart: American Gas Association

Market flexibility during peak events



Source: S&P Global Commodity Insights, ©2024 by S&P Global Inc., Chart: American Gas Association

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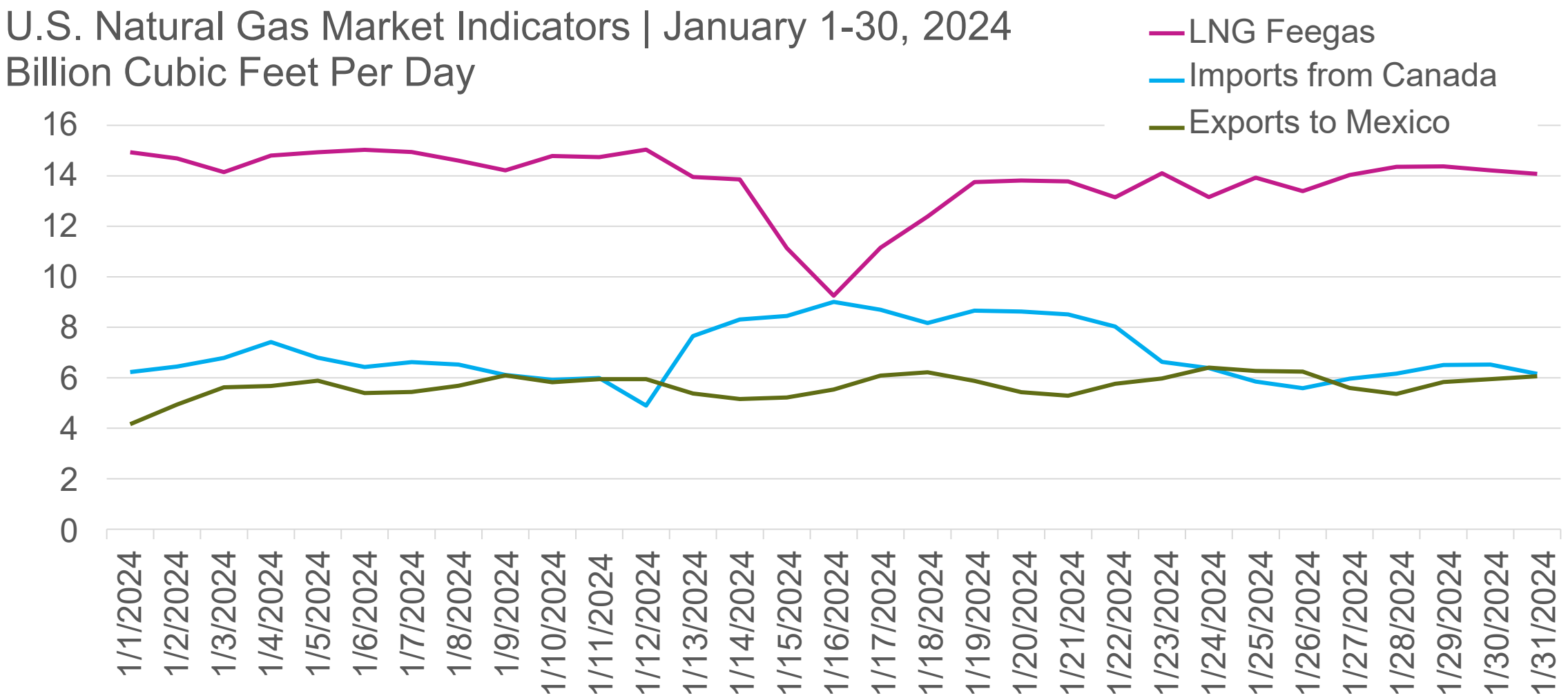
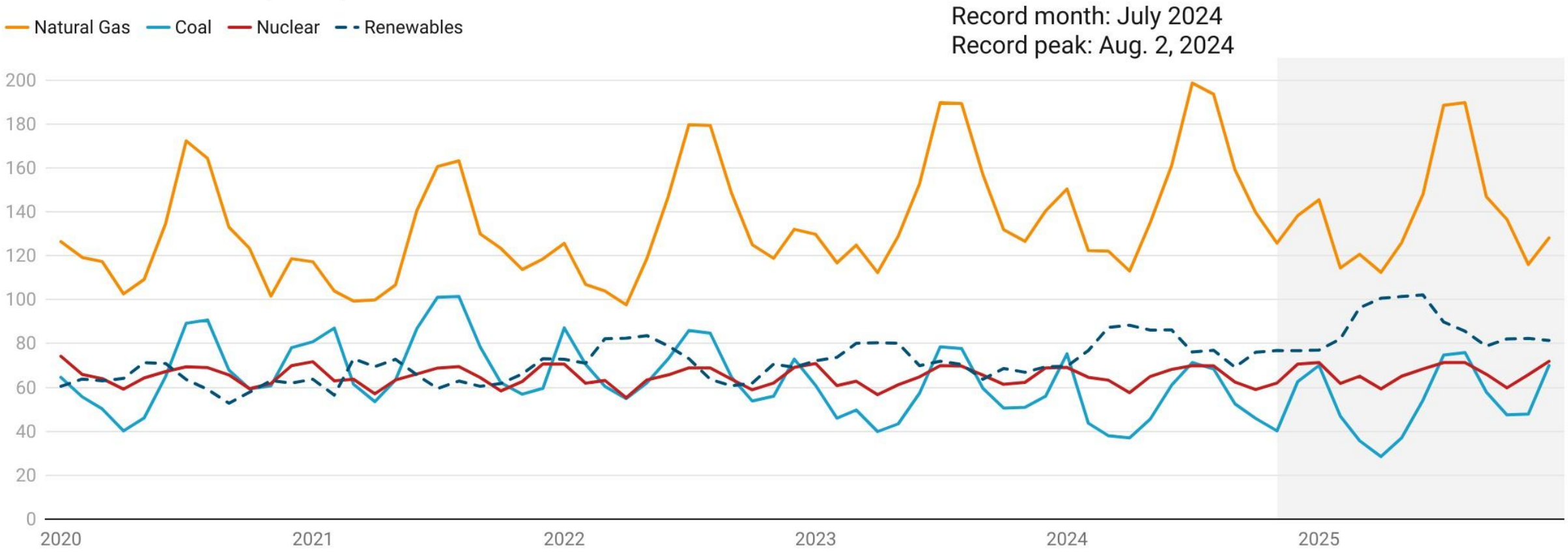


Source: S&P Global Commodity Insights, ©2024 by S&P Global Inc., Chart: American Gas Association

Natural Gas remains the leading fuel source for electricity generation

Monthly U.S. Electricity Generation by Top Energy Sources

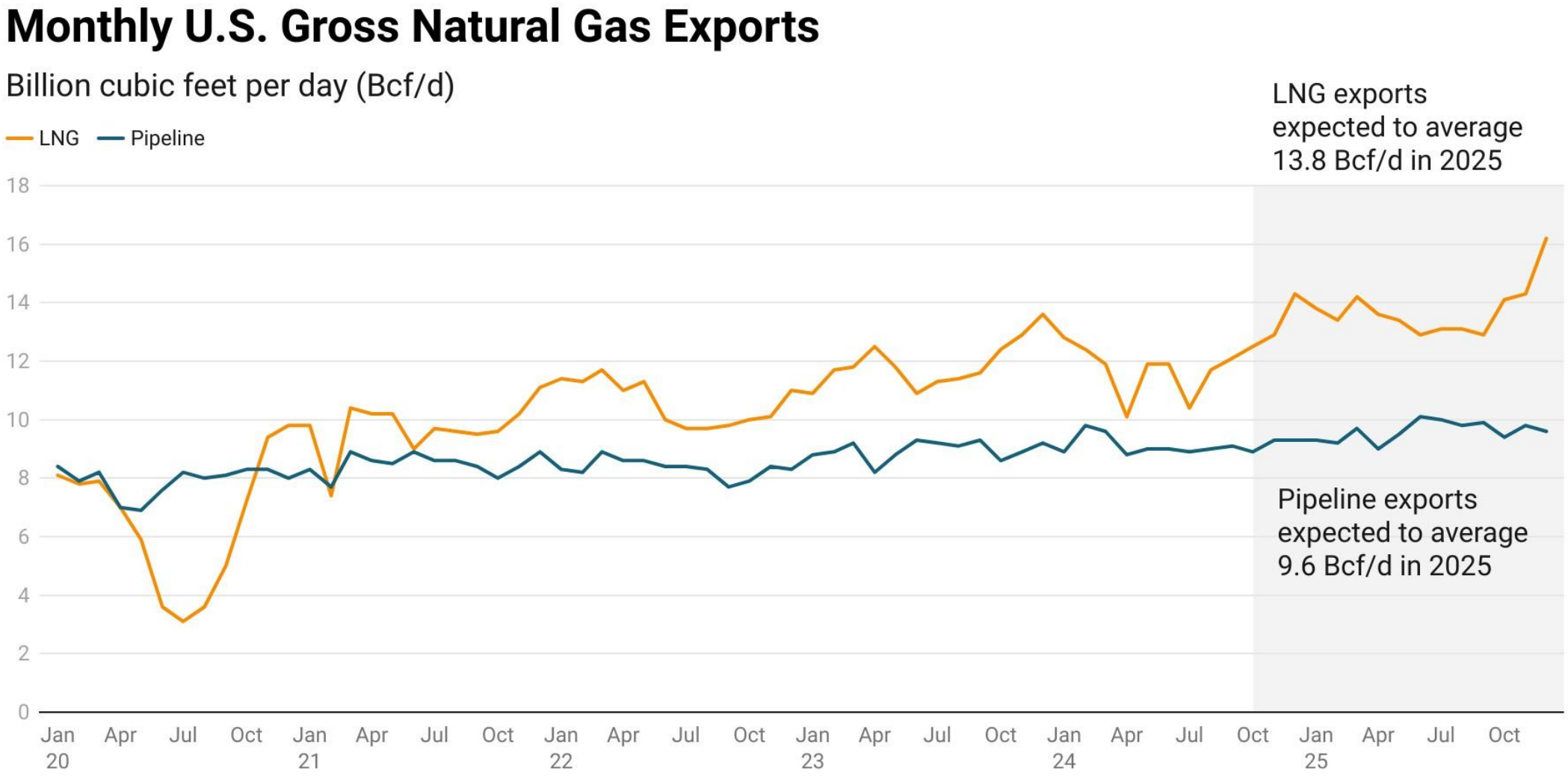
Billion kilowatthours (BkWh)



Subject to revision

Chart: American Gas Association • Source: EIA November 2024 Short-Term Energy Outlook • Created with Datawrapper

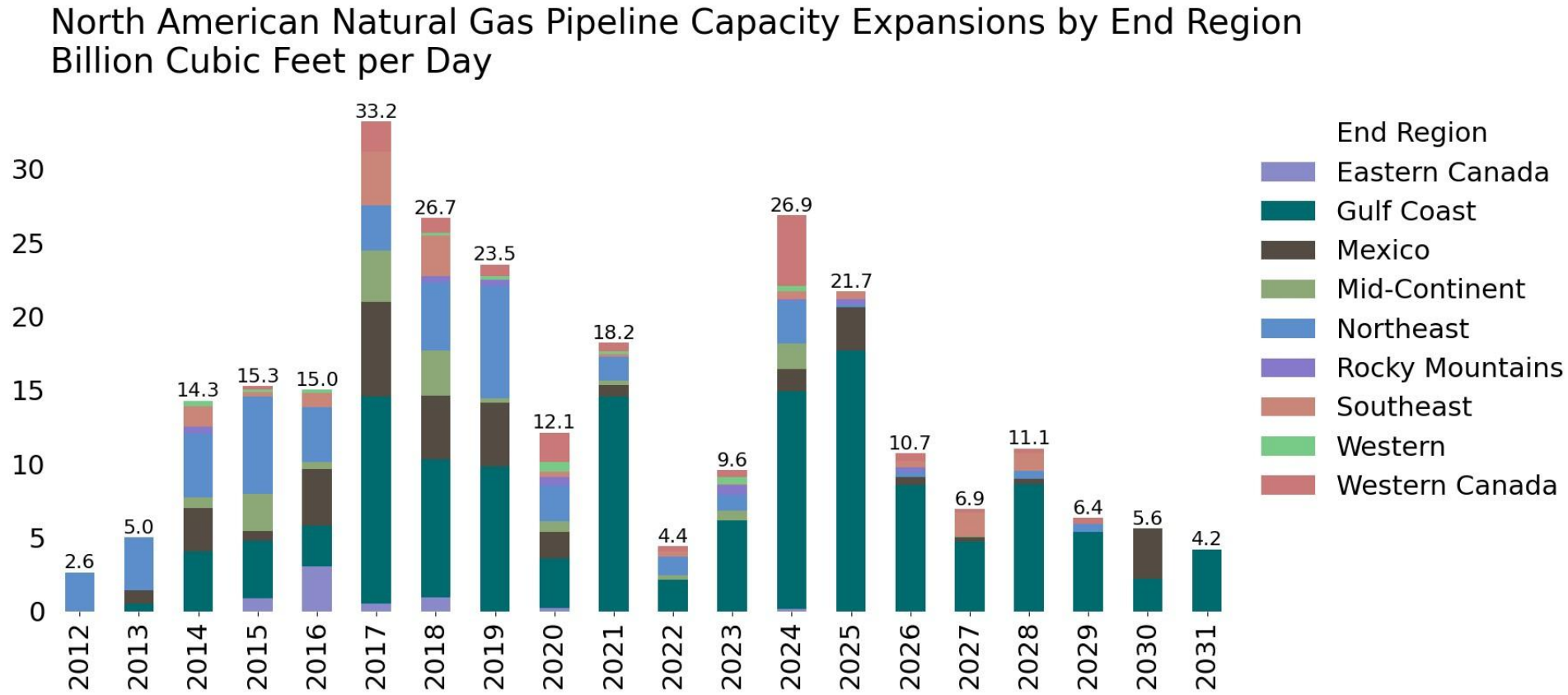
LNG export demand expected to grow as new facilities come online



Subject to revision

Chart: American Gas Association • Source: EIA November 2024 Short-Term Energy Outlook • Created with Datawrapper

New pipeline projects under construction or planned will support growing demand

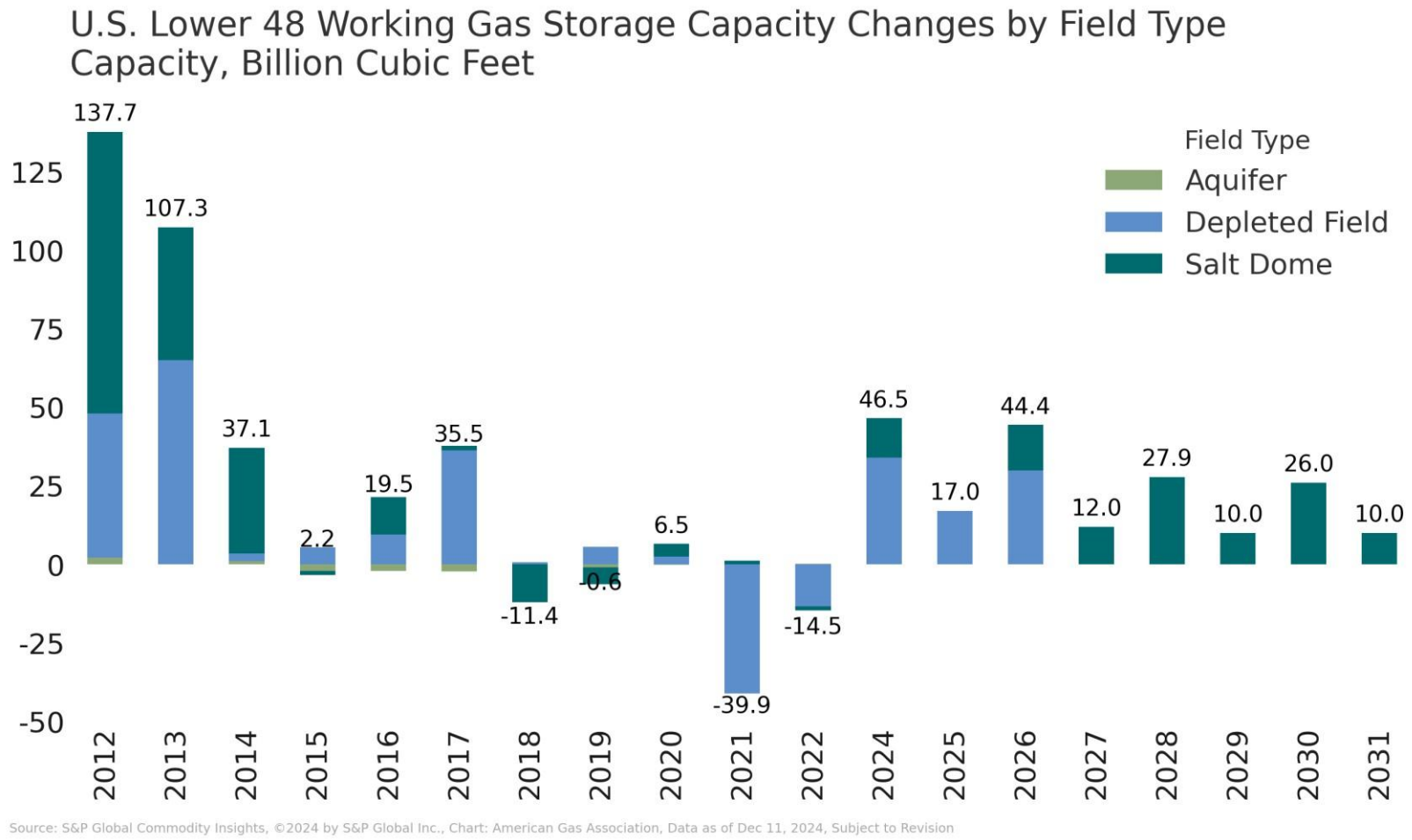


Source: S&P Global Commodity Insights, ©2024 by S&P Global Inc., Chart: American Gas Association

Projects shown in 2025 and beyond include pipelines under construction, announced, filed a regulatory application or received approval, or undergoing an open season.

AGA American Gas Association

New pipeline projects under construction or planned will support an evolving market



Source: S&P Global Commodity Insights, ©2024 by S&P Global Inc., Chart: American Gas Association, Data as of Dec 11, 2024, Subject to Revision

Projects shown in 2025 and beyond include pipelines under construction, announced, filed a regulatory application or received approval, or undergoing an open season.

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Demand growth is expected to exceed supply in 2024 & 2025

Natural Gas Balances (Bcf per Day)

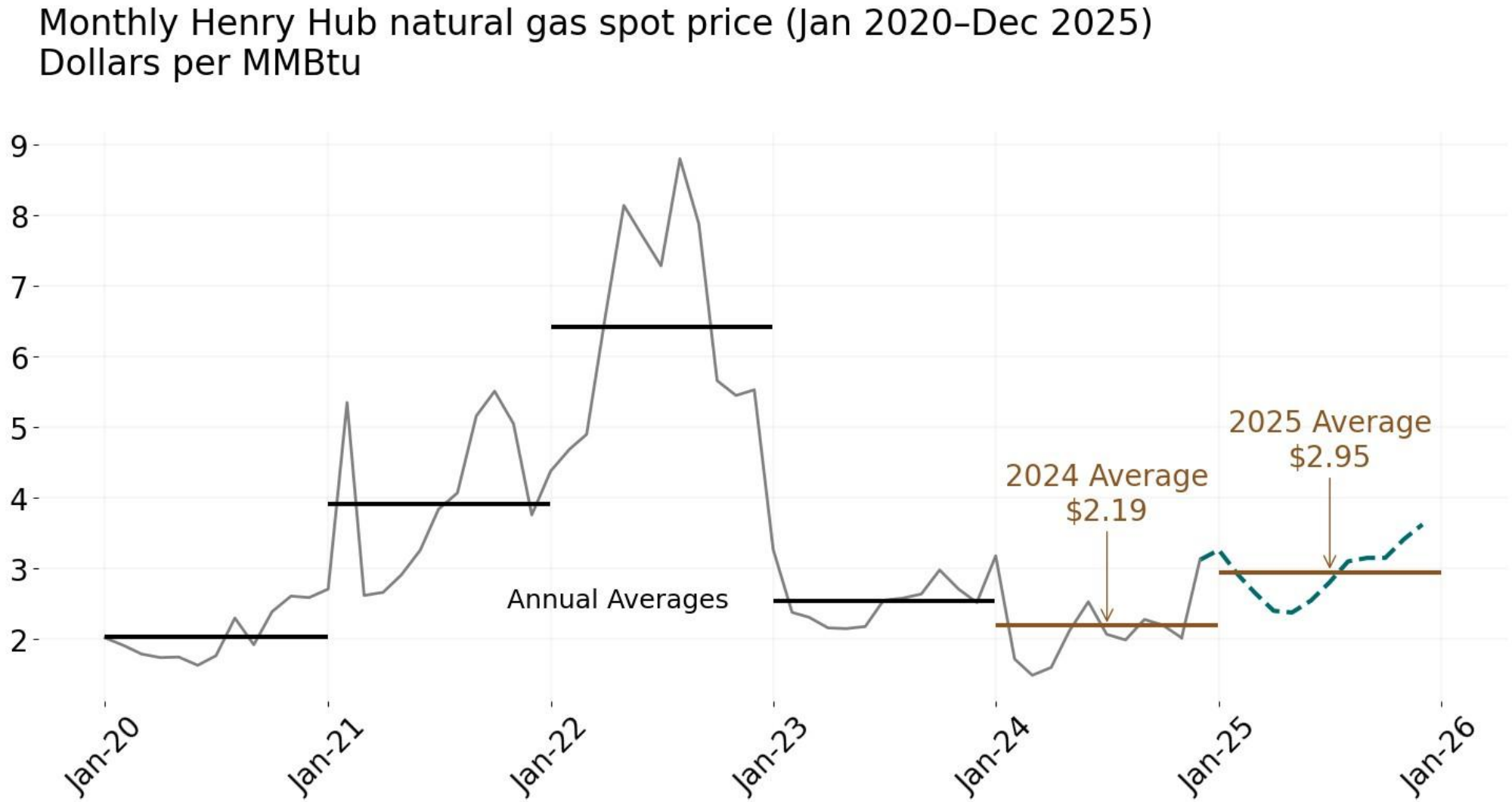
	2022	2023	Forecast 2024	Forecast 2025
Dry Gas Production	99.6	103.8	103.2	103.7
LNG Net Exports	10.5	11.9	11.9	13.6
Pipeline Net Exports	0.1	0.9	0.9	1.7
Total Consumption	88.5	89.1	90.5	90.2
Dec. Working Gas Inventories (Bcf)	2,925	3,457	3,371	3,160
Net Inventory Change	**-0.8**	**1.5**	**-0.2**	**-0.6**

Short-Term Energy Outlook, Energy Information Administration

December 2024

AGA American Gas Association

Average Henry Hub spot prices expected to soften in 2024, projected to increase 34% in 2025

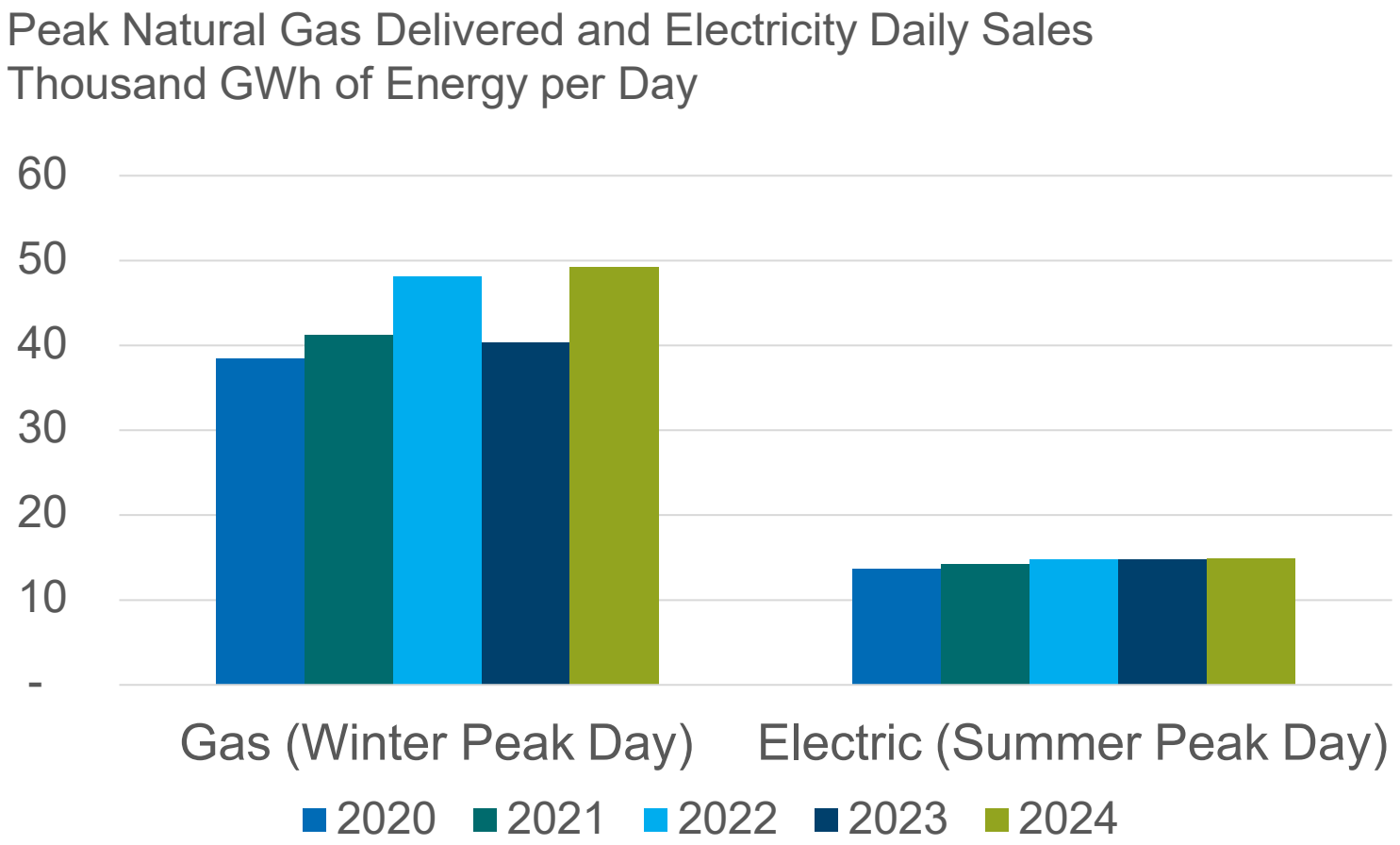


Data: U.S. Energy Information Administration, Short-Term Energy Outlook, December 2024, Chart: American Gas Association

Gas Utility Planning and Readiness

AGA
American Gas Association

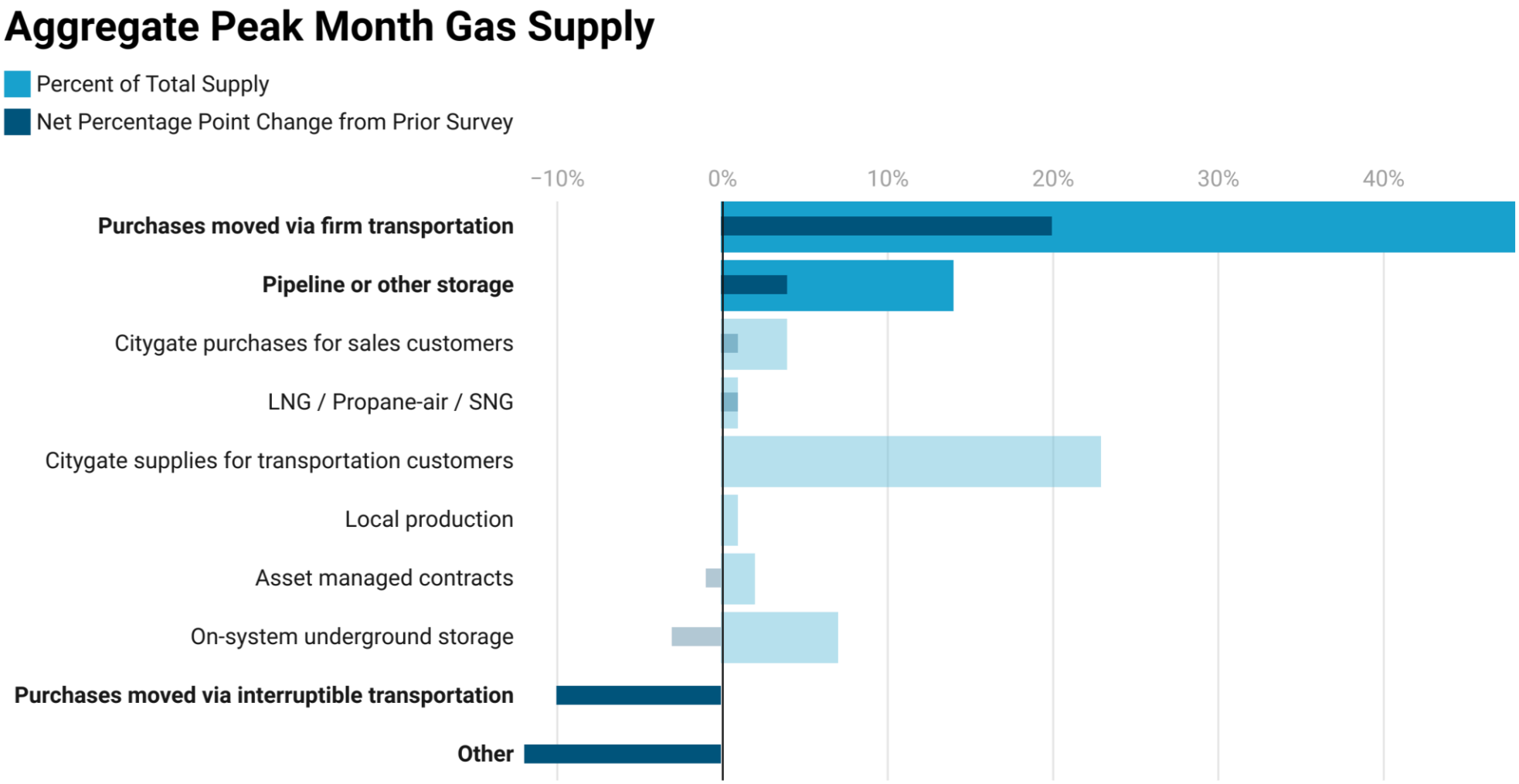
The natural gas system delivered 3.3 times as much domestic energy last winter compared with the electric grid during peak conditions.



*Natural gas volumes delivered for all end-use consumers were converted from MMBtu to GWhfor comparison only and do not reflect natural gas use in generation.

American Gas Association

Local gas utilities build and manage a portfolio of supply, storage, and transportation services to meet requirements



AGA Winter Heating Season Performance Survey 2021-22 & 2022-23
Note: 'Other' category includes supply sources such as linepack, transporter imbalances, and off-system displacement

Final Thoughts

- The natural gas market is set to be **well-supplied** headed into the winter heating season. **Gas utilities plan and prepare** to meet their obligations to consumers.
- **Gas for electric power** remains essential for meeting load growth and peak requirements. Maintaining generation, fuel deliverability, and infrastructure is essential for reliability.
- **The market may tighten** into 2025, but the outlook will be sensitive to production response.
- **New infrastructure will be necessary** to meet growing demand and maintain price stability.

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

2024-2025 Winter Reliability Assessment

John Moura, Director, Reliability Assessment and Performance Analysis
National Natural Gas Readiness Forum Meeting
December 16, 2024

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Hyper Complex Risk Environment

Rapidly Changing Resource Mix

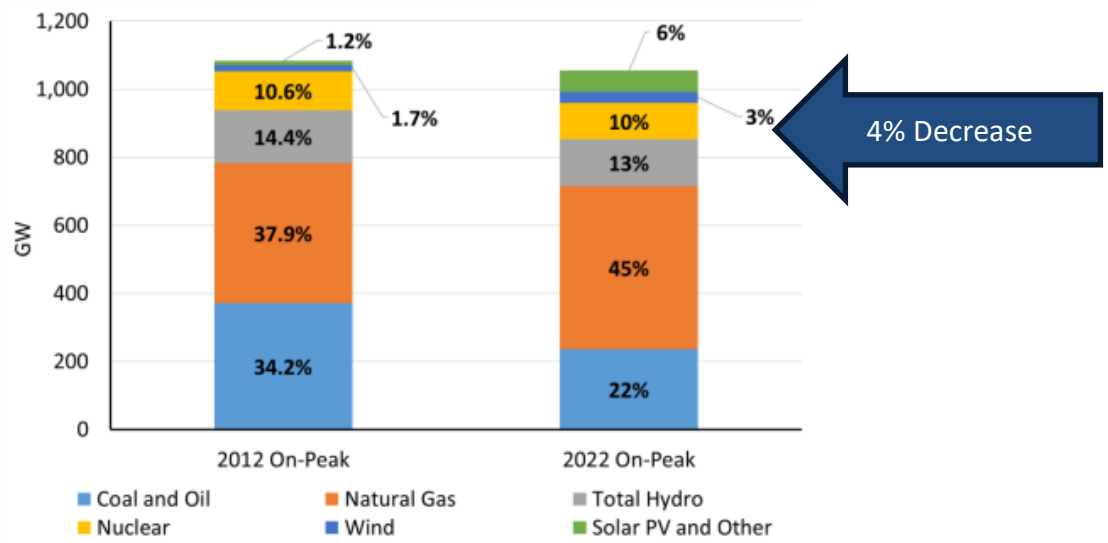
Accelerating Demand Growth

Extreme Weather Complexities

Evolving Threat landscape

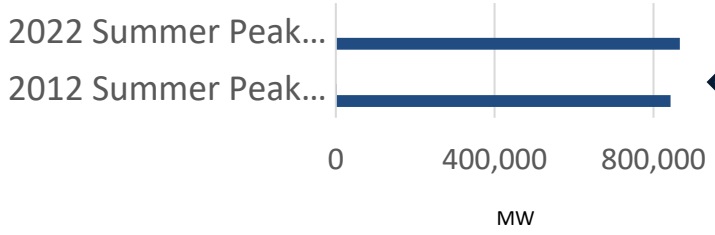
Across an Interconnected System:
Less Resources Means More Reliance on Neighbors

2012 and 2022 Peak Capacity Resource Mix NERC-Wide



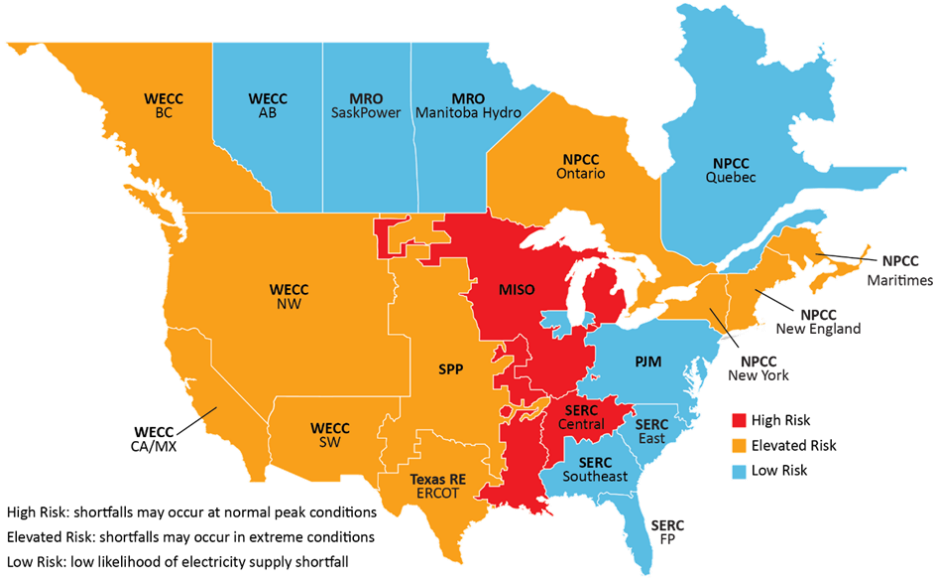
4% Decrease

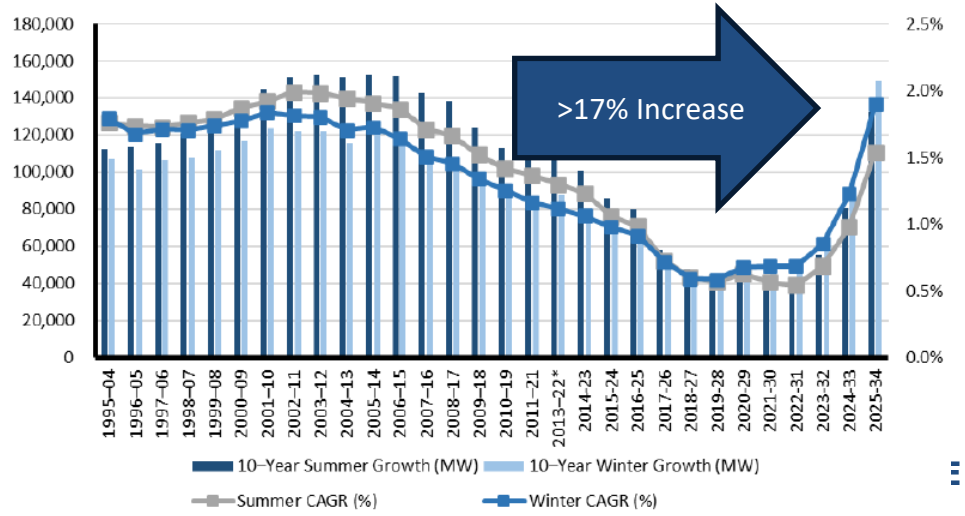
NERC-Wide Summer Peak Demand Changes 2012 and 2022



3% Increase

2024-2033 Risk Areas





>17% Increase

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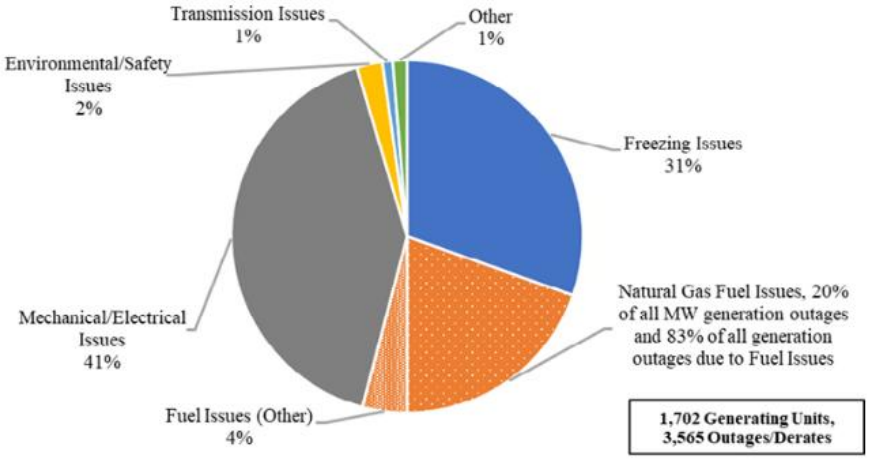
Similarities in Past Extreme Cold Weather Events

	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	✓		✓	✓	✓

Unplanned Generating Unit MW Outages, Derates and Failures to Start, Total Event Area: by Cause



Inquiry into Bulk-Power System Operations During December 2022 Winter Storm Elliott

Extreme Winter Events		
Event	**Geographic Area**	**Unavailable Generation (MW)**
February 1–5, 2011	Texas and Southwest	14,702
January 6–8, 2014 (Polar Vortex)	Midwest, South Central, East Coast	9,800
January 15–19, 2018	South Central	15,600
February 8–20, 2021 (Winter Storm Uri)	Texas and South Central	65,622
December 21–26, 2022 (Winter Storm Elliott)	Central, Midwest, large parts of Southeast and Northeast	90,500

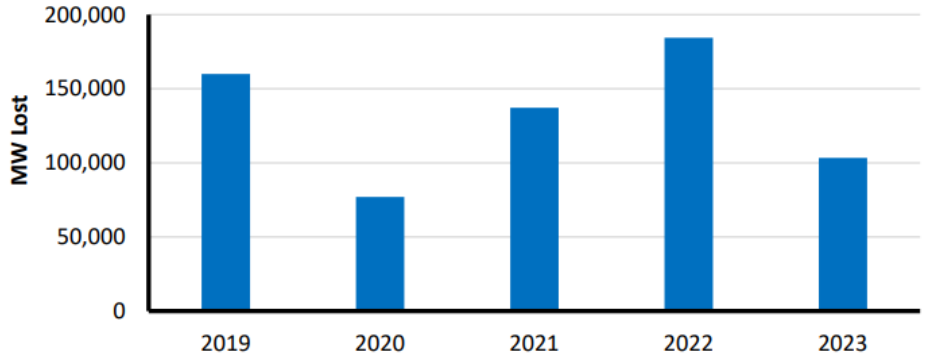
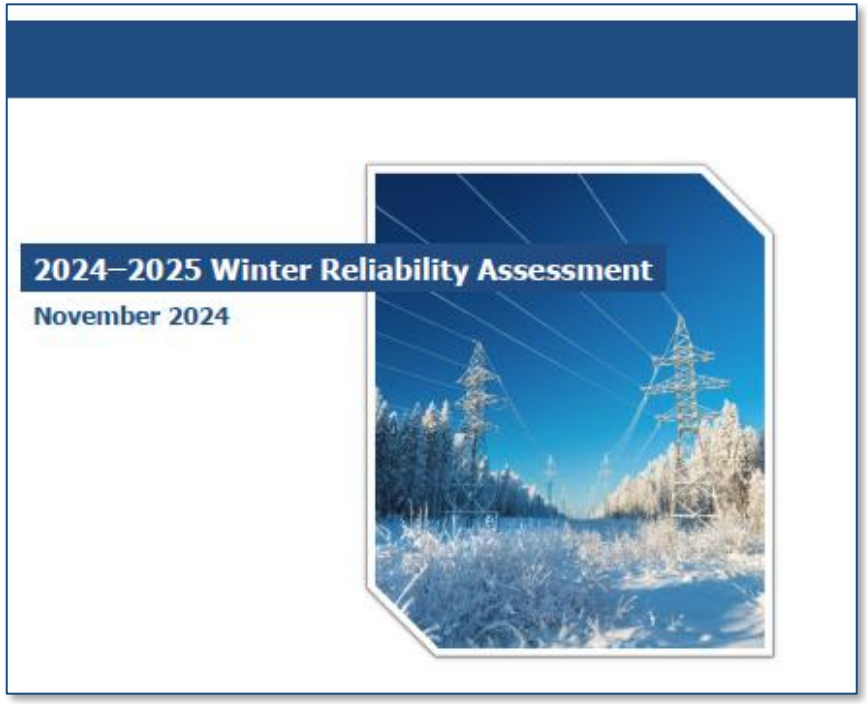


Figure 3.6: Natural-Gas-Fired Outages Due to Lack of Fuel

Annual Winter Assessment Highlights

Key Takeaways

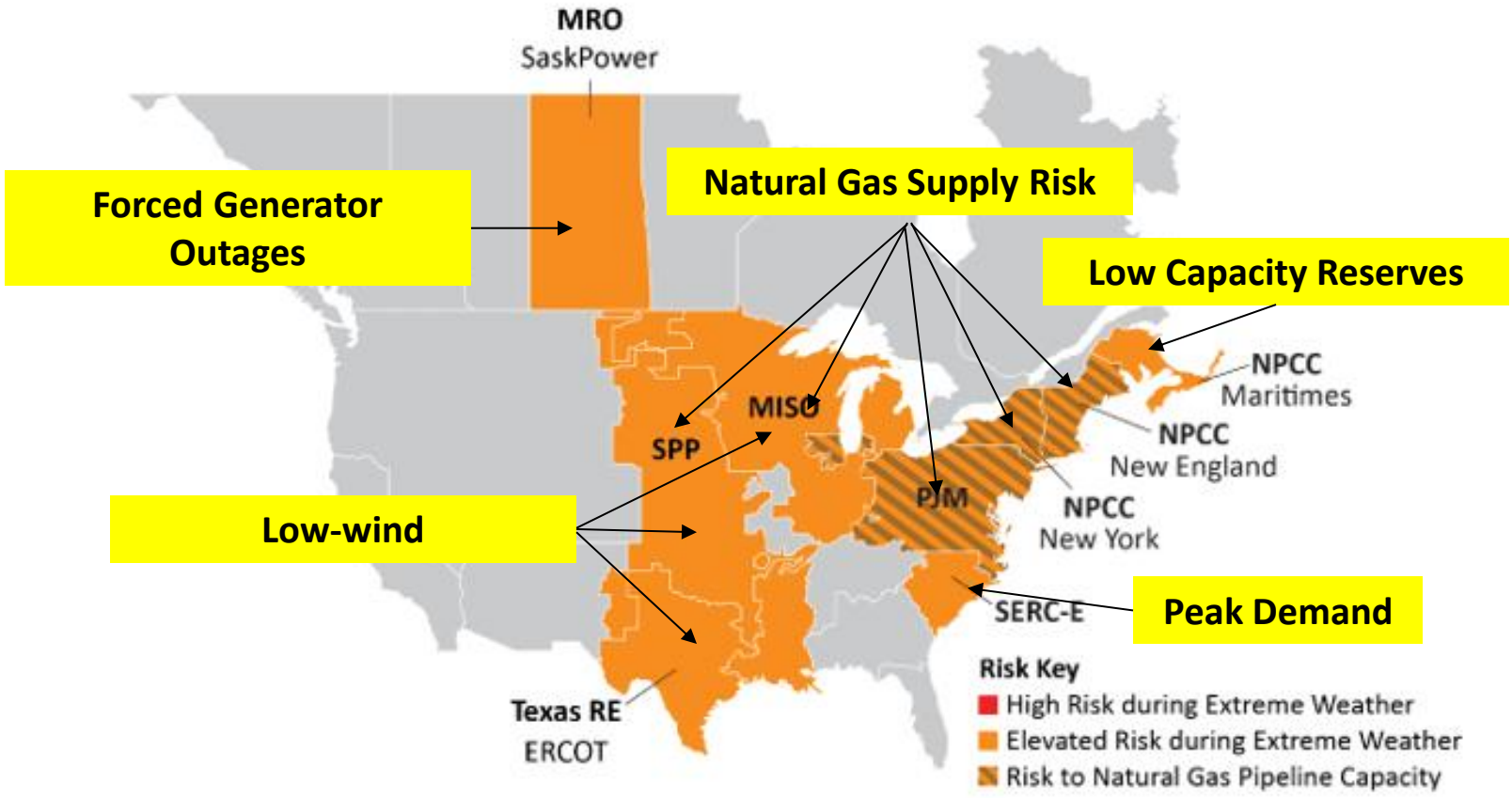
- Resources are adequate across North America for expected peak conditions
- Extreme winter conditions pose familiar challenges for bulk power system reliability
  - High electricity demand and forecasting challenges
  - Generator performance
  - Fuel supply issues
- Regulatory and industry initiatives are reducing winter reliability risks



The WRA examines resource adequacy, risk scenarios, and industry preparations for the winter season

Key Risk Elements During Extreme Winter Conditions

Results of WRA Probabilistic Analysis and Operational Risk Scenarios



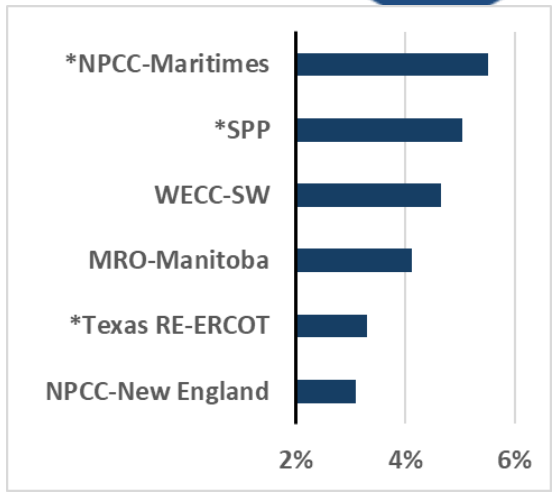
2024-2025 Winter Reliability Risk Map

- **MISO**
  - 5 GW retirements
- **NPCC-NE & NY**
  - 5 GW retirements
- **SERC-East**
  - 1 GW retirement
- **SPP**
  - 4 GW retirement

- Natural Gas Risk amplified by challenges to deploy new infrastructure

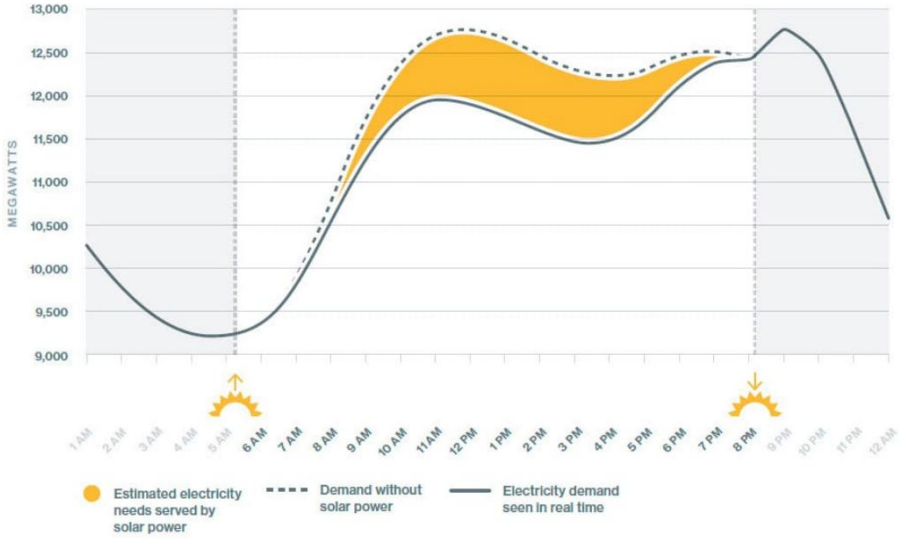
Rising Winter Demand

- Winter demand increases exceeding 2% are seen in most assessment areas
- Home heating, transportation systems, and new data centers
- Solar resources do not provide output during many hours when winter electricity demand is at its highest.
- New battery resources can extend the output from solar PV for short durations, but winter's longer hours of darkness, cloud cover, and precipitation will push the limits of today's battery storage capabilities
- Winter resource adequacy depends on dispatchable generation, reliable fuel supplies, and firm transfer agreements



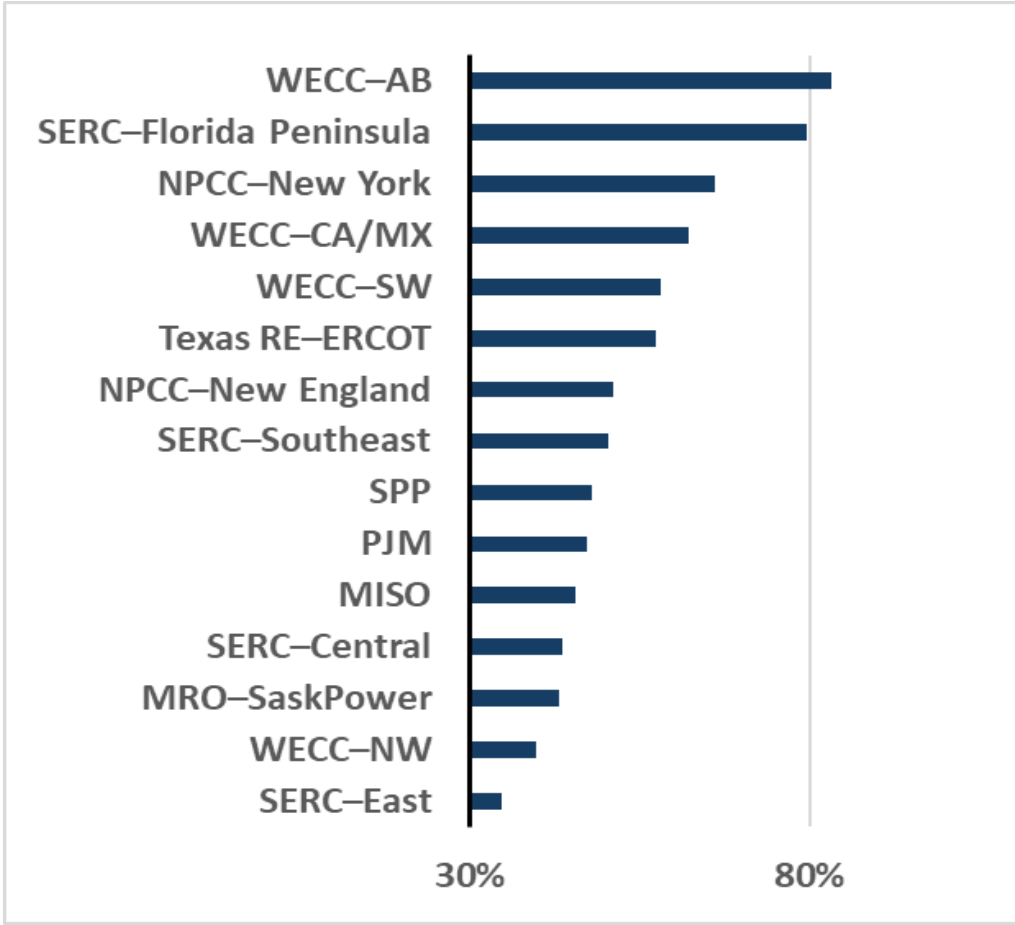
Annual Increase in Peak Winter Demand (3% or More) Since 2023

*Among the higher growth areas for consecutive years



Natural Gas Is Essential

- Generators that use natural gas as primary fuel are the main winter resource across the U.S. and in Alberta
- In winter storm Elliott (2022) 26% of all generator outages were due to fuel issues
- Fuel supply issues during extreme cold are a concern in MISO, SPP, PJM, New England, and New York
- Regional pipeline capacity faces limitations in the Mid-Atlantic to New England



Natural Gas-fired Generation Capacity In Winter (Percent of Total Capacity)

Reliability Initiatives Drive Improved Winter Performance

Regulatory Highlights

- Reliability standards implemented in 2023 require generator cold weather plans and operator coordination
- Rules in Texas respond to Winter Storm Uri (2021) generator and fuel supply issues
- FERC and NERC continue monitoring winter storm report recommendations
- NERC Generator Cold Weather Preparedness and Constraint Data

Industry Initiatives

- January 2024 Arctic Storms resulted in no load-loss events
- Improved generator performance attributed to weatherization, early warning and unit commitment

2024-2025 Winter Reliability Assessment Recommendations

- **Cold Weather Preparations** – Operators should review seasonal operating plans, communications protocols, and lessons-learned
- **Generator Readiness** - Generator Owners should complete winter readiness preparations, deploy weatherization packages in advance of winter storms, and frequently check cold-weather mitigations
- **Fuel** – Balancing Authorities (BA) should implement generator fuel surveys to monitor the adequacy of fuel supplies
- **Load Forecasting** – BA should anticipate load forecasts uncertainty and be prepared to take early action to manage potential reserve deficiencies
- **State regulators and policy makers** – support environmental and transportation waivers when requested to manage potential emergencies
- **Address gas/electric interface** through more gas infrastructure, increased information sharing, appropriate market-based incentives and consideration of accountability mechanisms

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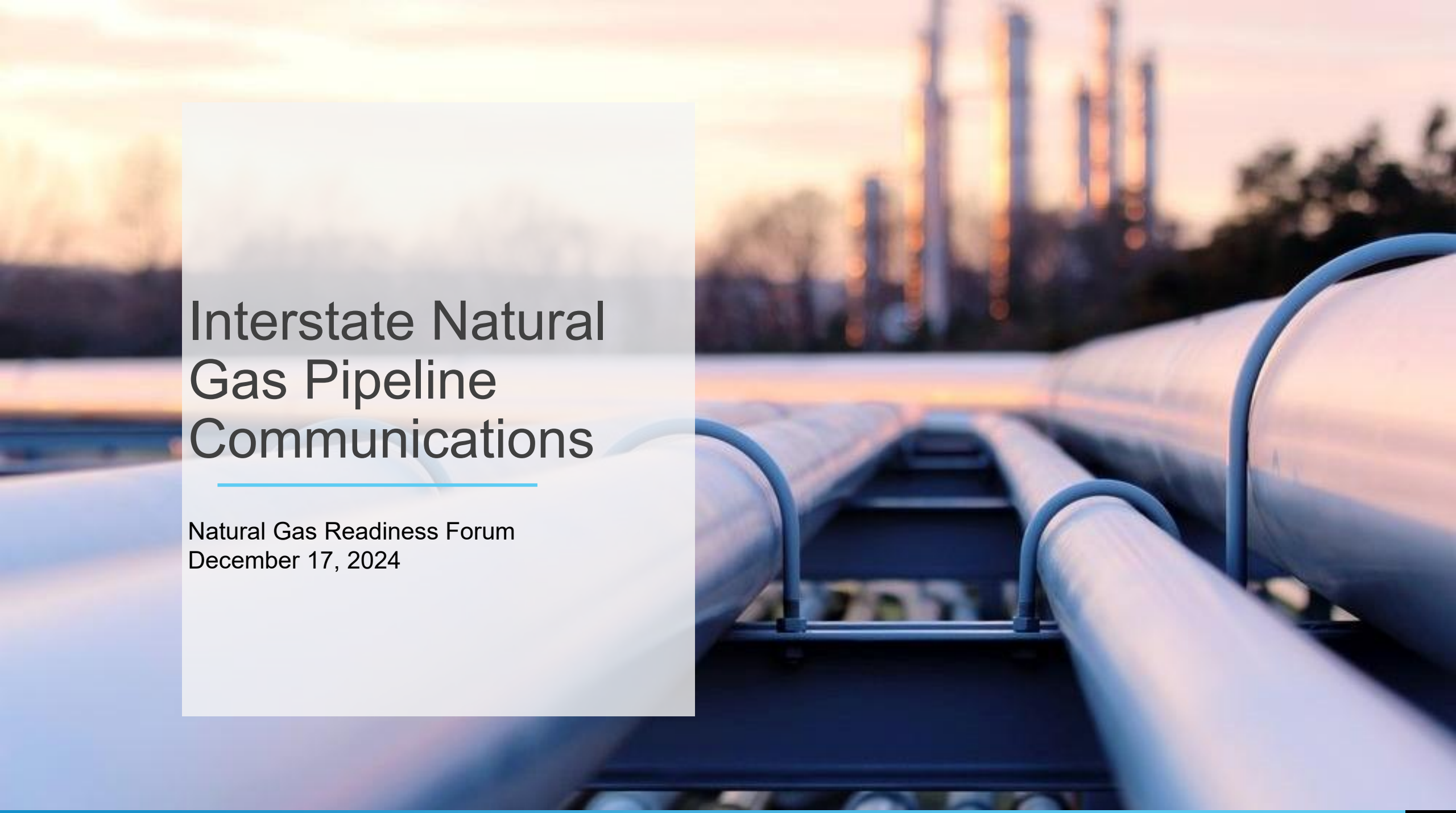
Questions Welcome



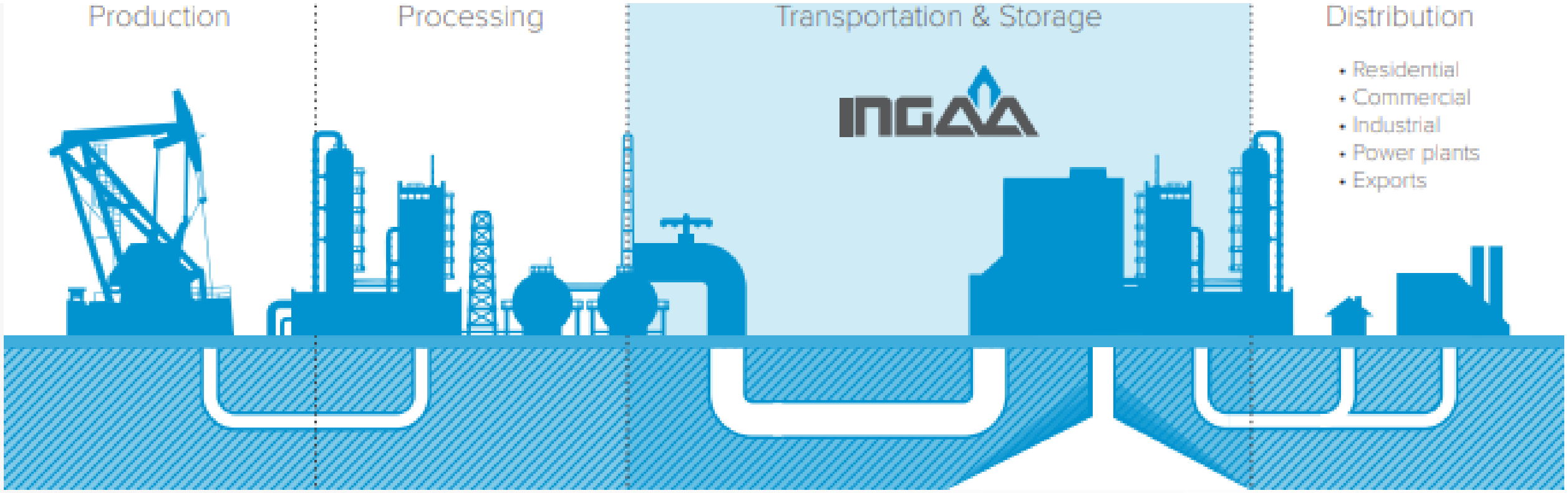
Interstate Natural Gas Pipeline Communications

Natural Gas Readiness Forum
December 17, 2024

Communication Protects the Pipeline System and Our Firm Customers.

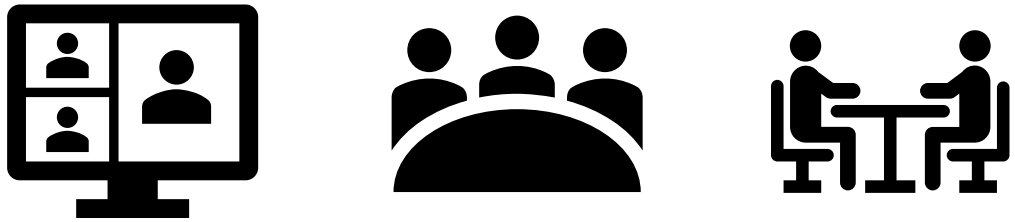
Interstate natural gas pipelines' top priority is maintaining a reliable and safe pipeline system while meeting commitments to firm transportation and storage customers.

Communication advances this priority by promoting awareness and advanced planning.



Ahead of Event Preparation: Advance Communication

Pipelines proactively address known challenges and set expectations through stakeholder coordination meetings and publicly posted critical notices.

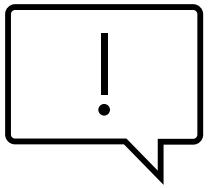


- **Pipelines meet with RTOs, LDCs and interested parties.**

- **INGAA Voluntary Winter Preparation Survey.** Accountability in ensuring safe and reliable operations through assessment of critical equipment.

- **Pipelines monitor weather throughout the year and typically will post weather advisories or notices in advance of event.**

During an Event: Issuing Notices & Monitoring



Critical Notices

Publically posted notices to point operators, shippers, and other interested stakeholders:

- Inform of expected conditions on the pipeline during a weather event
- Reinforce the pipeline's expectations that shippers abide by the tariff and their contracts.
- Should also prompt shippers to review their supply, transportation arrangements.
- Indicate limited flexibility due to anticipated high system utilization.

Monitoring Flows and Pressure

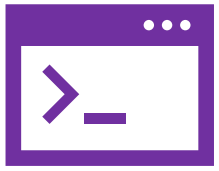
Increased monitoring of locations off rate indicating potential of underperformance

A pipeline's response to underperformance varies by pipeline, system conditions, and quantity of the underperformance.

Pipes might post an underperformance notice based on analysis of the circumstances.

End users must communicate with their suppliers and/or marketers to understand how production shortfalls affect them.

Pipelines Communicate 24-7-365.



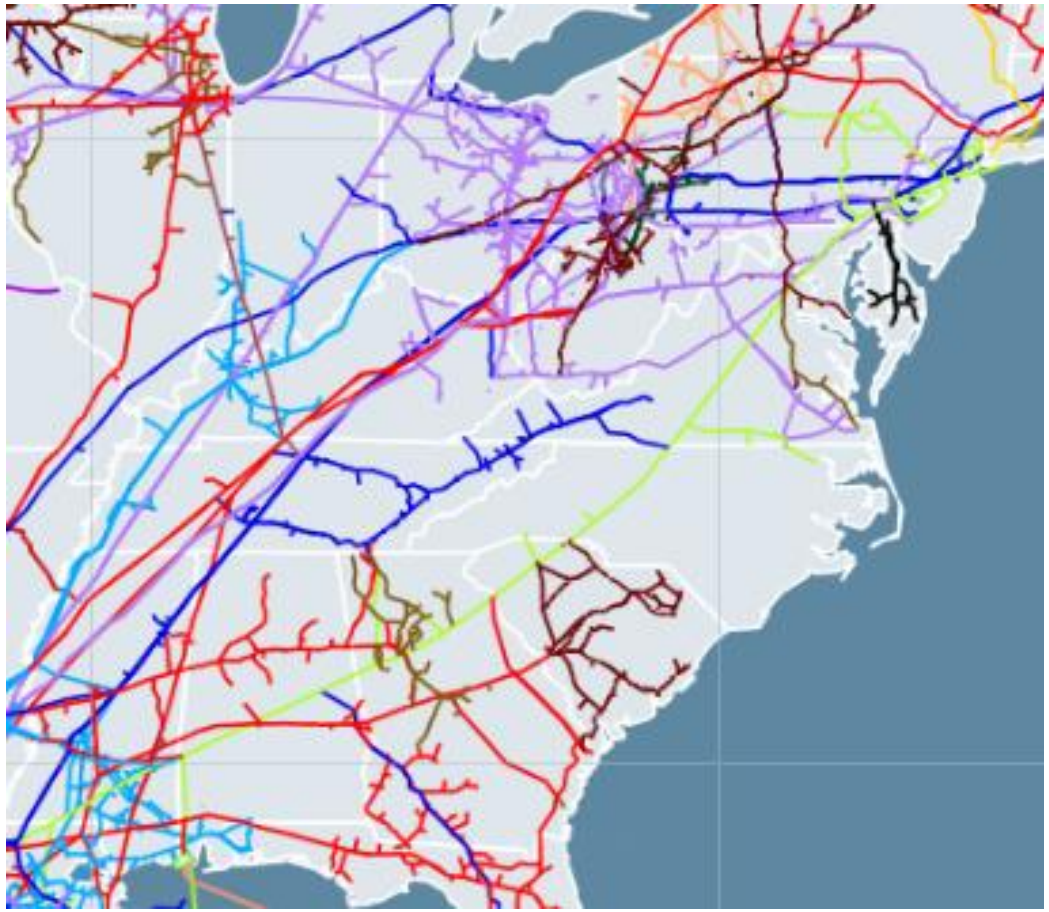
- **FERC has taken several steps to promote transparency and gas-electric coordination:**
  - 18 C.F.R. §§ 284.12, 13 requires regular, public posting of substantial operational information.
  - Order 698 requires communication procedures between pipes and generators and pipes and RTOs/ISOs.
  - Order 787 permits sharing of non-public, operational information between pipes and RTOs/ISOs.

- **FERC Regulations and NAESB Standards govern how interstate pipelines post and deliver "notices" to shippers and the public.**
  - Notices can cover a variety of issues ranging from capacity constraints to maintenance updates to pipeline conditions to weather.
  - Pipelines must designate a notice as "critical" if the conditions described in the notice affect scheduling or adversely affect scheduled gas flow.
  - NAESB Standards dictate the form, content, and method of delivery (e.g., email, EDI) for these notices.

Recent Changes: Pipelines Propose New Standards for Public Postings.

NAESB convened a forum in 2024 to review and, as needed, modify its Business Practice Standards to enhance situational awareness during extreme weather events.

Stakeholders identified changes to pipelines' notices to help more quickly identify relevant data.



Pipelines proposed to

- add geographic information (county, state, etc.) for locations identified in critical notices; and
- collect on a dedicated page scheduled quantity information for power plants directly connected to the pipeline

The proposal continues to move through the NAESB and regulatory approval process.