

Winter 2023-2024 Cold Weather Operations

Aaron Markham

VICE PRESIDENT OPERATIONS, New York ISO

NYISO Operating Committee

March 15, 2024, Rensselaer, NY

Key Observations from Winter 2023/24

- Winter 2023-2024 temperatures were above average with minimal short duration cold weather events
- Moderate fuel prices (natural gas, LNG, distillate fuel, etc.) were in place for much of the season
- Stored fuel burned in short duration periods of cold weather. Operations will continue to monitor replenishment in preparation for winter 2024/25
- Continued examples of limited flexibility on the gas system to start and operate generators on gas without a Day Ahead Schedule for energy or reserves
- Estimated supply mix for the peak hour (1/17/24 HB 18): 26% natural gas, 14% oil, 17% hydro, 20% imports, 14% nuclear, 8% wind, 1% other renewables

Peak Loads

- **NYCA all-time Winter Electric Peak Load was 25,738 MW on January 7, 2014**
- **NYCA Seasonal Peak Forecast was 24,220 MW for Winter 2023-2024**
- **This Winter's Actual Peak (to date) is 22,754 MW on Wednesday, January 17, 2024**

Above Normal Winter Temperatures Prevailed

| Average Temperatures and Departures from 1991 – 2020 Normals | | | | | |
|--|----------------------|----------------------|----------------------|----------------------|-----------------------------|
| Station | December | January | February | Season | Coldest |
| Islip | 42.2 °F (+5.1 °F) | 35.1 °F (+3.2 °F) | 36.1 °F (+2.8 °F) | 37.8 °F (+3.7 °F) | 17 °F (1/20, 1/21, 1/22) |
| Central Park | 44.6 °F (+5.5 °F) | 37.0 °F (+3.3 °F) | 39.9 °F (+4.0 °F) | 40.5 °F (+4.3 °F) | 17 °F (1/17) |
| Albany | 37.6 °F (+7.2 °F) | 30.1 °F (+5.7 °F) | 33.8 °F (+7.0 °F) | 33.8 °F (+6.6 °F) | 7 °F (1/20, 1/21, 1/22) |
| Syracuse | 38.6 °F (+8.2 °F) | 29.6 °F (+5.5 °F) | 34.5 °F (+9.0 °F) | 34.2 °F (+7.5 °F) | 7 °F (1/20, 2/20) |
| Buffalo | 39.4 °F (+8.0 °F) | 29.4 °F (+3.9 °F) | 34.8 °F (+8.4 °F) | 34.5 °F (+6.7 °F) | 6 °F (1/17, 1/20) |
| Plattsburgh | 32.4 °F (+6.0 °F) | 24.3 °F (+5.1 °F) | 27.7 °F (+6.7 °F) | 28.1 °F (+5.9 °F) | -4 °F (1/20) |

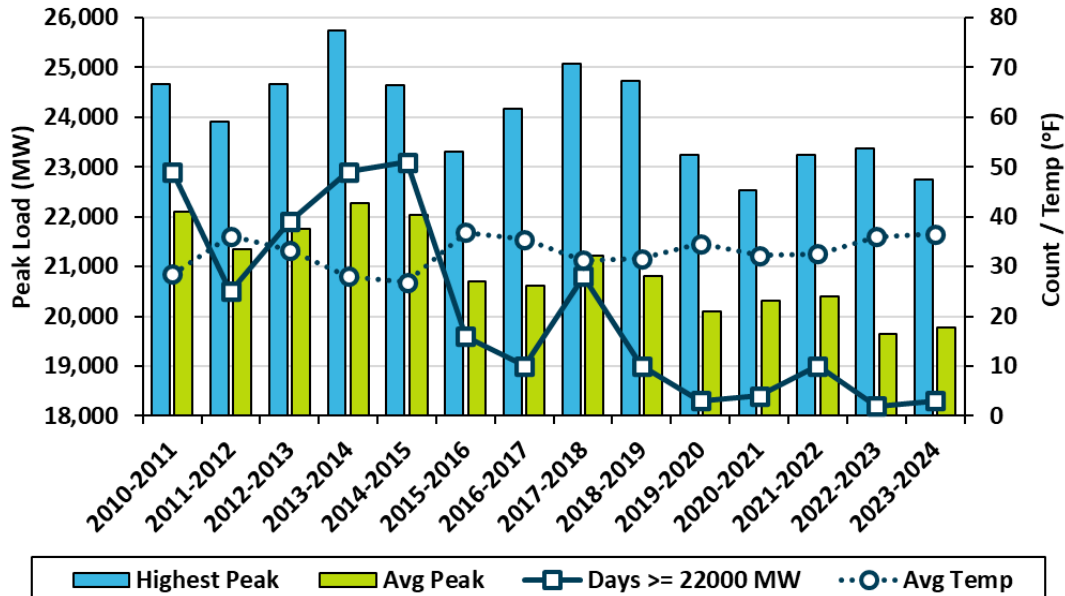
Data Source: NWS Local Offices (www.weather.gov)

Legend:  Below Normal  Above Normal



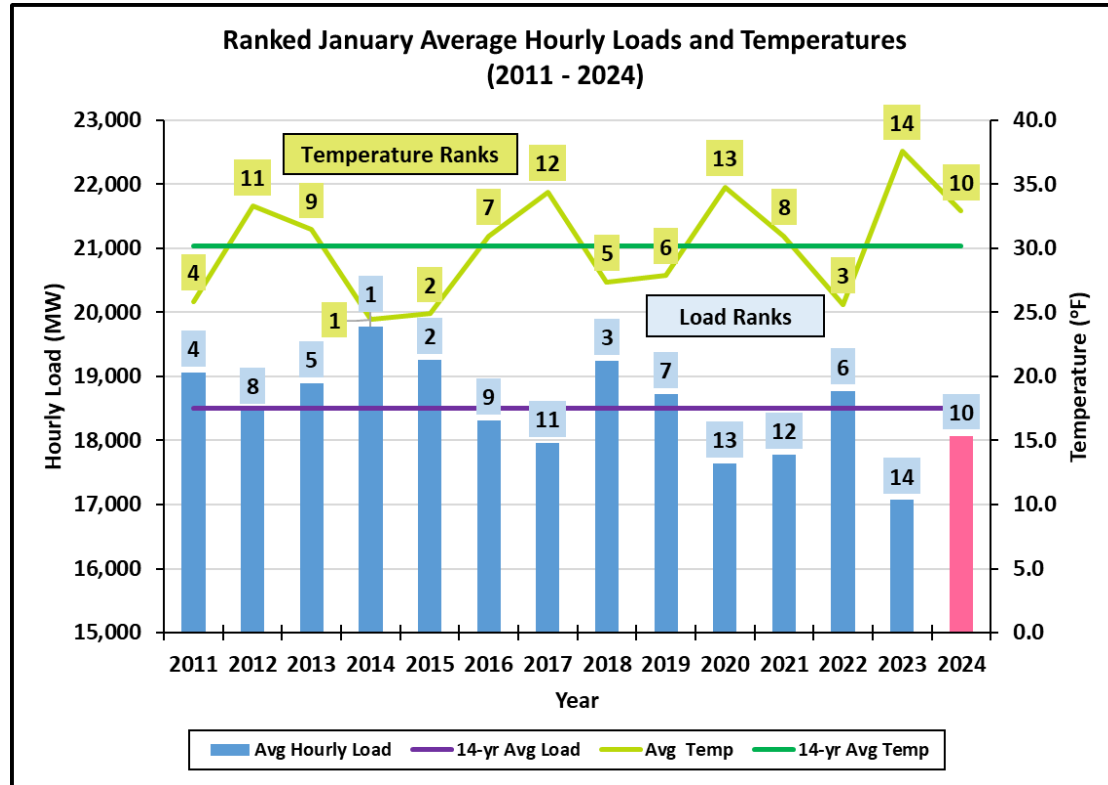
Winter 2023 – 2024 Daily Peak Loads In Perspective

Winter Seasonal and Daily Average Peak Load Trends
(December through February)



- Second highest Winter average hourly temperature (36.5°F) since 2010 – 2011
 - 2015 – 2016: 36.8°F
- Winter 2023 – 2024 peak load (22,754 MW) occurred on January 17th
 - Second lowest winter season peak since 1997 – 1998 after 2020 – 2021 (22,542 MW)
 - Third winter season peak less than 23,000 MW since 1997 – 1998
- Peak load exceeded 22,000 MW only two other times
 - 1/18 (22,314 MW)
 - 1/19 (22,157 MW)
- Second time the season average peak load was below 20,000 MW since 2010 – 2011
 - 2022 – 2023 was the other season

January 2024 Hourly Average Loads In Perspective



- Average temperature: 32.9 °F**
 - Fifth highest average hourly temperature since 2011
- Average Hourly Load: 18,075 MW**
 - Fifth lowest average hourly load since 2011
- Peak Hourly Load: 22,754 MW (1/17)**
 - Winter 2023 – 2024 peak to date
 - Second lowest winter season peak since 1997 – 1998 behind 2020 – 2021 (influenced by COVID)
- Three days above 22,000 MW in January 2024**
 - 2011 – 2023 Average: 11 January days above 22,000 MW

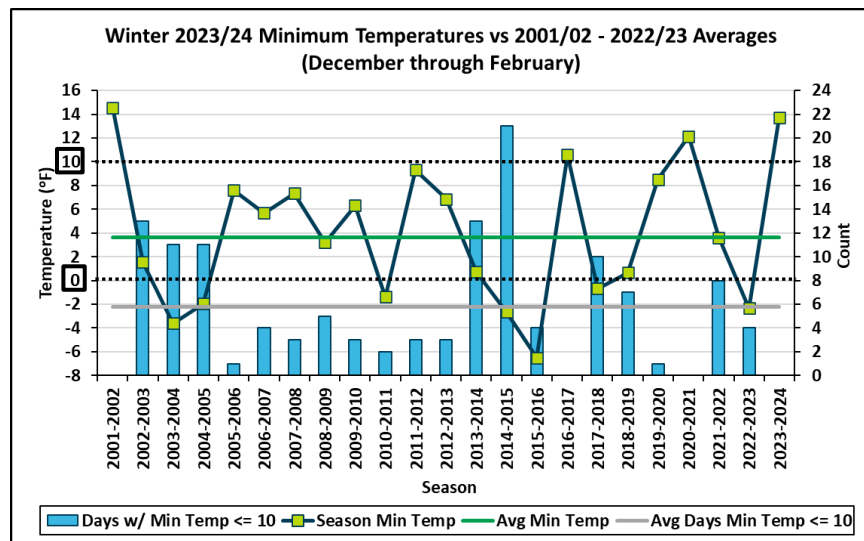
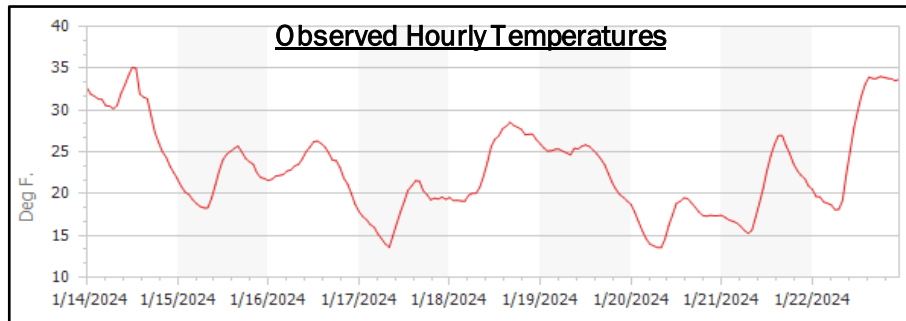
Cold Weather Conditions (1/14 – 1/22) Electric Peak

- The above average temperatures experienced this winter returned to seasonal or a bit below for the week of January 14th.
- 1/17/24 - The forecast peak temperature index was 21.4°F. Partly to mostly sunny, windy and cold with lake effect snow.
- Forecast highs were in the upper-teens to lower-20s upstate and mid-20s downstate. Overnight lows were mainly in the lower- to mid-teens upstate and lower-20s downstate.
- The Actual peak on 1/17/24 and peak of the winter was 22,754 MW, HB18, ~94% of the winter 2023/2024 baseline forecast.
- Most severe Operational Flow Orders (OFOs) during the period:
 - Con Ed 1/20th Hourly OFO, 1/17/24 and 1/20/24-1/22/24 04:00 - 10:00
 - NG Downstate 5% Over-Burn Daily OFO, 1/16/24 10:00 - 1/23/24 10:00
 - NG Upstate East Gate Interruption, 1/20/24 10:00 - 1/21/24 10:00
- SREs – 1/20/24, Northport 3, HB00-20 and 1/22/24, Bowline 2, HB15-23 for statewide capacity

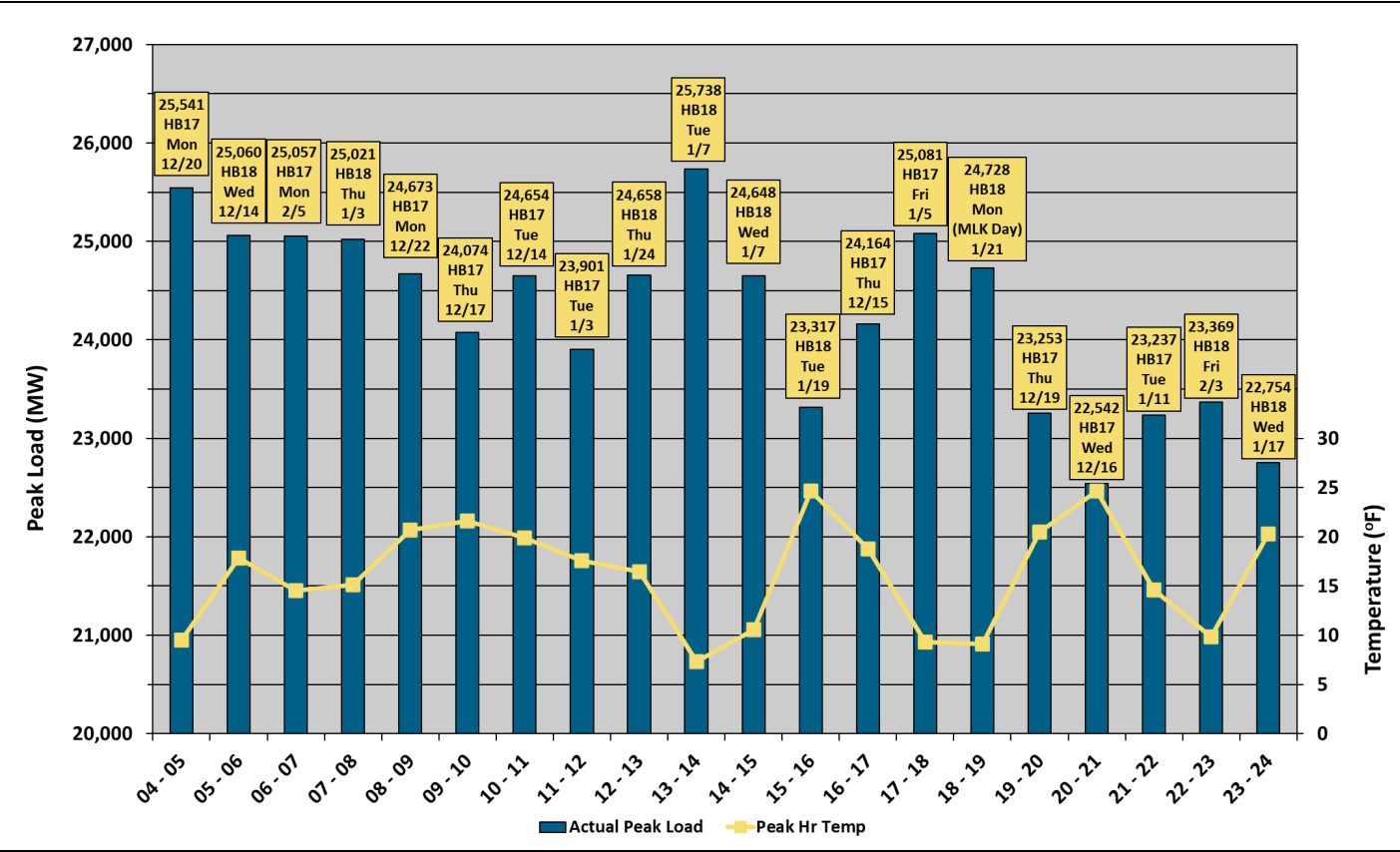
NYCA Temperature and Peak Load Statistics for January 14 – 22, 2024

- Coldest stretch of the 2023 – 2024 winter season, but still milder than typical coldest winter days/ periods
- Minimum temperature (13.7 °F) occurred on Saturday January 20th and was the lowest of the season
 - Highest minimum since the 2001 – 2002 season
 - Average season minimum: 3.6 °F(2001 – 2002 to 2022 – 2023)
- Third time with a winter season minimum temperature above 10 °F since the 2001 – 2002 season
 - Average season: 6 days with a minimum temperature ≤ 10 °F

| Date | DOW | AM Low Temp | Aft High Temp | HB18 Temp | Avg Temp | Peak Load (MW) |
|------------------|------------|-------------|---------------|-------------|-------------|----------------|
| 1/14/2024 | Sun | 30.1 | 35.7 | 28.1 | 30.5 | 20,107 |
| 1/15/2024 | Mon | 18.8 | 25.8 | 24.4 | 22.4 | 21,506 |
| 1/16/2024 | Tue | 21.8 | 26.7 | 24.4 | 23.6 | 21,995 |
| 1/17/2024 | Wed | 14.6 | 21.9 | 20.3 | 18.5 | 22,754 |
| 1/18/2024 | Thu | 19.5 | 28.4 | 28.2 | 24.4 | 22,314 |
| 1/19/2024 | Fri | 24.8 | 25.4 | 22.6 | 24.0 | 22,157 |
| 1/20/2024 | Sat | 13.7 | 19.9 | 18.1 | 17.1 | 21,984 |
| 1/21/2024 | Sun | 15.7 | 27.1 | 25.1 | 20.8 | 21,735 |
| 1/22/2024 | Mon | 19.1 | 34.2 | 34.2 | 27.4 | 21,749 |

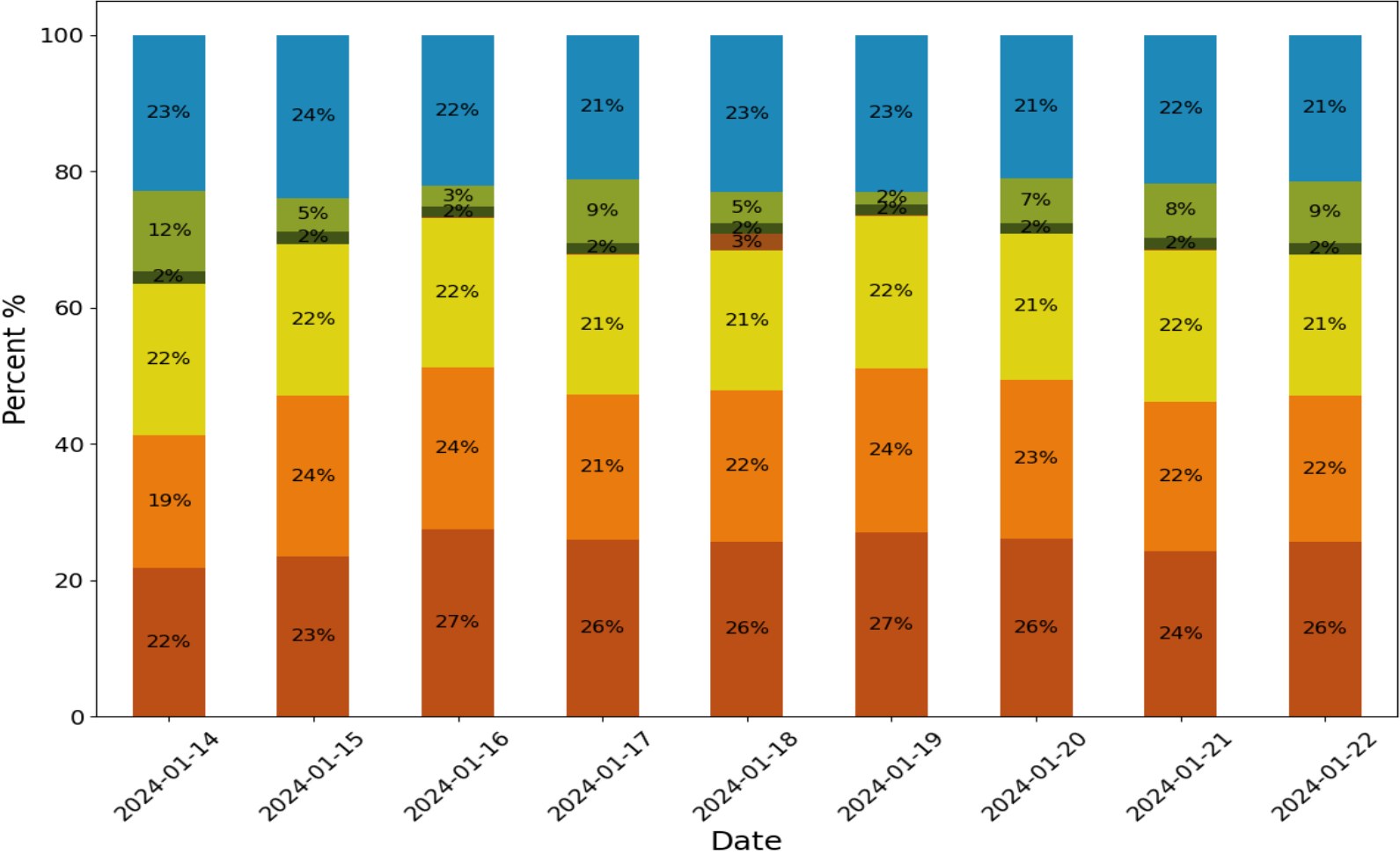
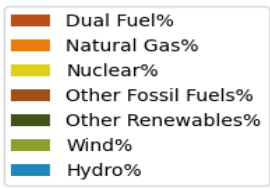


Winter Peak Loads in MW: 2004 – 2005 to 2023 – 2024

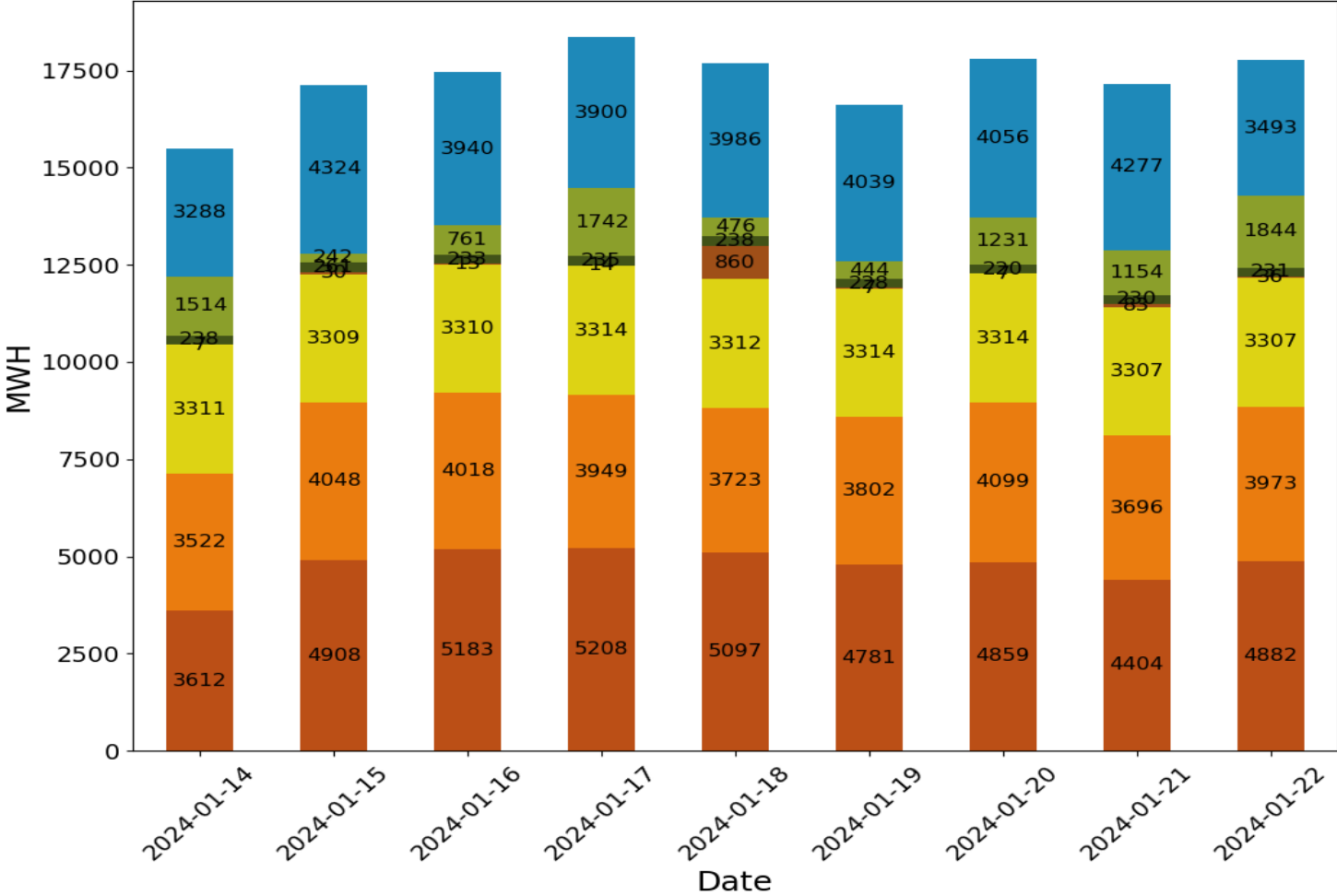
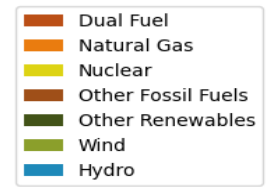


Generation Mix, Outage Data, and Fuel Inventory/Burn

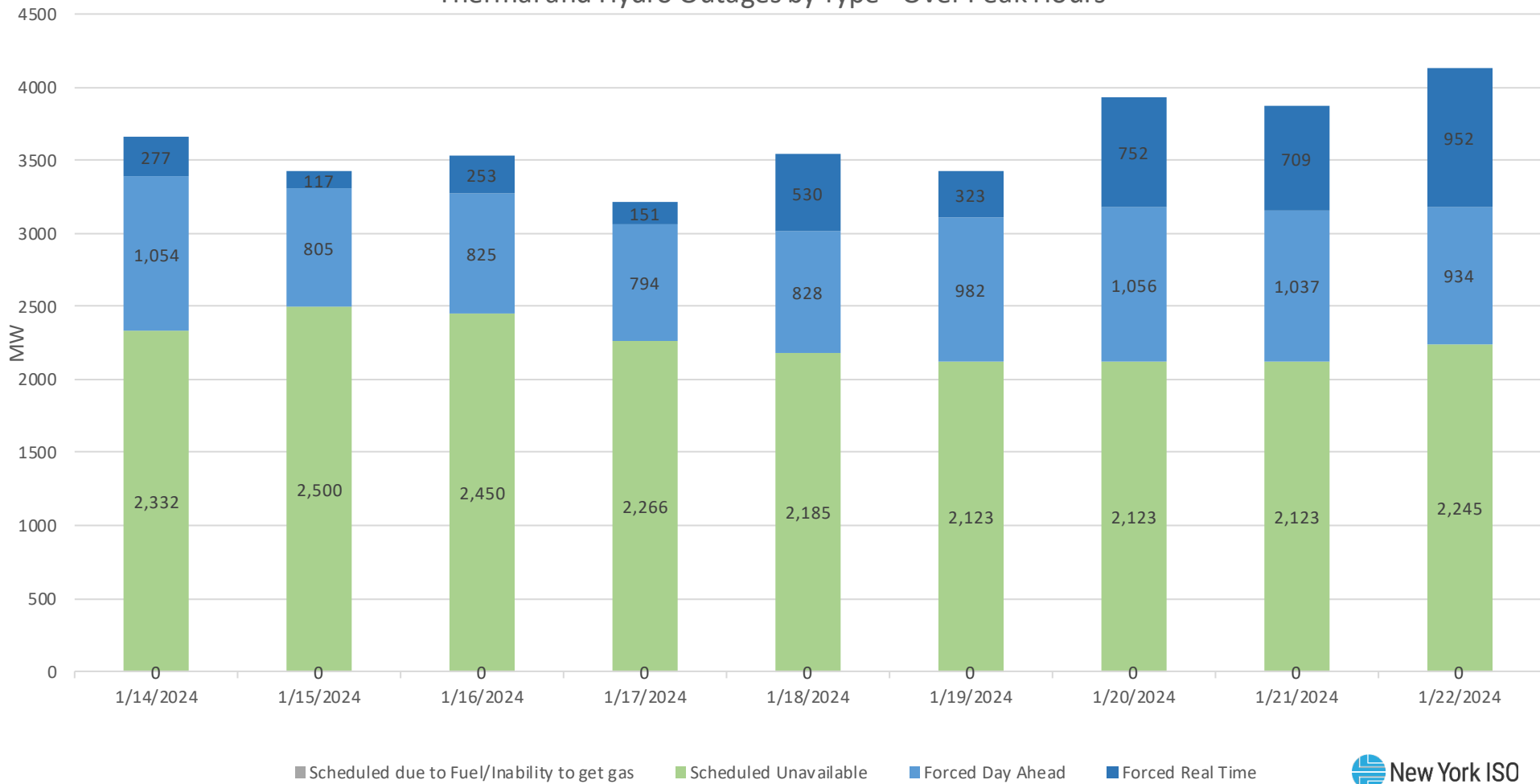
Total Actual Generator by Fuel Mix Across Day



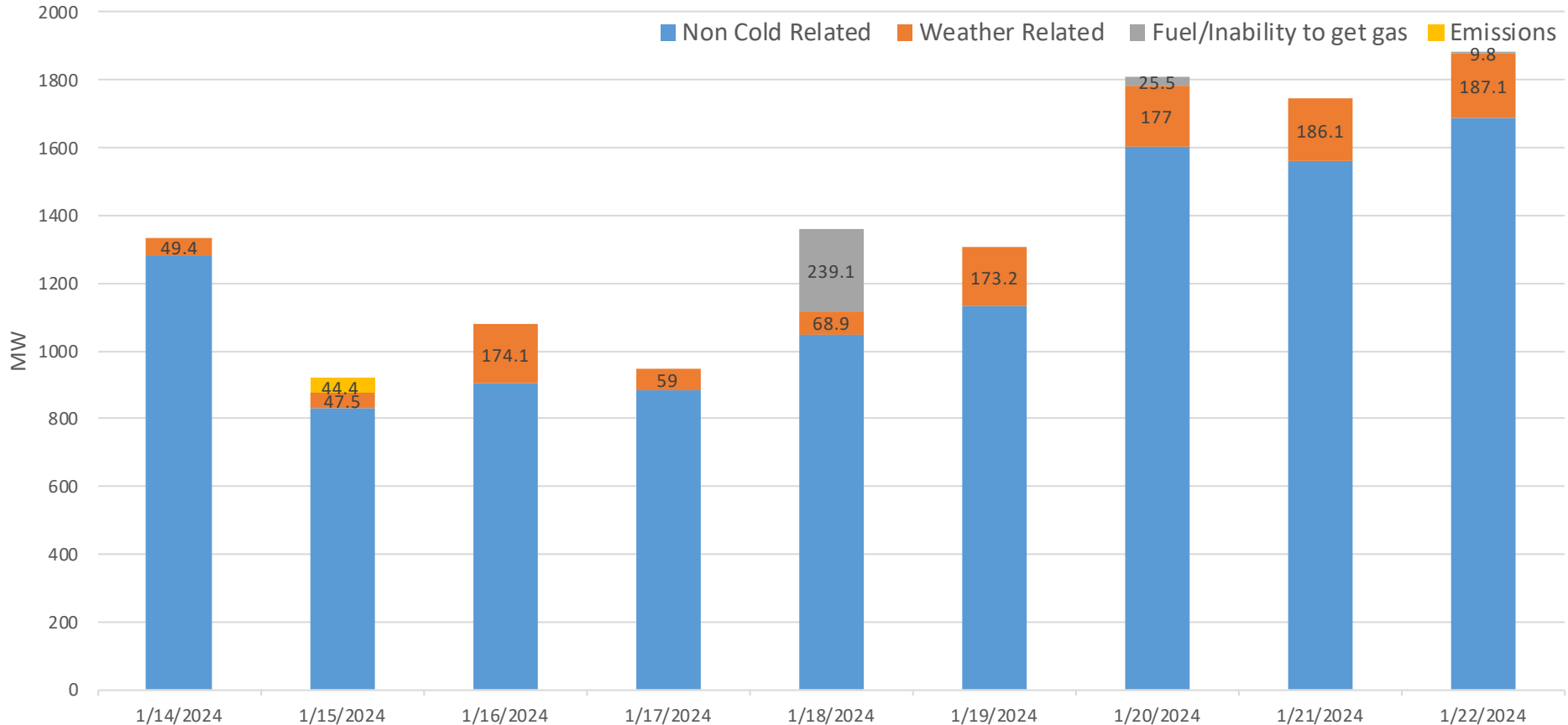
Total Actual Generator by Fuel Mix During Peak Hours



Thermal and Hydro Outages by Type - Over Peak Hours



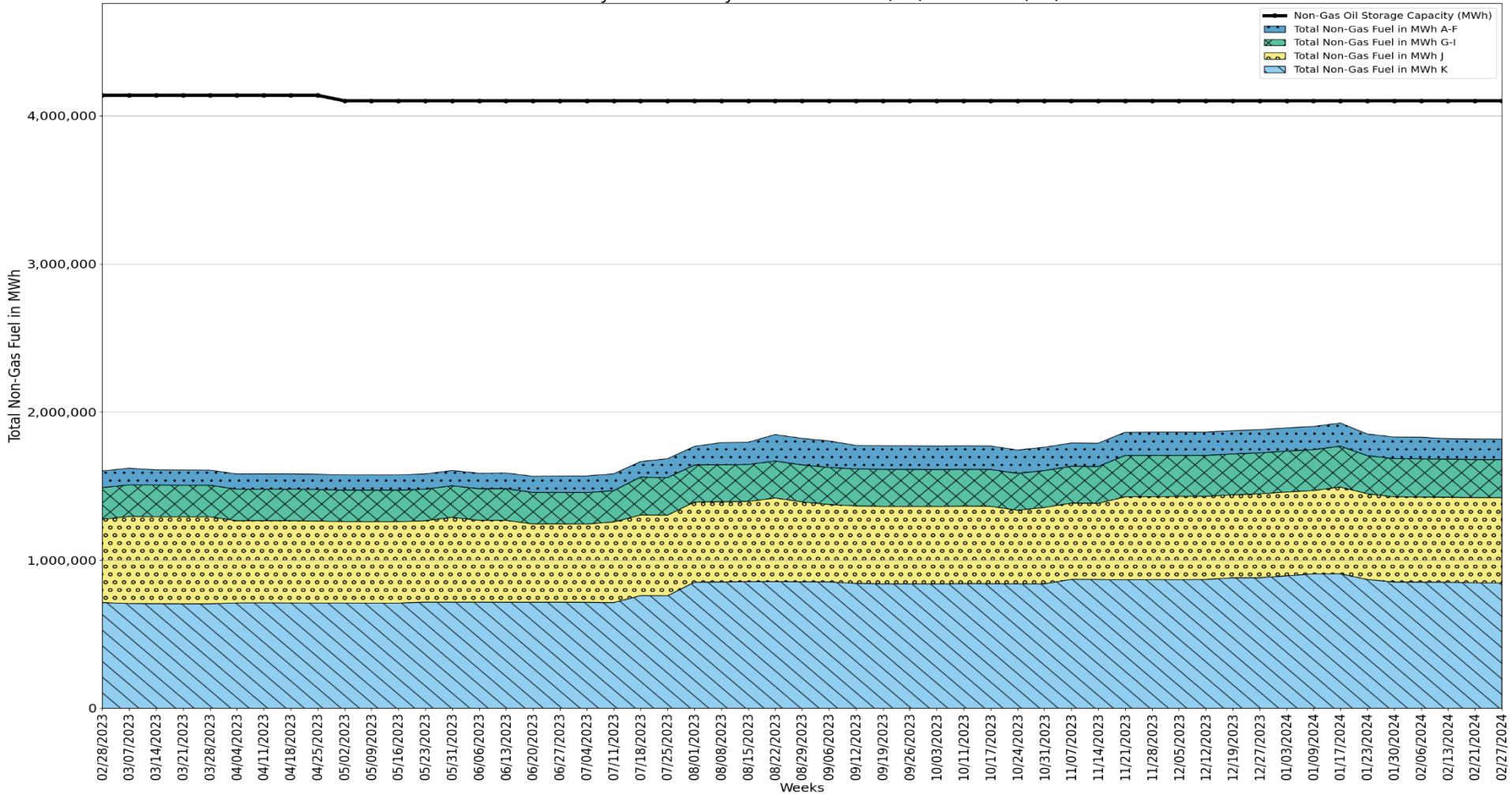
Thermal and Hydro Forced Outages and Forced Derates by Category



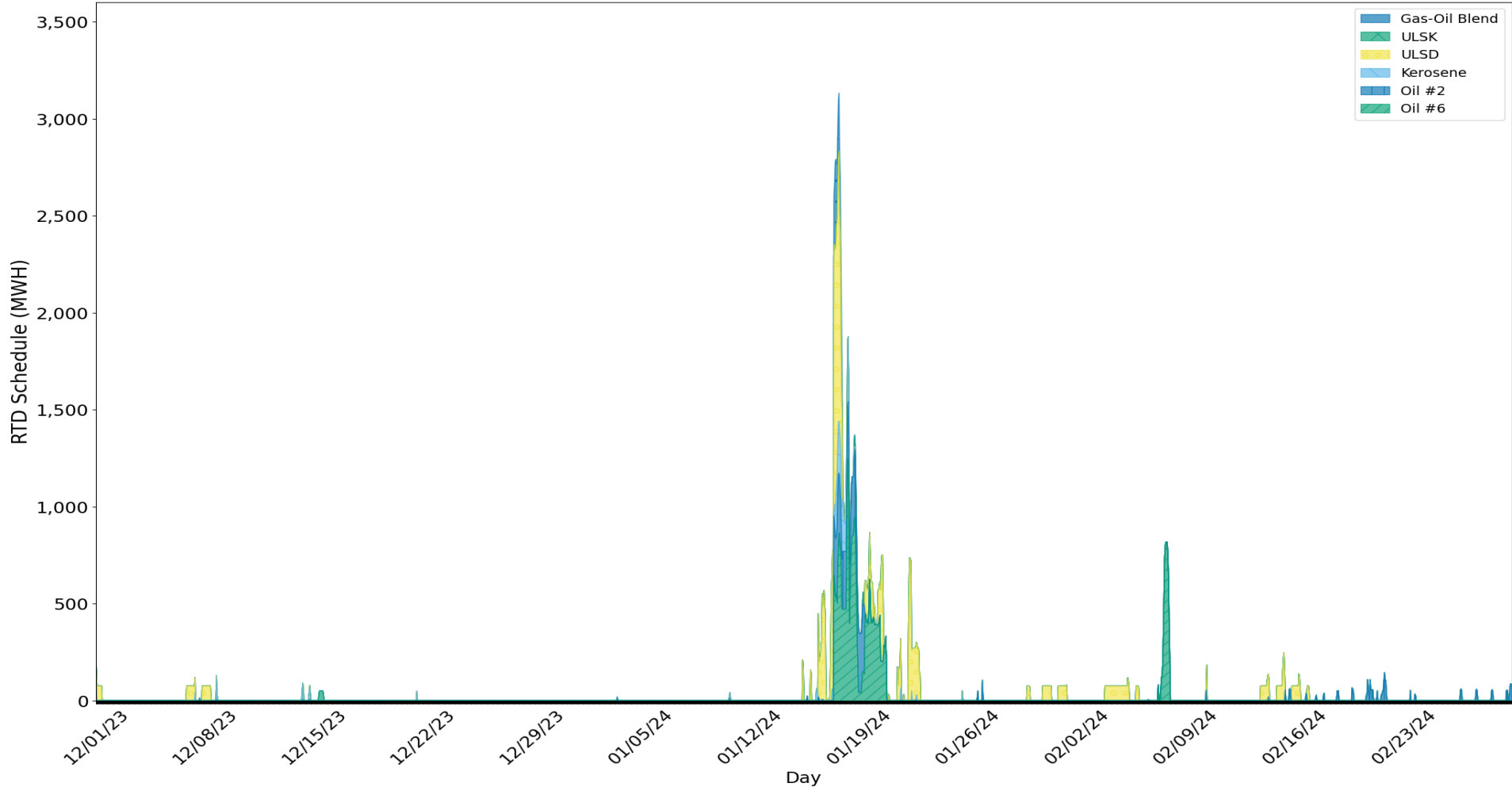
In the November 29, 2023 Management Committee presentation, "2023-24 Winter Assessment & Winter Preparedness" based on 60 months of history the projection was 2,750MW of Hydro and Thermal Forced outages



Total Weekly Oil Inventory in MWH from 02/28/2023 to 02/27/2024



Alternative Fuel Mix Plot for 12-01-2023 to 02-29-2024



- Gas-Oil Blend
- ULSK
- ULSD
- Kerosene
- Oil #2
- Oil #6

Major Takeaways

Operations

- **The NYISO worked with the TOs to recall certain transmission line outages, and participated in NPCC coordination calls with neighboring external market systems**
- **NYISO weekly fuel surveys indicated sufficient alternate fuel inventory**
- **NYISO met operating criteria throughout the winter**
- **No need for NYISO to call Demand Response**
- **No need for emergency actions (voltage reduction, public appeals, etc.)**

Transmission Infrastructure Performance

- **Continuing Forced Outages**
 - Hudson-Farragut 345 kV B3402
 - Marion-Farragut 345 kV C3403
- **Other impactful outages throughout the season (not all occurring concurrently)**
 - Dunwoodie-Shore Rd 345kV Y50
 - Dunwoodie-Motthaven 345kV 71
 - Sprainbrook-W 49th St 345kV M51
 - Adirondack- Lake-Porter 230kV 12
 - Moses-Willis 230kV MW2

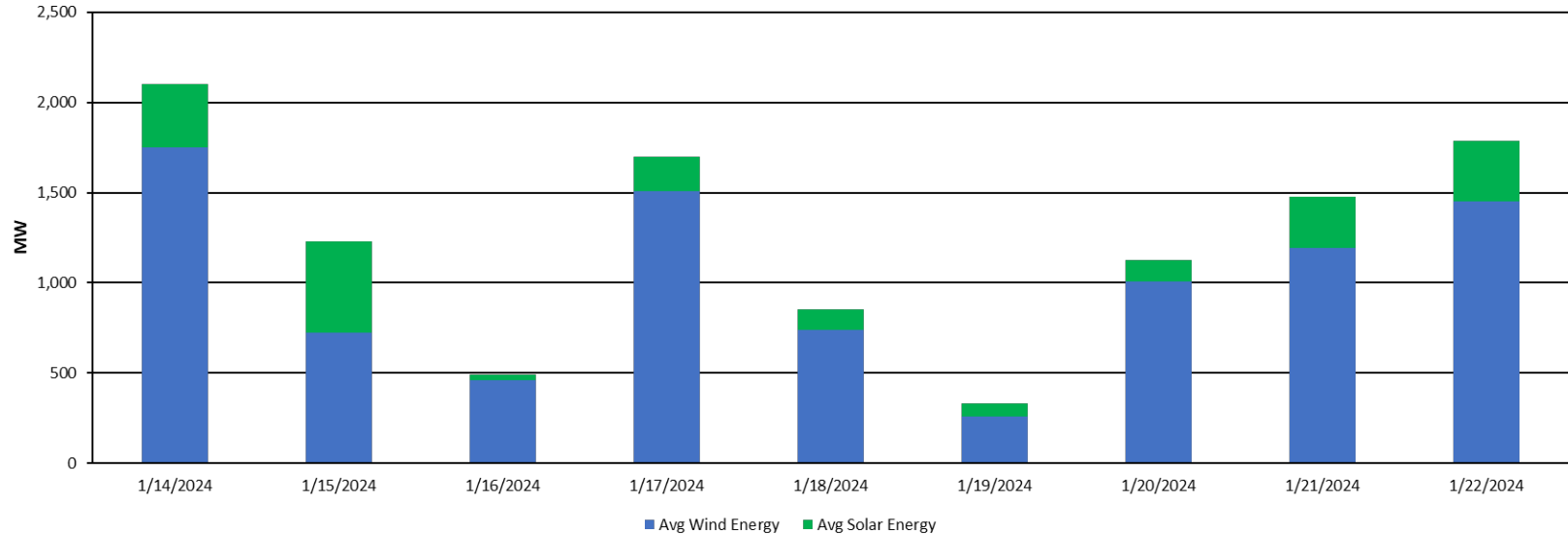
Gas System NY

- **Gas pipelines and Gas LDCs issued many of the following:**
 - Gas Alerts
 - Daily OFOs (Operational Flow Orders)
 - Hourly OFOs
 - Interruption of Transportation Services (Interruptible Gas Customers will not be able to get Gas)
- **In many cases these notices were issued with enough lead time (before the Day Ahead market closes at 5 am the prior day) to properly account for the impacts in Day Ahead Market solution**
- **NY experienced a high number of OFO conditions, including many days not identified as cold weather timeframes in this presentation**

Intermittent Generation Data

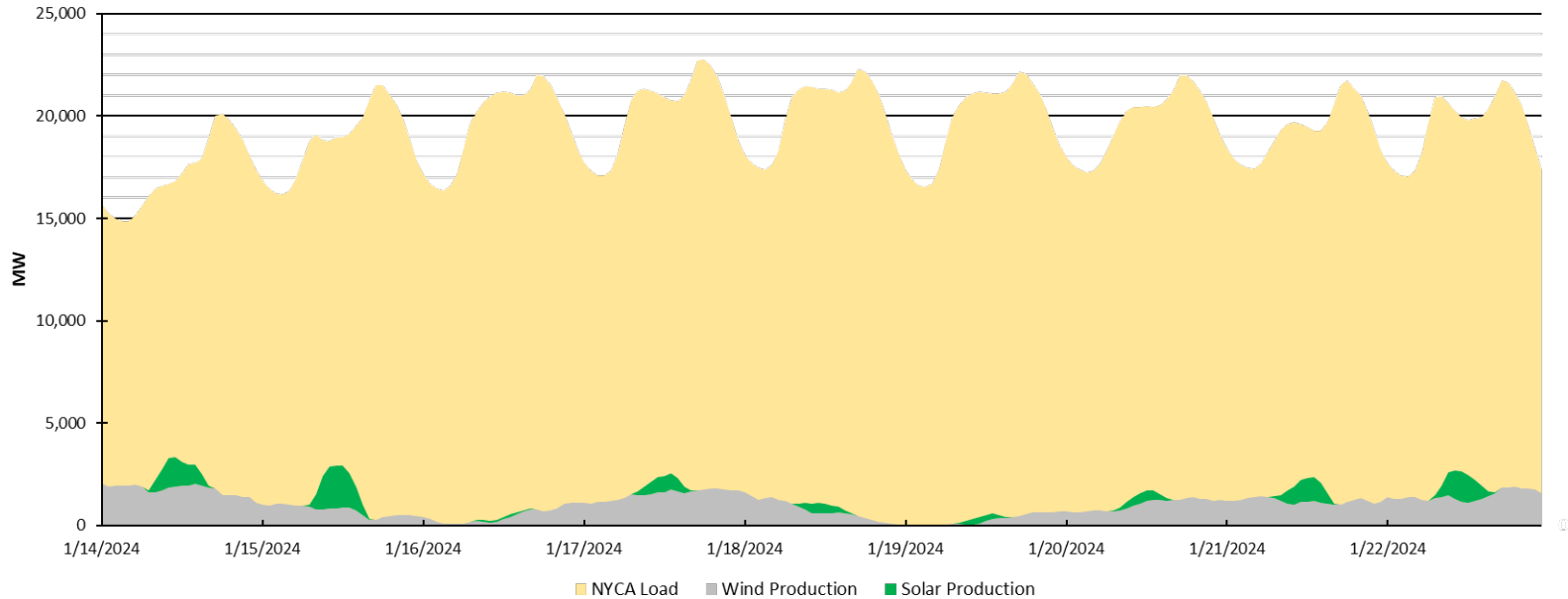
1/14 - 1/22 Renewable Chart #1

Daily Wind & Solar Production
1/14 - 1/22



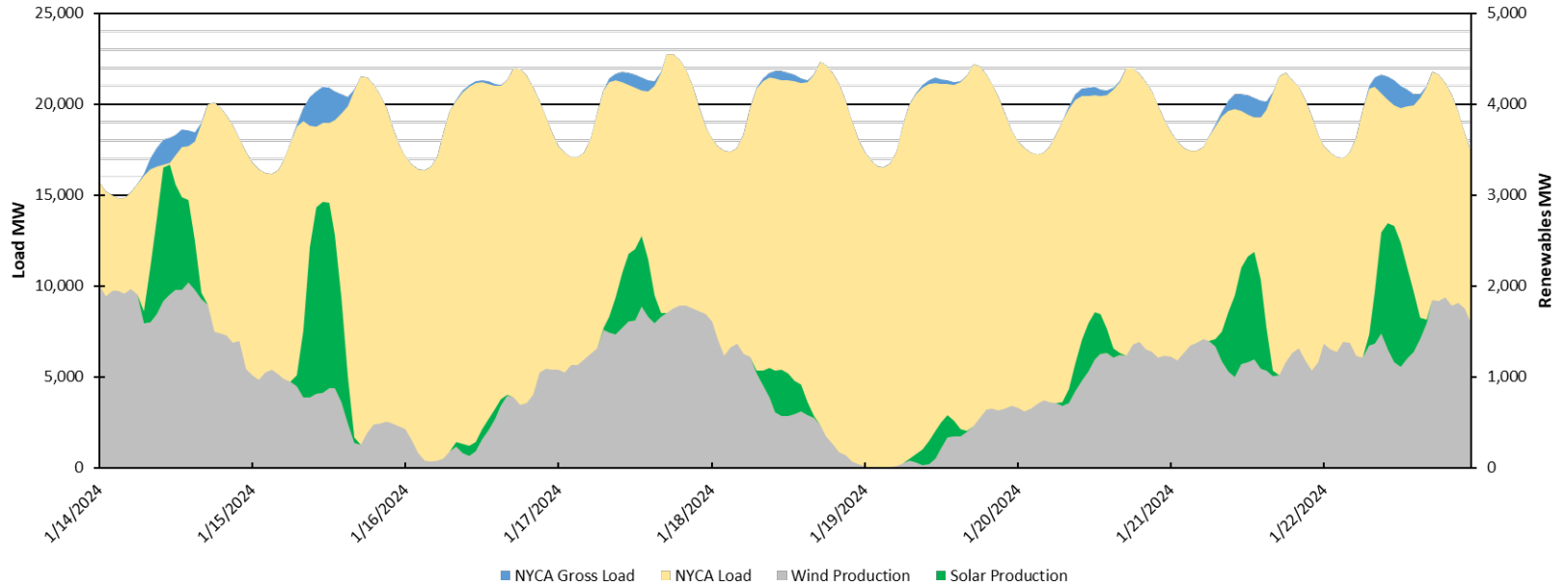
1/14 - 1/22 Renewable Chart #2b

Hourly Wind & Solar Production 1/14 - 1/22



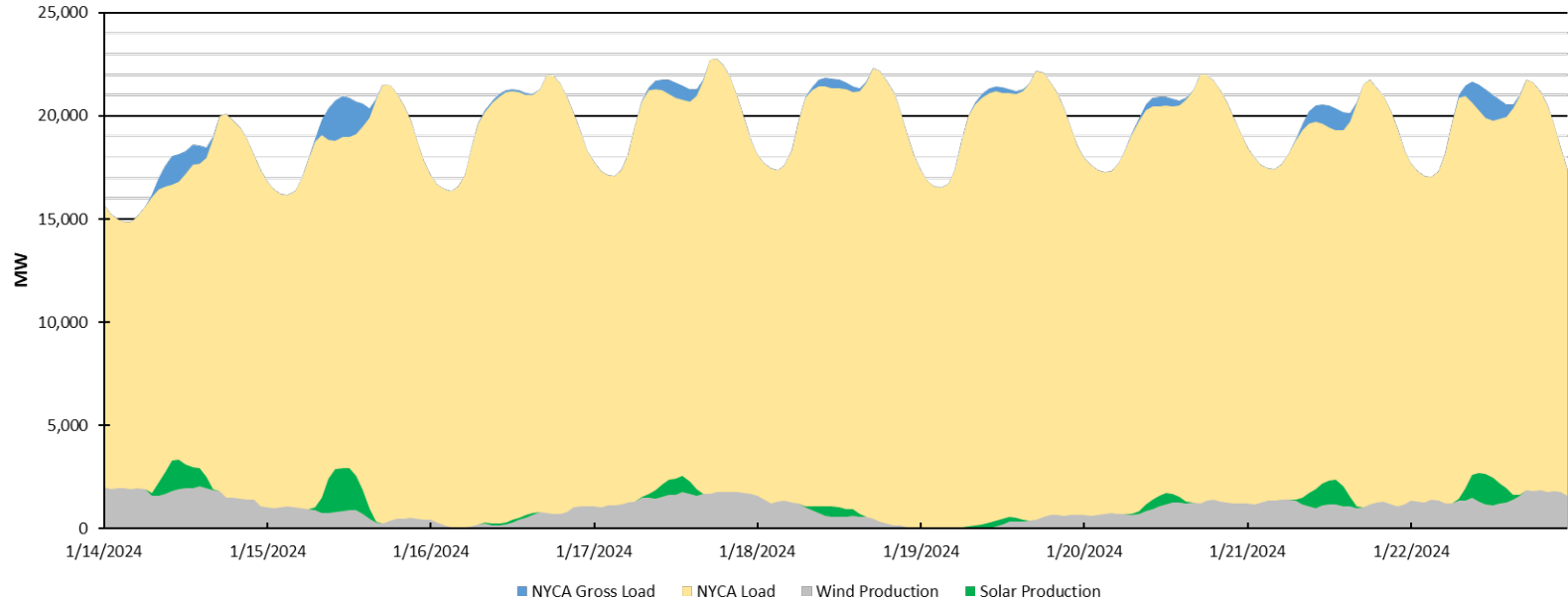
1/14 - 1/22 Renewable Chart #3a

Hourly Wind & Solar Production 1/14 - 1/22



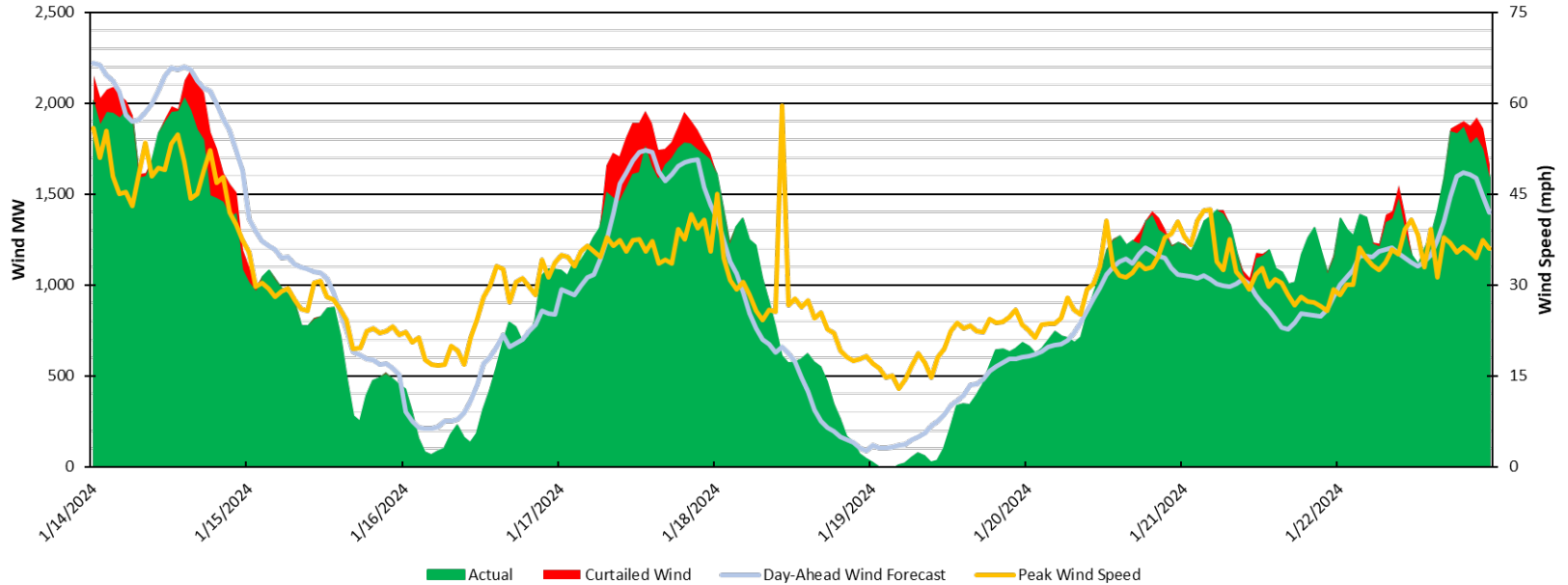
1/14 - 1/22 Renewable Chart #3b

Hourly Wind & Solar Production 1/14 - 1/22



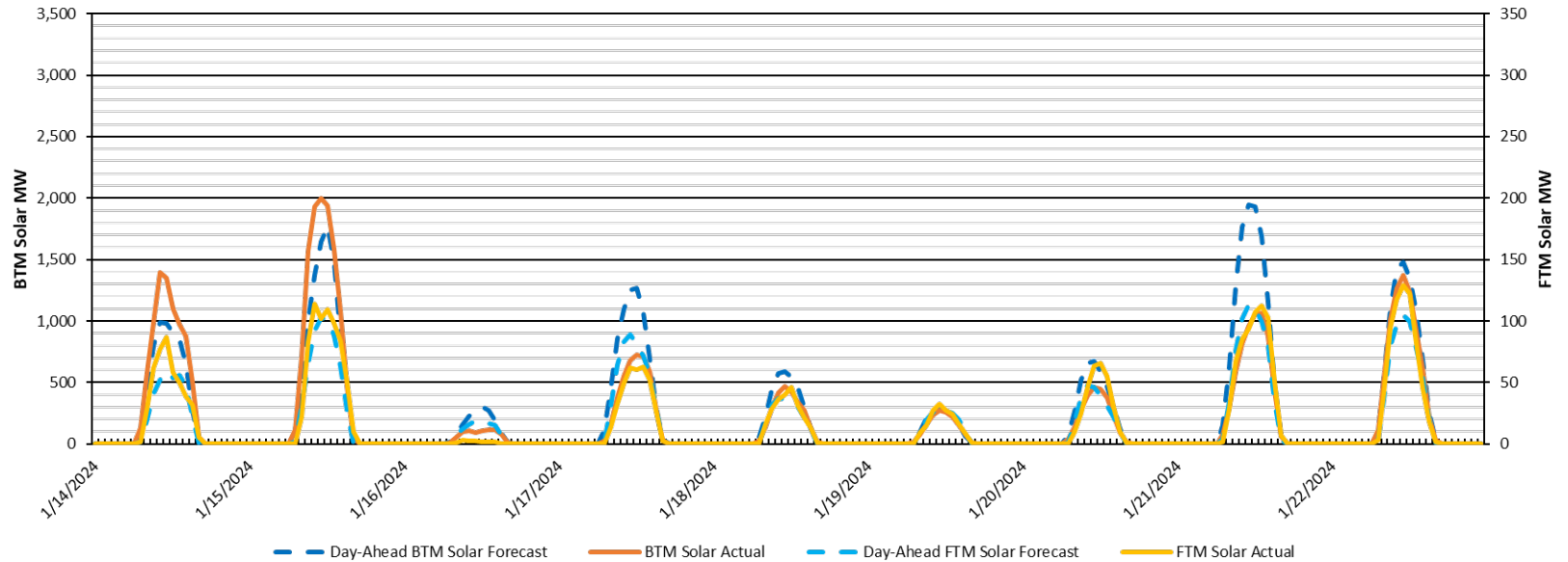
1/14 - 1/22 Wind Chart

NYCA Wind Profile (2,872 MW) 1/14 - 1/22



1/14 - 1/22 Solar Chart

NYCA Solar Profile 1/14 - 1/22
Installed Capacities - Est BTM: 5,276 MW FTM: 194 MW



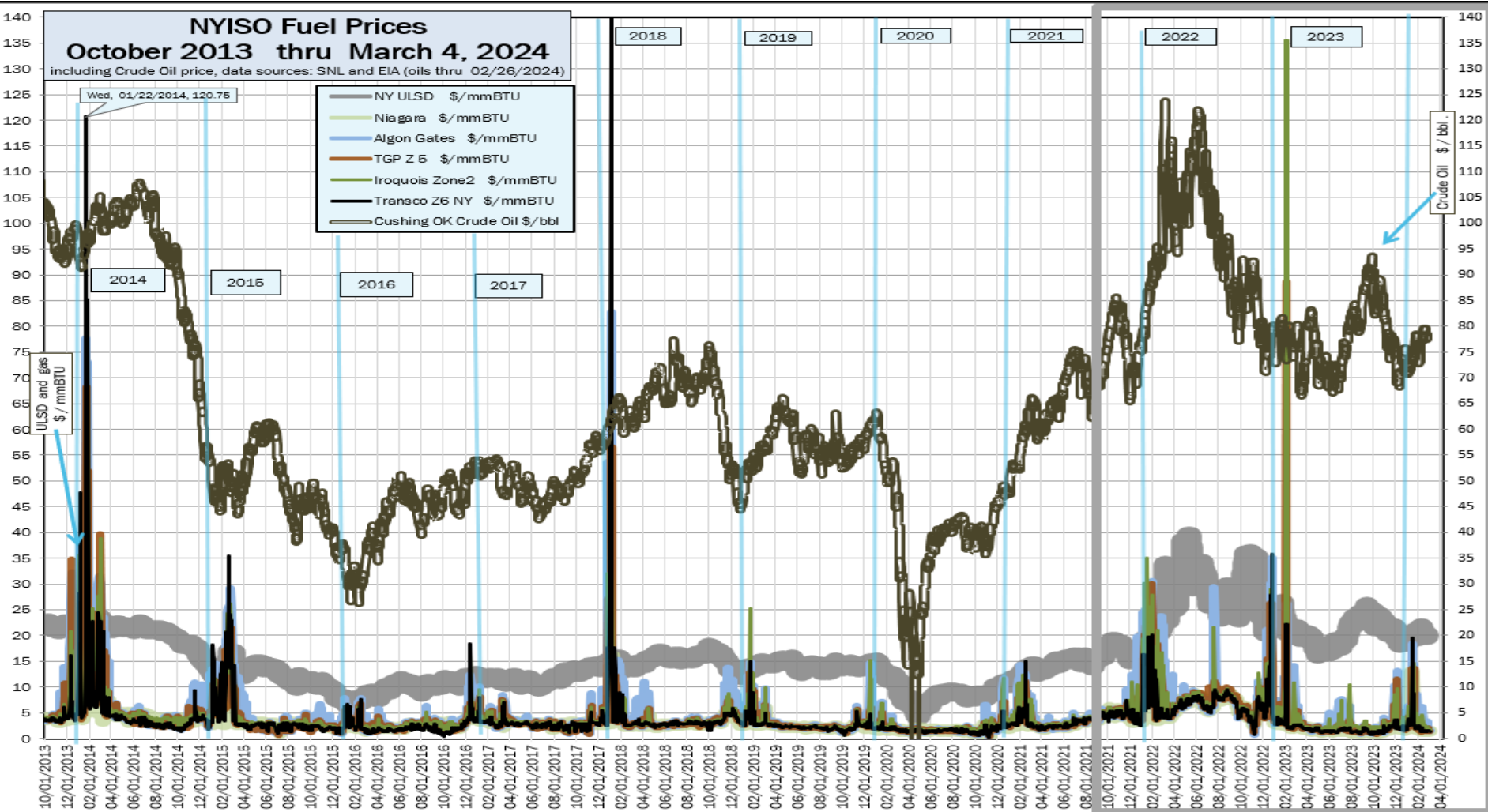
Fuel and Energy Prices

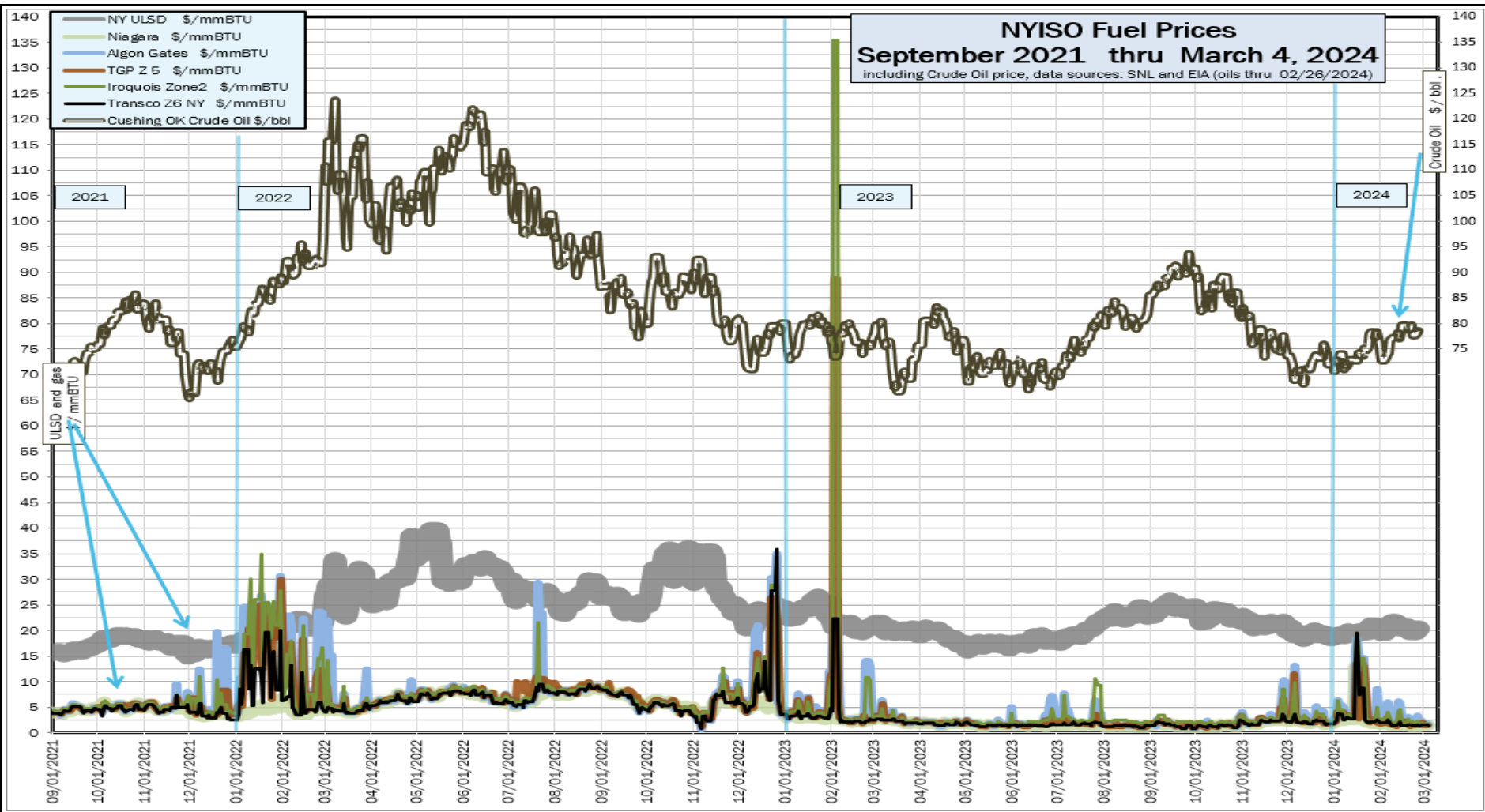
NYISO Fuel Prices

October 2013 thru March 4, 2024

including Crude Oil price, data sources: SNL and EIA (oils thru 02/26/2024)

- NY ULSD \$/mmBTU
- Niagara \$/mmBTU
- Algon Gates \$/mmBTU
- TGP Z 5 \$/mmBTU
- Iroquois Zone2 \$/mmBTU
- Transco Z6 NY \$/mmBTU
- Cushing OK Crude Oil \$/bbl

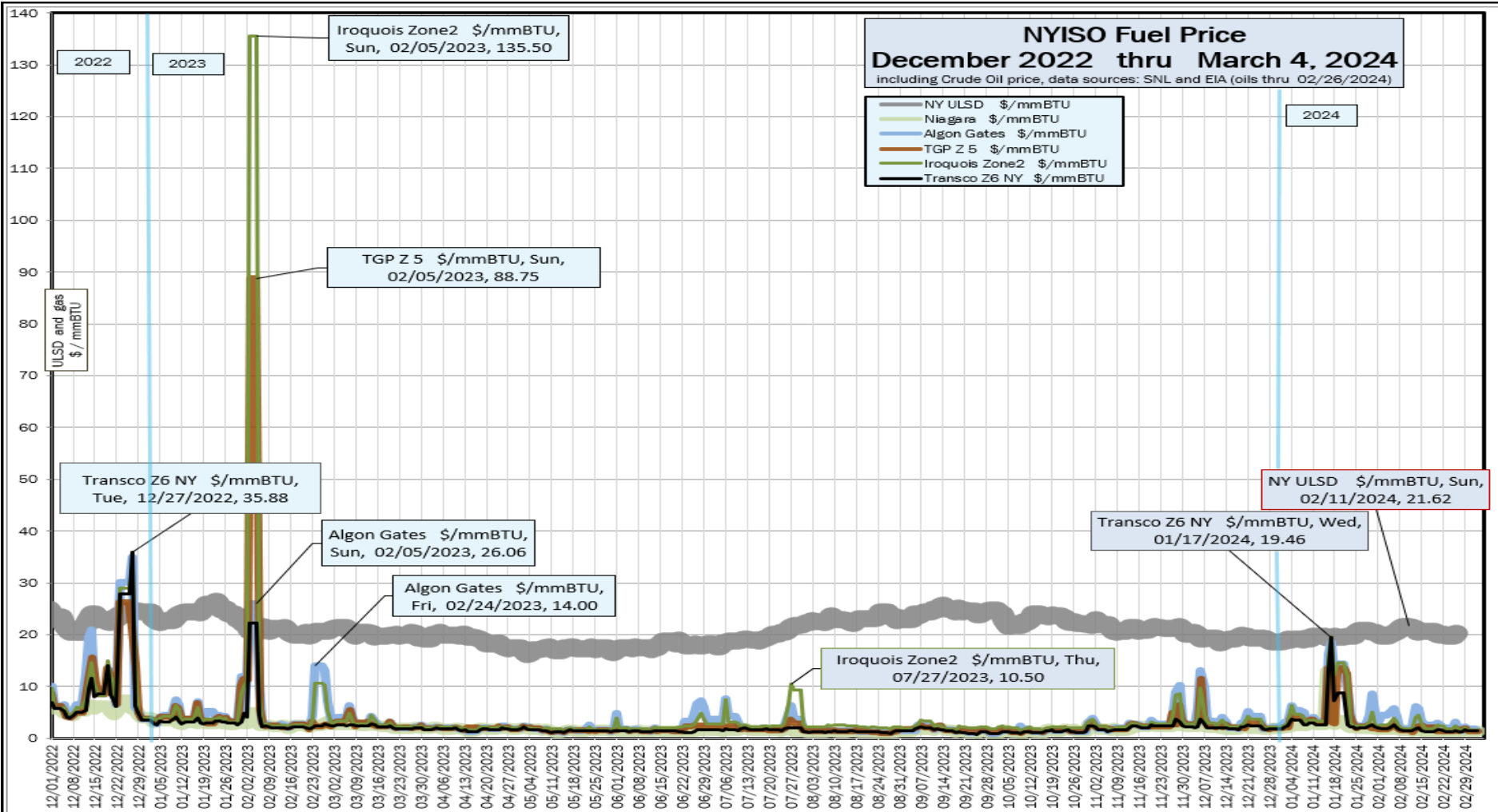


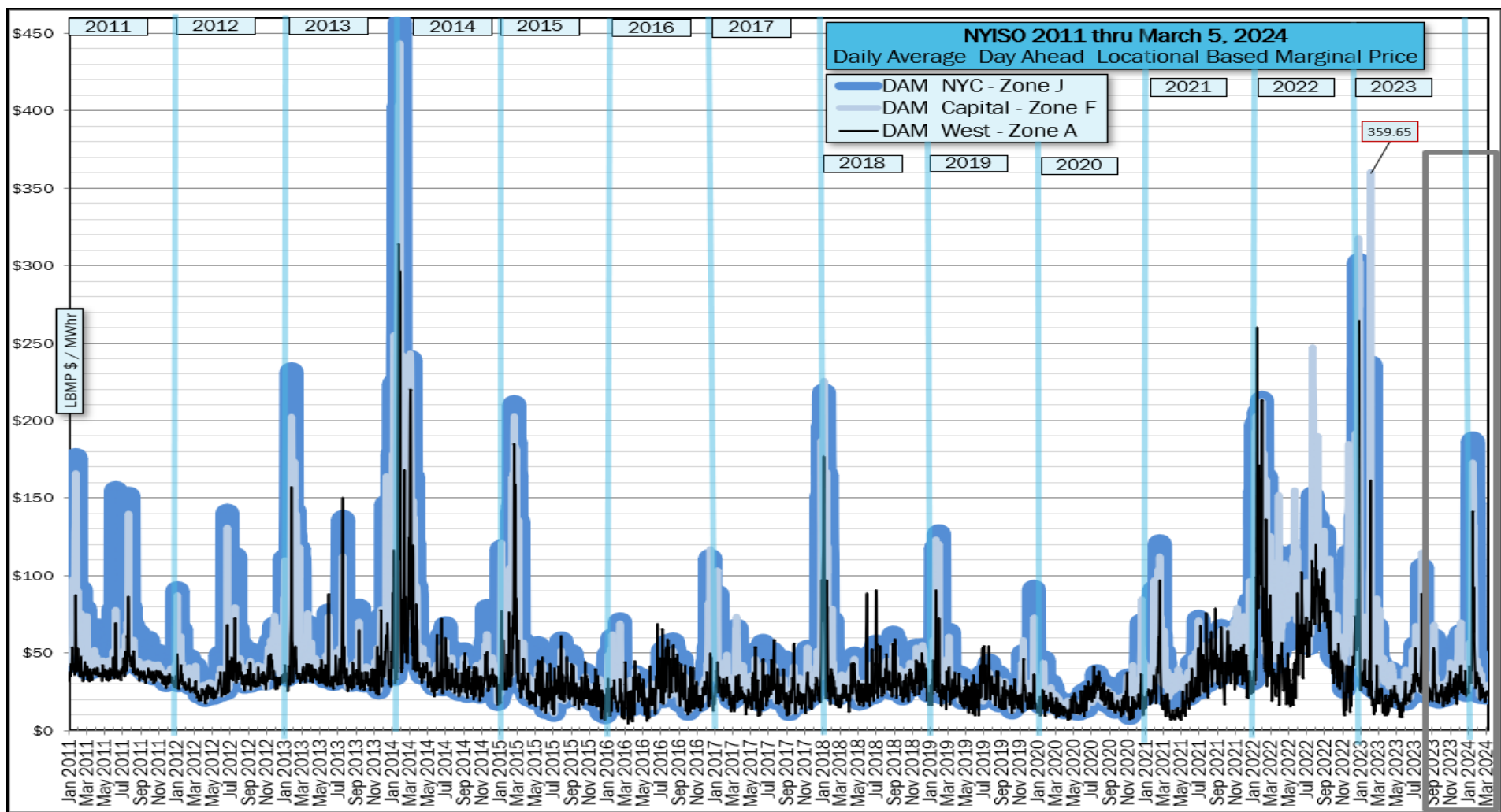


NYISO Fuel Price

December 2022 thru March 4, 2024

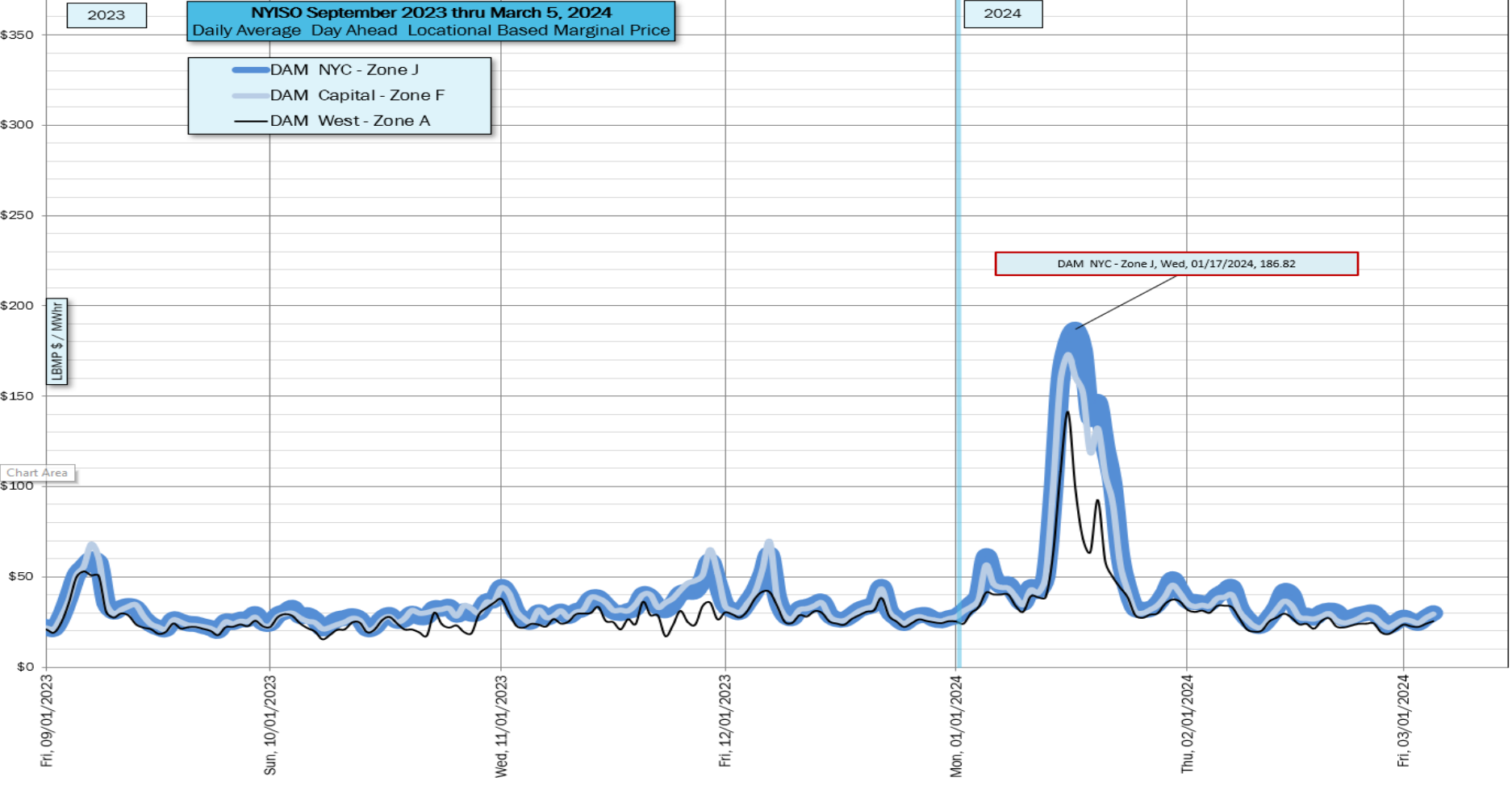
including Crude Oil price, data sources: SNL and EIA (oils thru 02/26/2024)





NYISO September 2023 thru March 5, 2024
Daily Average Day Ahead Locational Based Marginal Price

- DAM NYC - Zone J
- DAM Capital - Zone F
- DAM West - Zone A



Questions?