

# **Winter 2021-2022 Cold Weather Operations**

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**NYISO Management Committee**

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# Key Observations from Winter 2021/22

- First winter season operating without Indian Point 2 & 3
- High natural gas and LNG prices in eastern NY/NE based on world markets
- Significant stored fuel burned in January and inventory levels have not been replenished. Operations will continue to monitor replenishment in preparation for winter 2022/23.
- 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.
- Proposing a 2023 project to refresh the Fuel and Energy Security assessment conducted by AG in 2019 with updated future assumptions.
- Estimated supply mix for the peak hour, 30% natural gas, 21% oil, 15% hydro, 15% imports, 14% nuclear, 2% other fossil, 2% wind, 1% other renewables

# Peak Loads

- NYISO all-time Winter Electric Peak Load was 25,738 MW on January 7, 2014
- NYISO Seasonal 50-50 Load Forecast was 24,025 MW for Winter 2021/2022
- The Winter 2021/2022 Winter Actual Peak was 23,237 MW on Tuesday, January 11, 2022

# Variable Winter Weather Prevailed

Average Temperatures and Departures from 1991 – 2020 Normals					
Station	December	January	February	Season	Coldest
Islip	41.7 °F (+4.6 °F)	28.8 °F (-3.1 °F)	34.7 °F (+1.4 °F)	35.1 °F (+1.0 °F)	6 °F (1/30 & 1/31)
Central Park	43.8 °F (+4.7 °F)	30.3 °F (-3.4 °F)	37.3 °F (+1.4 °F)	37.1 °F (+0.9 °F)	10 °F (1/15 & 1/16)
Albany	36.1 °F (+5.7 °F)	19.7 °F (-4.7 °F)	27.5 °F (+0.7 °F)	27.8 °F (+0.6 °F)	-6 °F (1/22)
Syracuse	38.0 °F (+7.6 °F)	19.5 °F (-4.6 °F)	27.8 °F (+2.3 °F)	28.4 °F (+1.7 °F)	-9 °F (1/22 & 1/30)
Buffalo	38.2 °F (+6.8 °F)	21.9 °F (-3.6 °F)	28.5 °F (+2.1 °F)	N/A	1 °F (1/22)

Data Source: NWS Local Offices ([www.weather.gov](http://www.weather.gov))

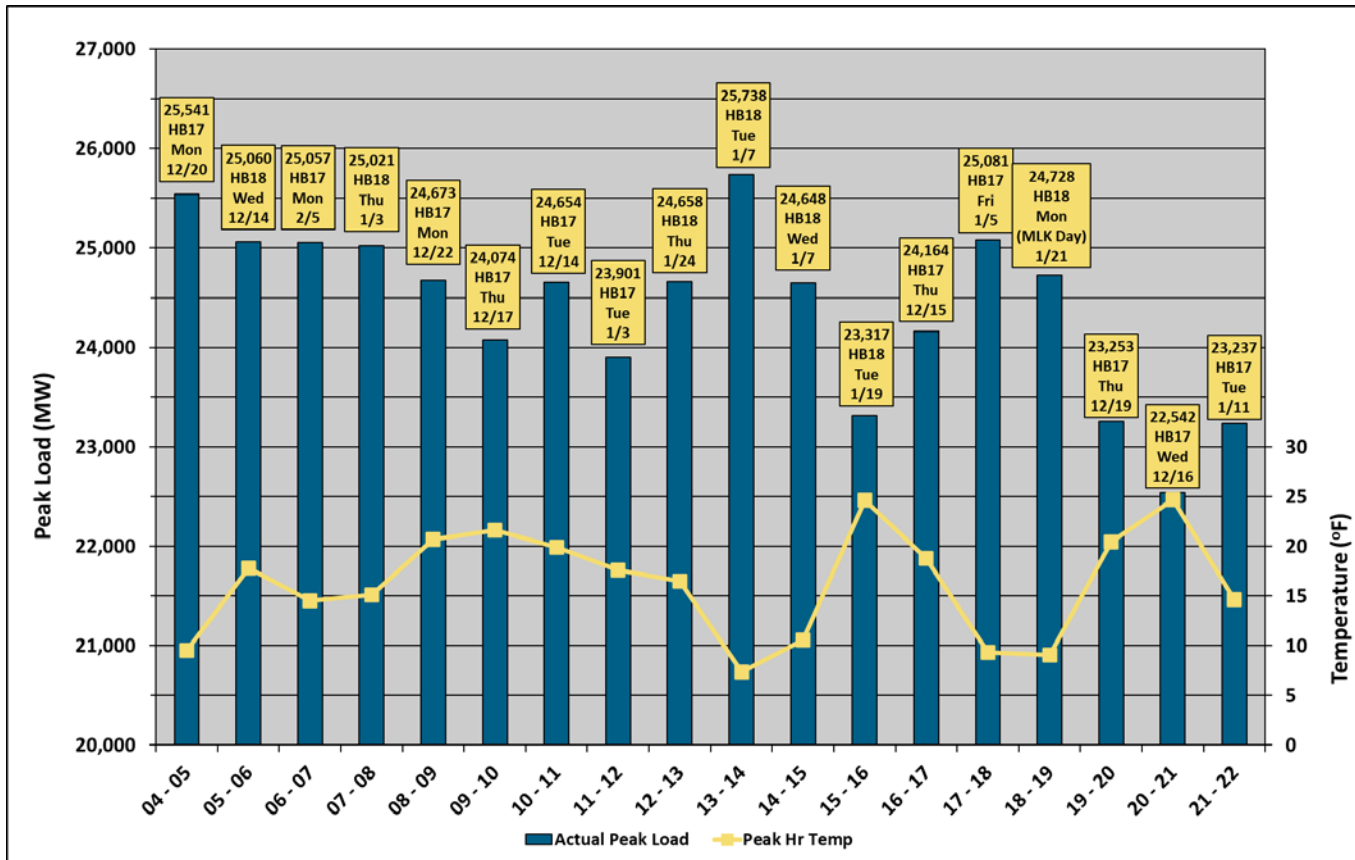
# Cold Weather Conditions (1/7, 1/10 – 1/12) Electric Peak

- 1st instance of significantly cold weather without coal generation and Indian Point 2&3.
- OFOs
  - Con Ed 1/24<sup>th</sup> Hourly OFO, 1/11/22 04:00 - 1/12/22 10:00
  - NG Downstate Tier 1 Interruption, 1/11/22 06:00 – 1/12/22 10:00
- SREs – 1/11/22, Bethlehem 2, HB7-22 for statewide capacity (generator performance)
- 1/11/22 - The day-ahead forecast was 23,720 MW. The forecast peak temperature index was 14.4°F. Partly to mostly sunny, breezy, and very cold. The Actual peak on 1/11/22 and peak of the winter was 23,237 MW, HB17.
- Forecast highs were mainly in the teens upstate to lower-20s downstate. Overnight lows were in the single digits (east) to lower-teens (west) upstate and mid-teens to near 20 downstate, with temperatures expected to steadily rise a bit overnight.

# Longest consecutive Cold Weather Conditions (1/25 – 2/1)

- Estimated largest hourly stored fuel burn for the season (4,550 MWh) occurred on 1/29/2022 HB13
- OFOs
  - Con Ed 1/20<sup>th</sup> Hourly OFO, 1/26/22 04:00 - 1/27/22 10:00 & 2/1/22 04:00 - 10:00
  - Con Ed 1/24<sup>th</sup> Hourly OFO 1/29/22 04:00 - 1/31/22 10:00
  - NG Downstate Tier 2 Interruption, 1/26/22 22:00 - 1/27/22 12:00
  - NG Downstate Tier 1 Interruption, 1/29/22 10:00 - 1/31/22 10:00
- SREs
  - 1/25/22 - Astoria 3, HB10-23 for statewide capacity concerns due to colder weather/increased load forecast and uncertainty in DAM scheduled imports.
  - 1/28/22 - In-day SRE of Roseton 1 HB15-23 for statewide capacity concerns due to generator performance and uncertainty in DAM scheduled imports.
- 1/29/22 - The day-ahead forecast was 22,070 MW. The forecast peak temperature index was 15.5°F. Mostly cloudy, cold, and windy as snow, moderate to heavy at times continues throughout the day, especially downstate.
- Published downstate highs were expected to occur shortly after midnight, with afternoon highs ranging from the lower- to mid-teens upstate to the lower-20s downstate. Overnight lows range from the single digits (and lower in northern areas) upstate to the mid-teens downstate.

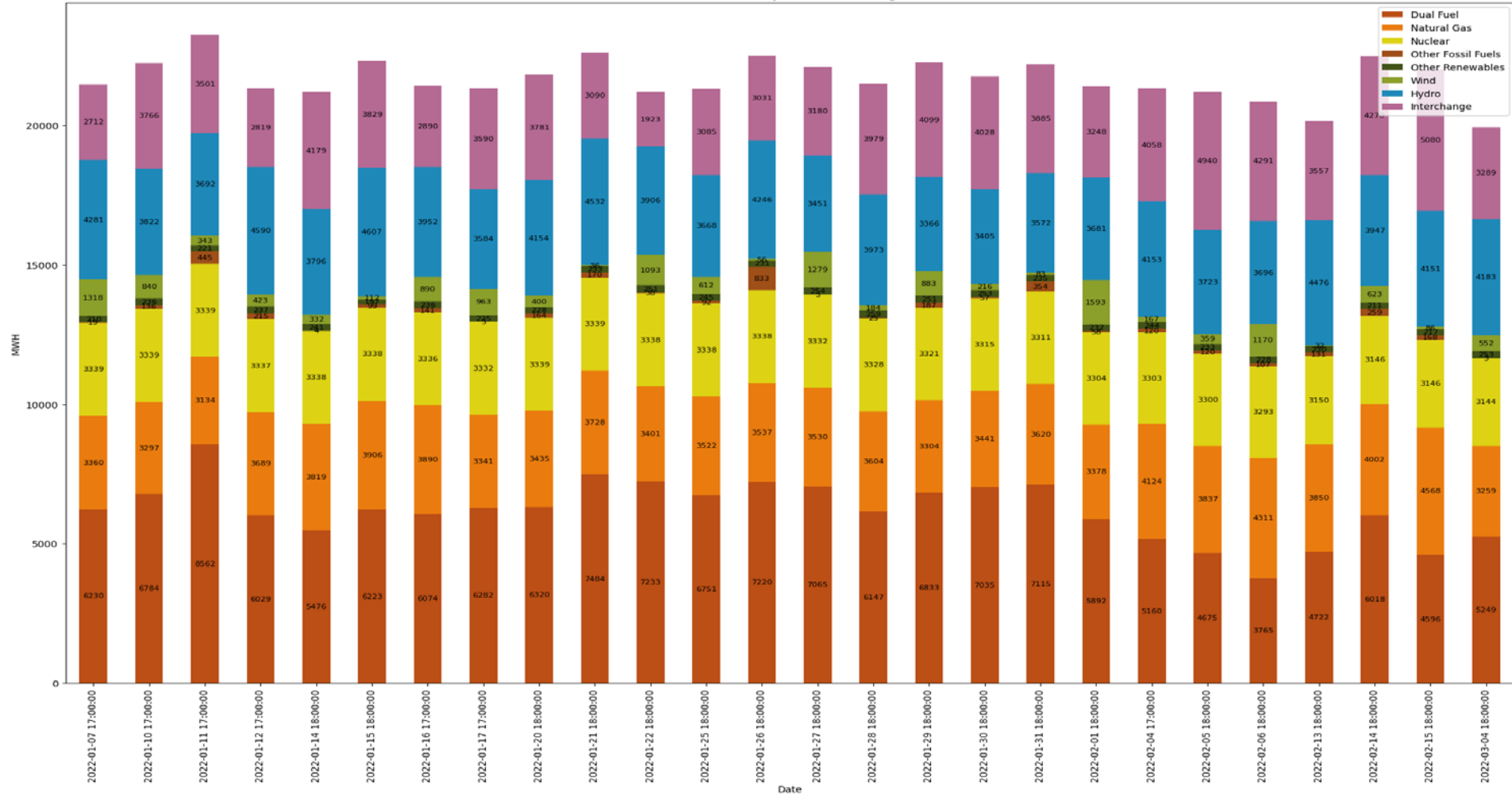
# Winter Peak Loads in MW: 2004-05 to 2021-22



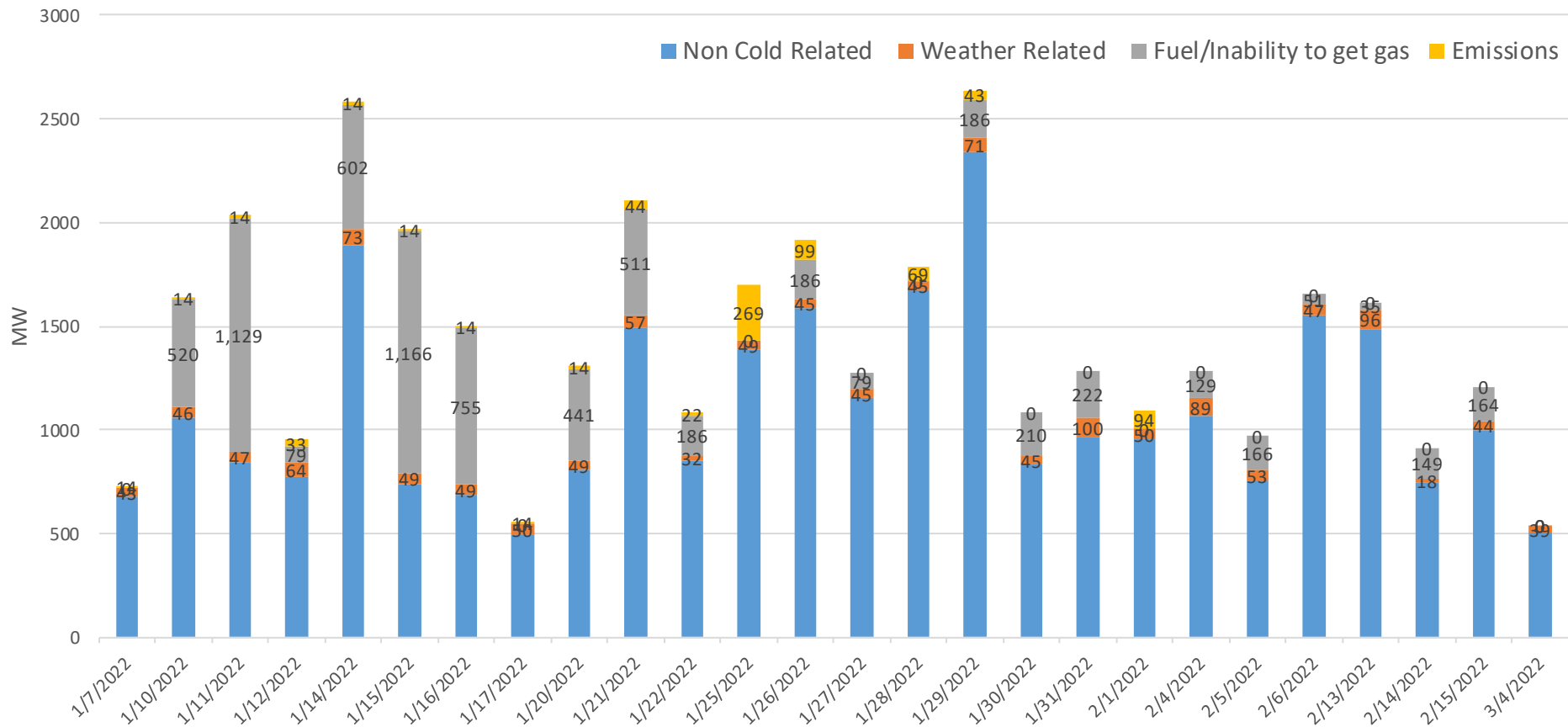
# Gen Mix, Outage data, and Fuel Inventory/Burn



Total Actual Generator by Fuel Mix During Peak Hours

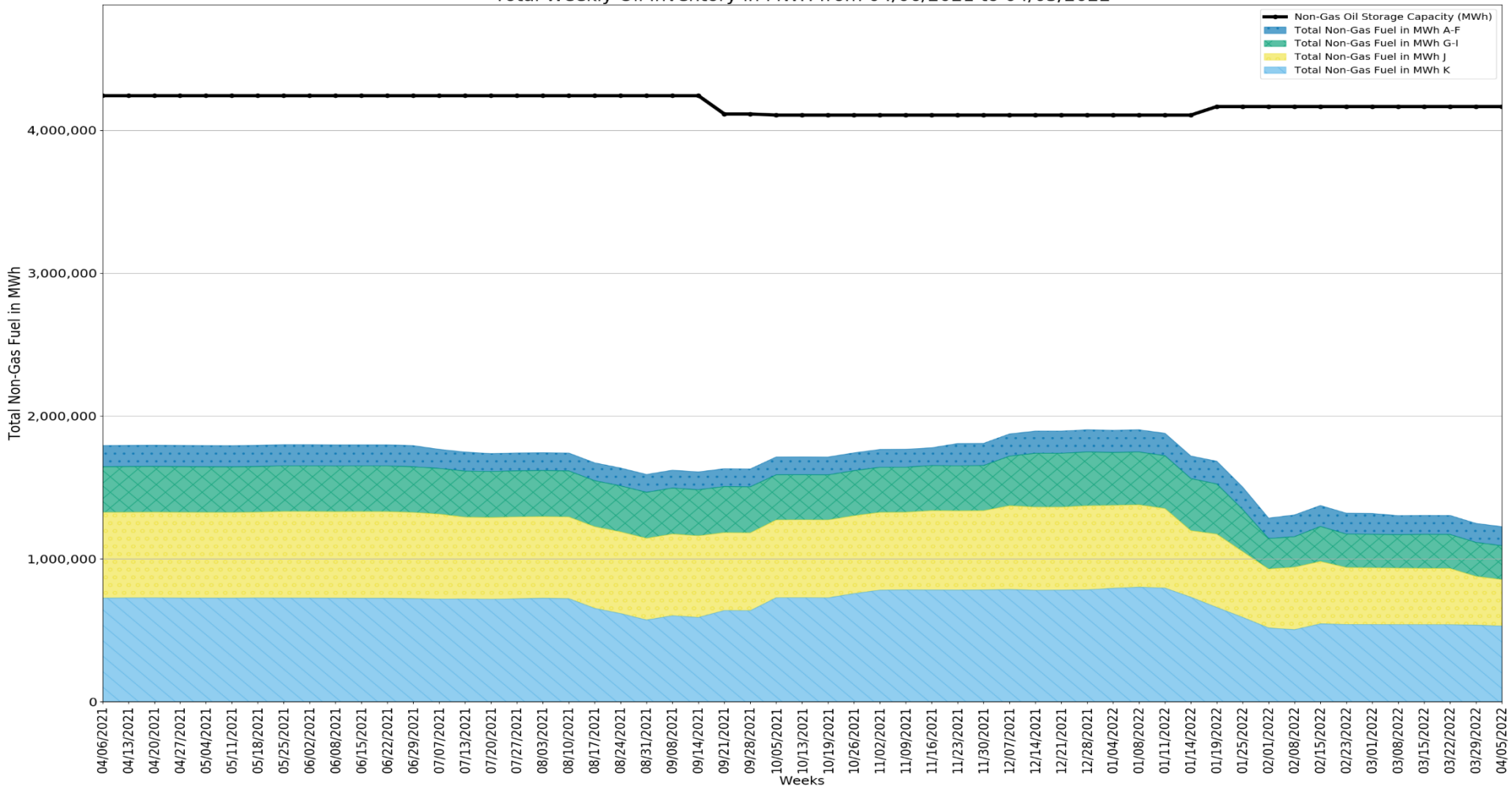


# Thermal and Hydro Forced Outages and Forced Derates by Category - Over Peak Hours

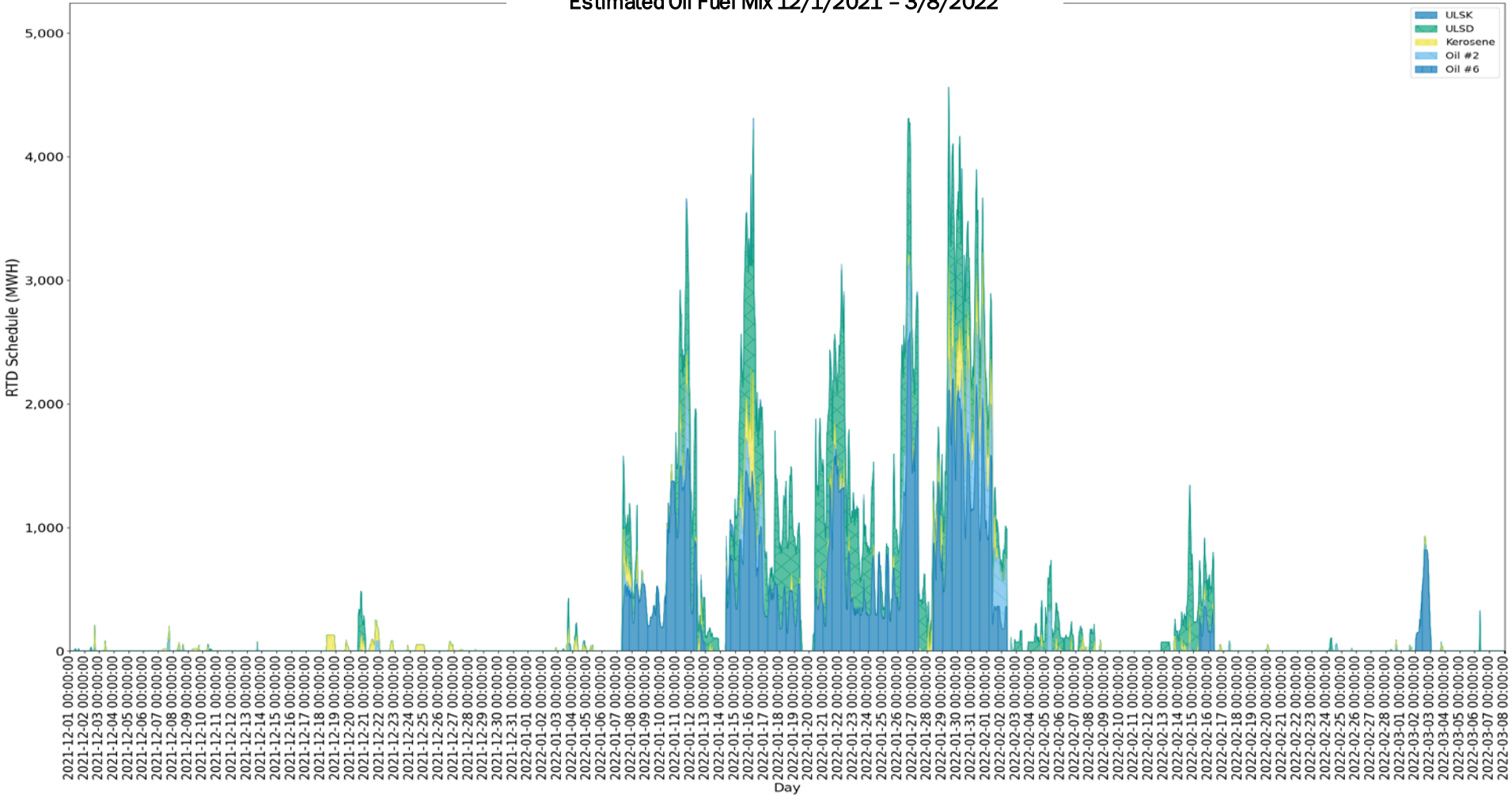


In the November 17, 2021 Management Committee presentation, "2021-22 Winter Assessment & Winter Preparedness" based on 60 months of history the projection was 2,768MW of Hydro and Thermal Forced outages

Total Weekly Oil Inventory in MWH from 04/06/2021 to 04/05/2022



# Estimated Oil Fuel Mix 12/1/2021 - 3/8/2022



# 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 (Ad-hoc fuel surveys issued 1/7/22 & 1/13/22)
- 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.)
- No need for emergency purchases from neighboring control areas to resolve capacity issues.

# Gas System NY

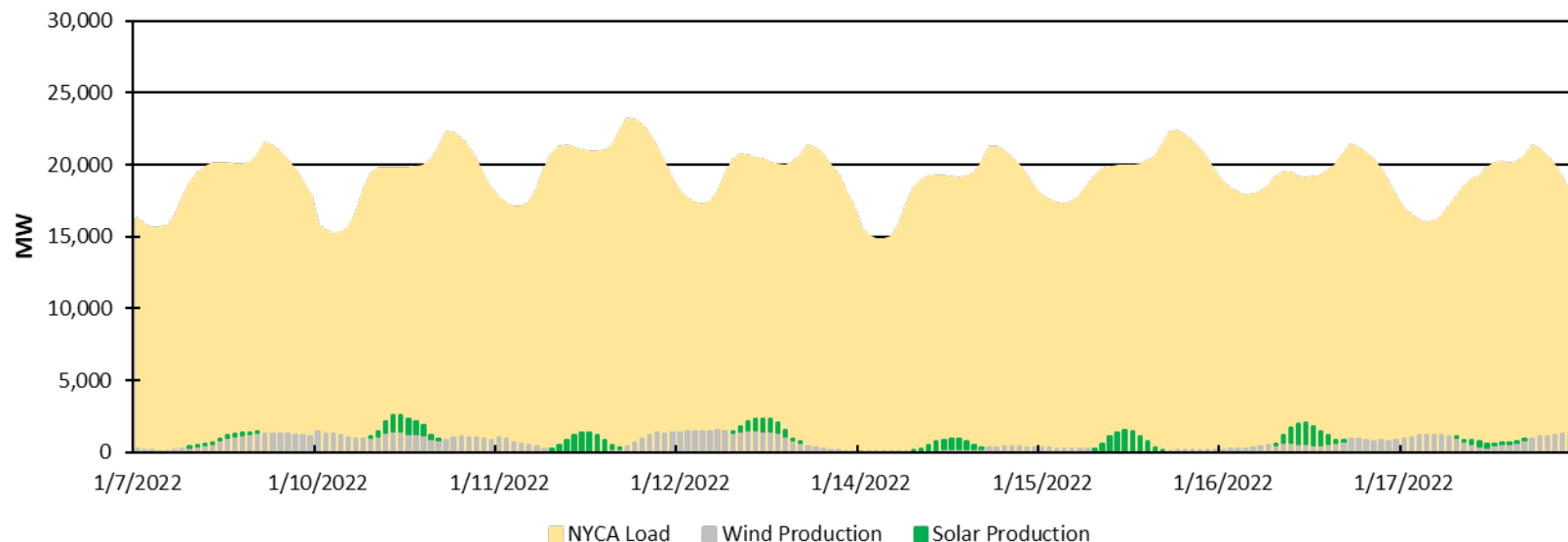
- **The interstate and gas LDC pipelines all remained in-service**
- **Gas pipelines and Gas LDCs issued many of the following**
  - Gas Alerts
  - Daily OFOs (Operational Flow Orders)
  - Hourly OFOs
  - Interruption of Transportation Services (Interruptible Gas Customers will not be able to get Gas)
- **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 during Winter 2022 including many days not identified as cold weather timeframes in this presentation.**

# Intermittent Generation Data



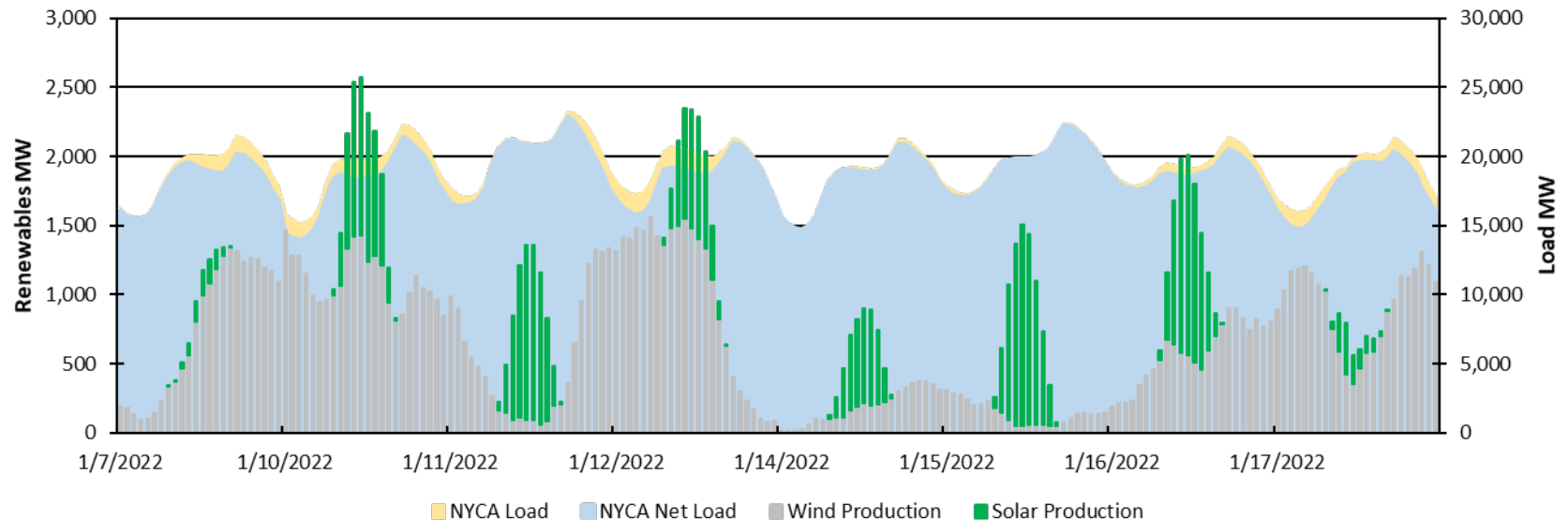
# 1/7, 1/10 – 1/12, 1/14 – 1/17 Renewable Chart #2b

Hourly Wind & Solar Production 1/7, 1/10 - 1/12, 1/14 - 1/17

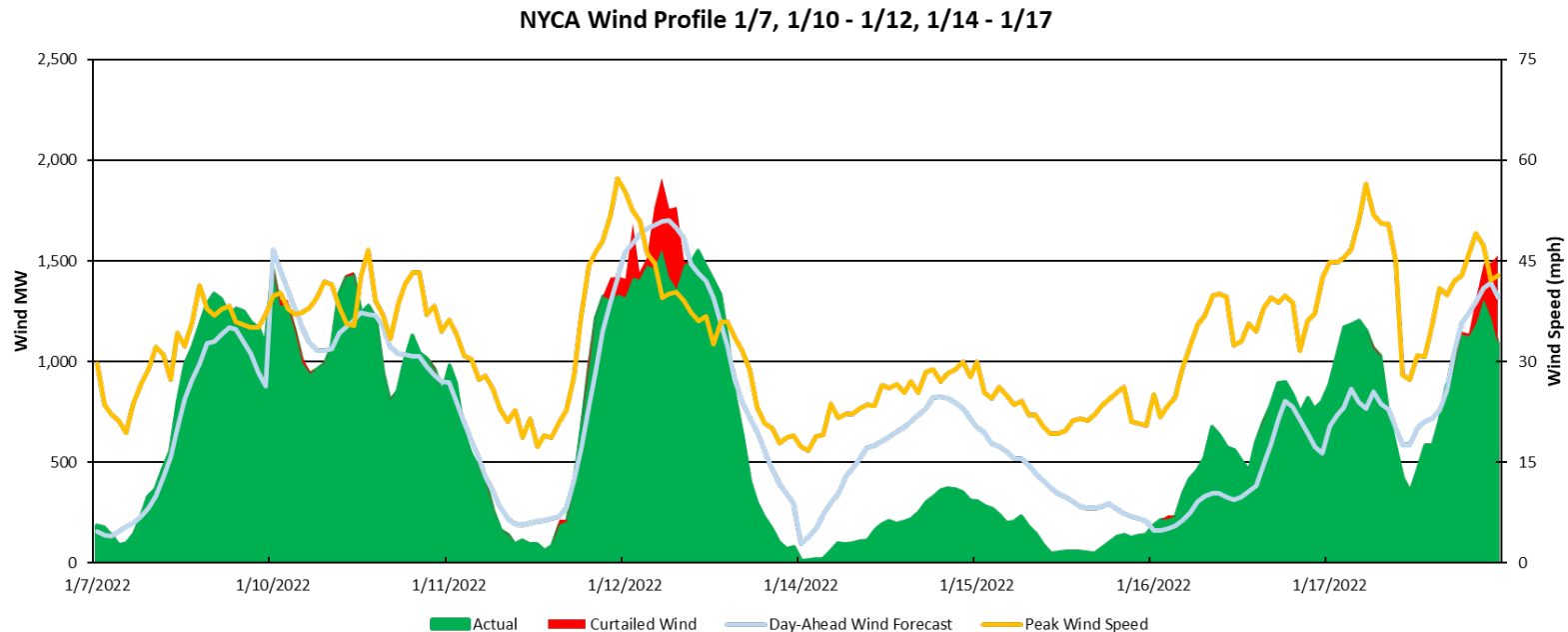


# 1/7, 1/10 – 1/12, 1/14 – 1/17 Renewable Chart #3

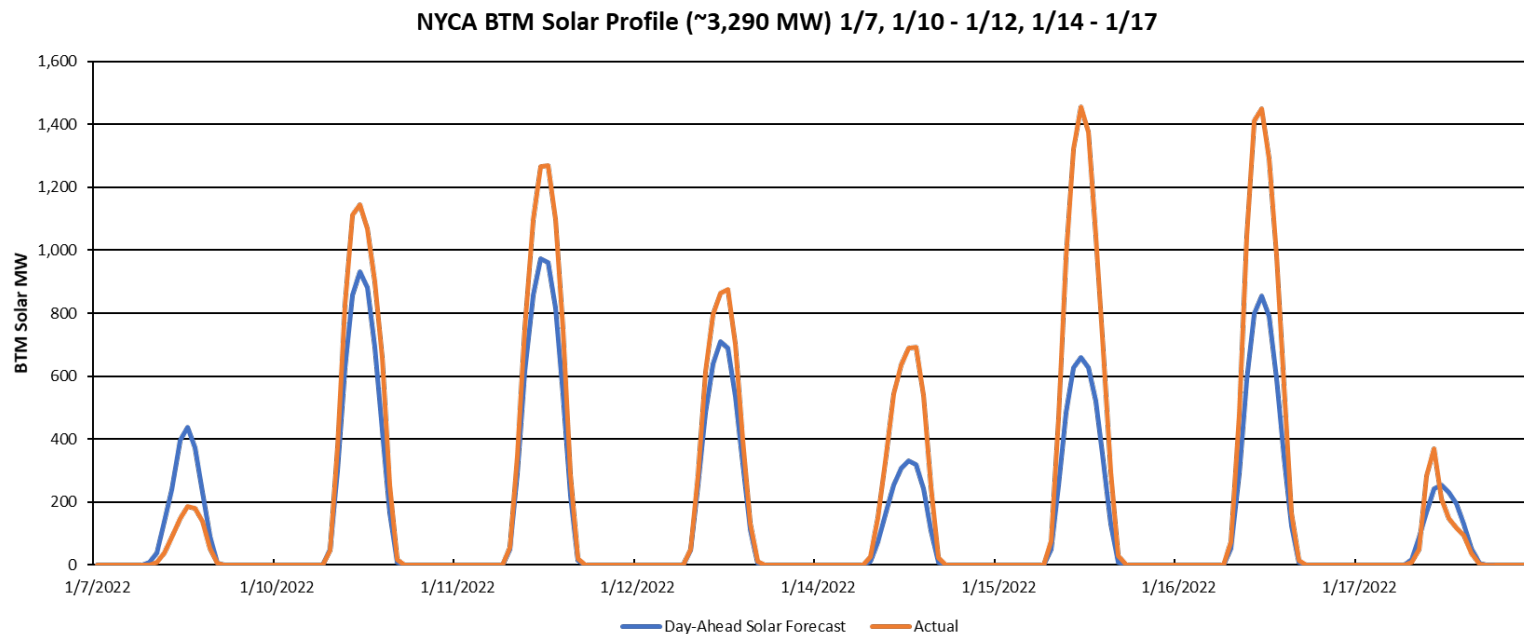
Hourly Wind & Solar Production 1/7, 1/10 - 1/12, 1/14 - 1/17



# 1/7, 1/10 – 1/12, 1/14 – 1/17 Wind Chart

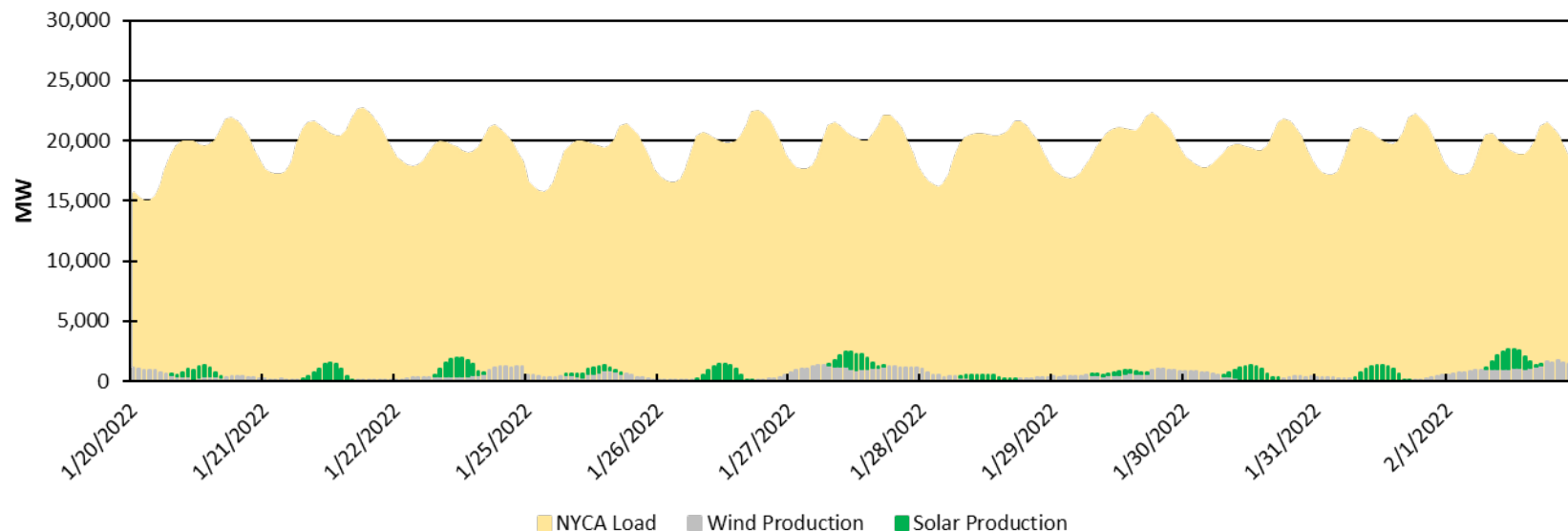


# 1/7, 1/10 – 1/12, 1/14 – 1/17 Solar Chart



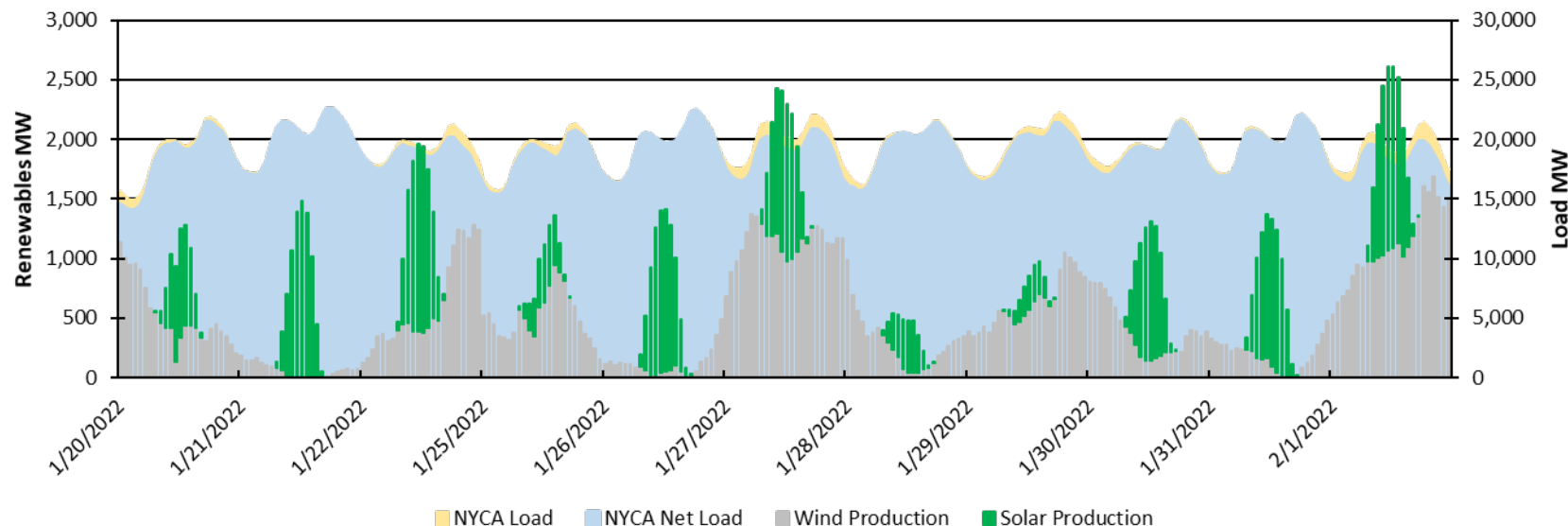
# 1/20 - 1/22, 1/25 - 2/1 Renewable Chart #2b

Hourly Wind & Solar Production 1/20 - 1/22, 1/25 - 2/1

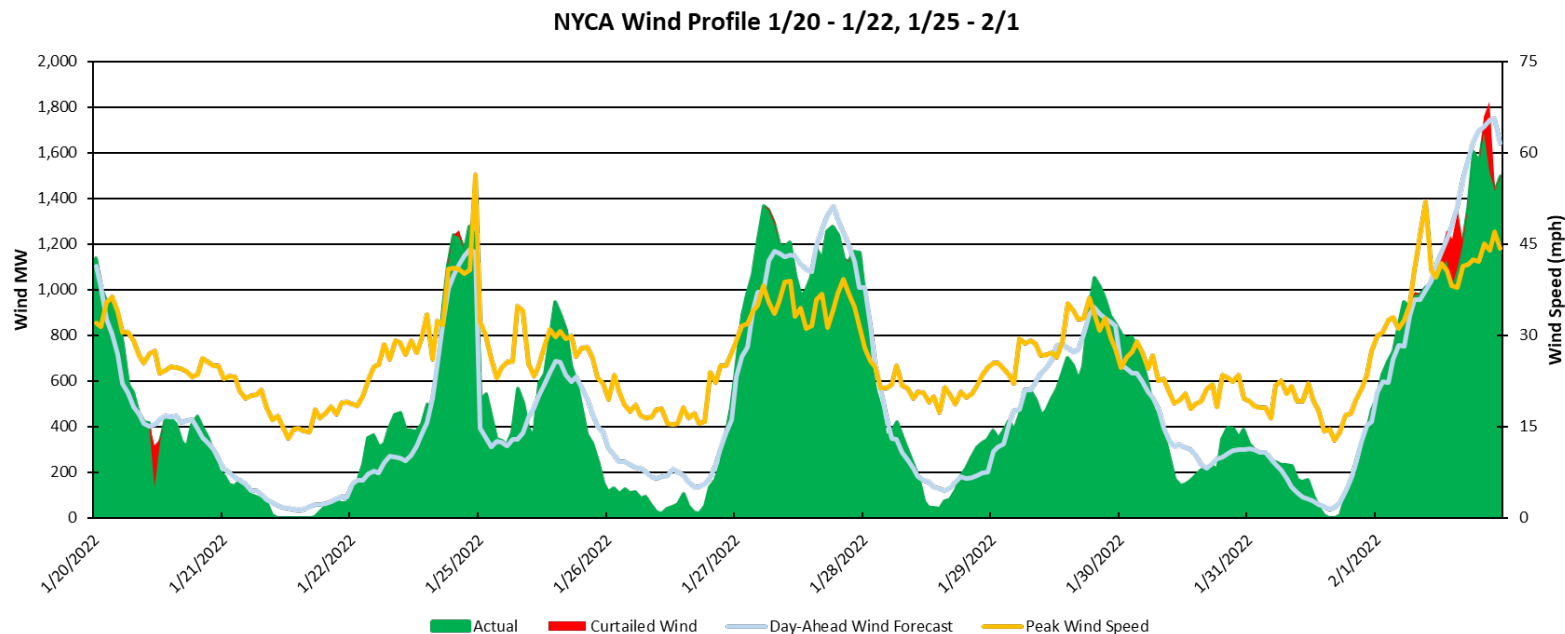


# 1/20 - 1/22, 1/25 - 2/1 Renewable Chart #3

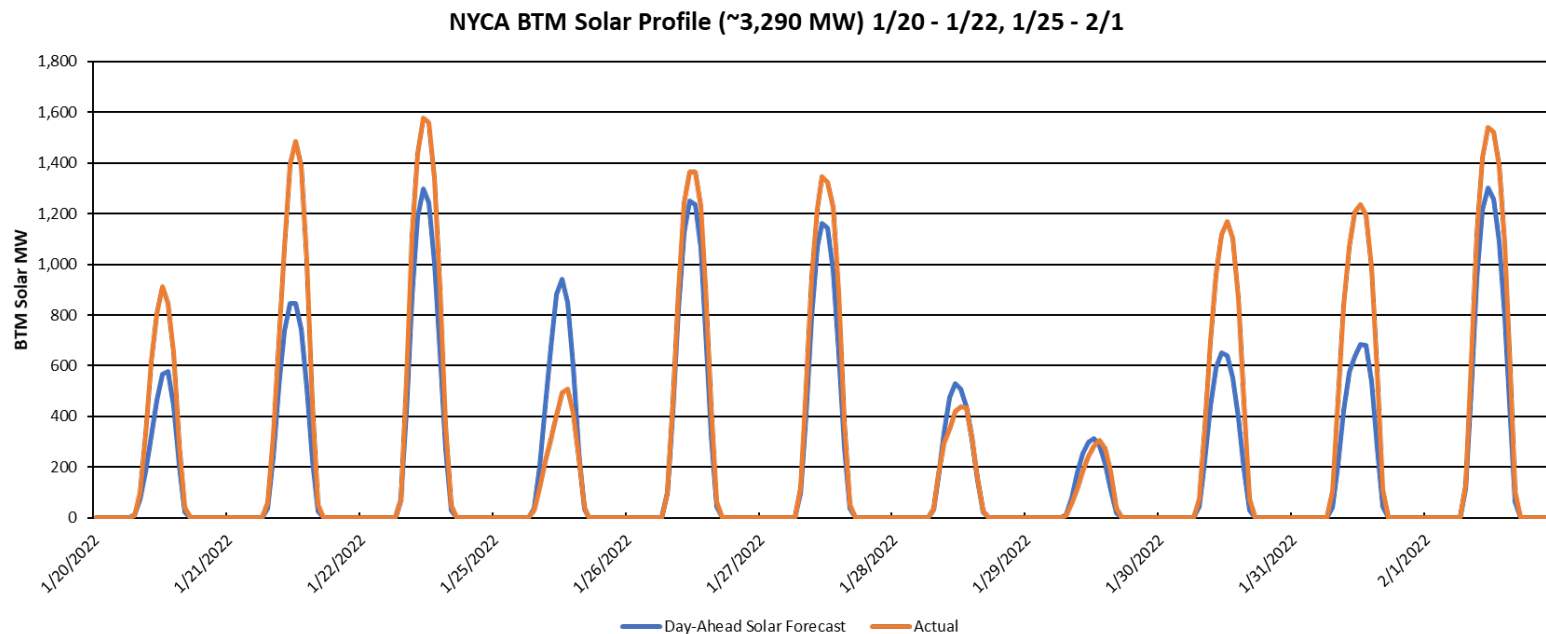
Hourly Wind & Solar Production 1/20 - 1/22, 1/25 - 2/1



# 1/20 - 1/22, 1/25 - 2/1 Wind Chart

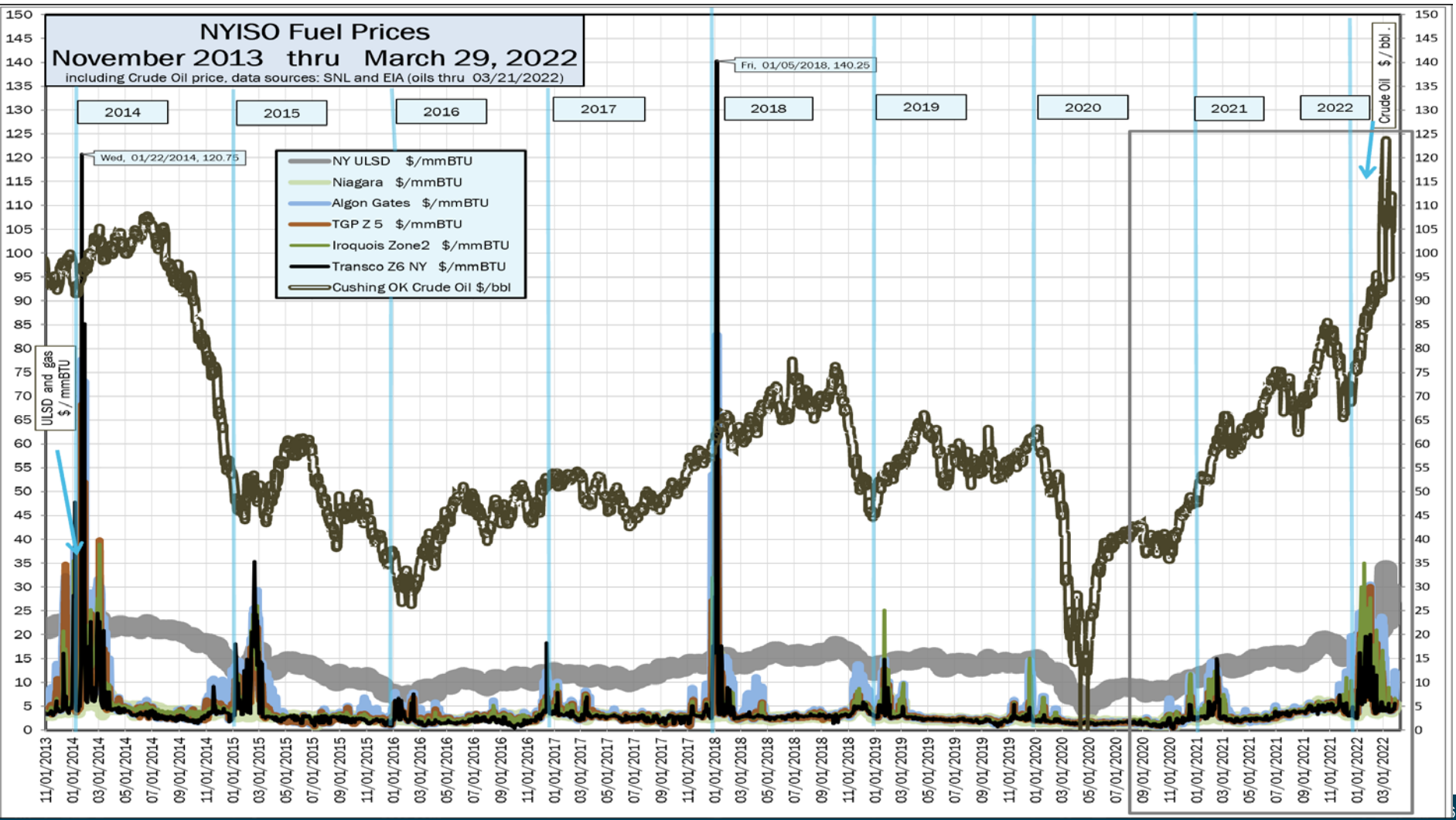


# 1/20 - 1/22, 1/25 - 2/1 Solar Chart





# Fuel and Energy Prices



# NYISO Fuel Prices September 2021 thru March 29, 2022

including Crude Oil price, data sources: SNL and EIA (oils thru 03/21/2022)

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

ULSD and gas  
\$/ mmBTU

Crude Oil \$ / bbl .

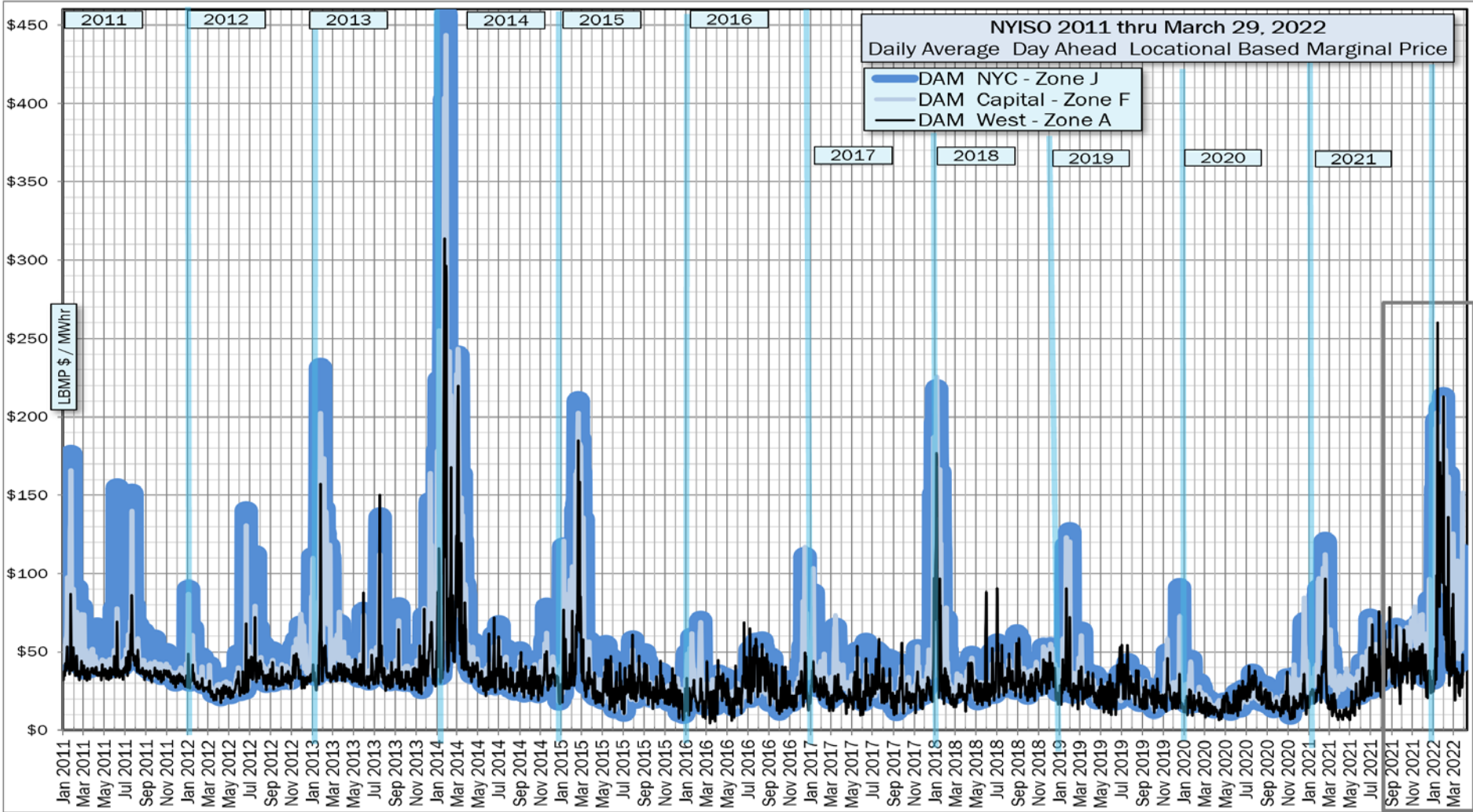
09/01/2020 10/01/2020 11/01/2020 12/01/2020 01/01/2021 02/01/2021 03/01/2021 04/01/2021 05/01/2021 06/01/2021 07/01/2021 08/01/2021 09/01/2021 10/01/2021 11/01/2021 12/01/2021 01/01/2022 02/01/2022 03/01/2022 04/01/2022

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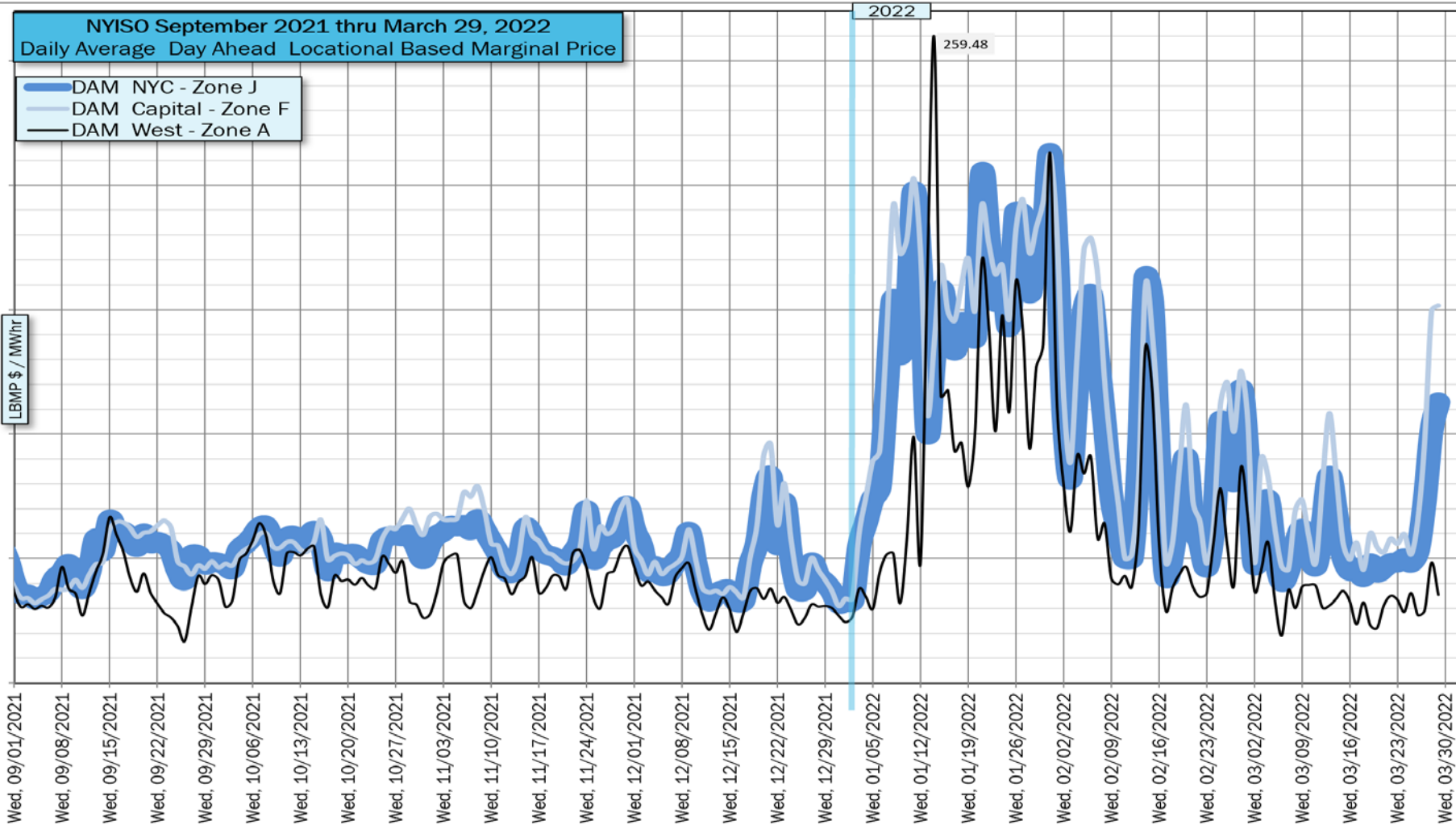
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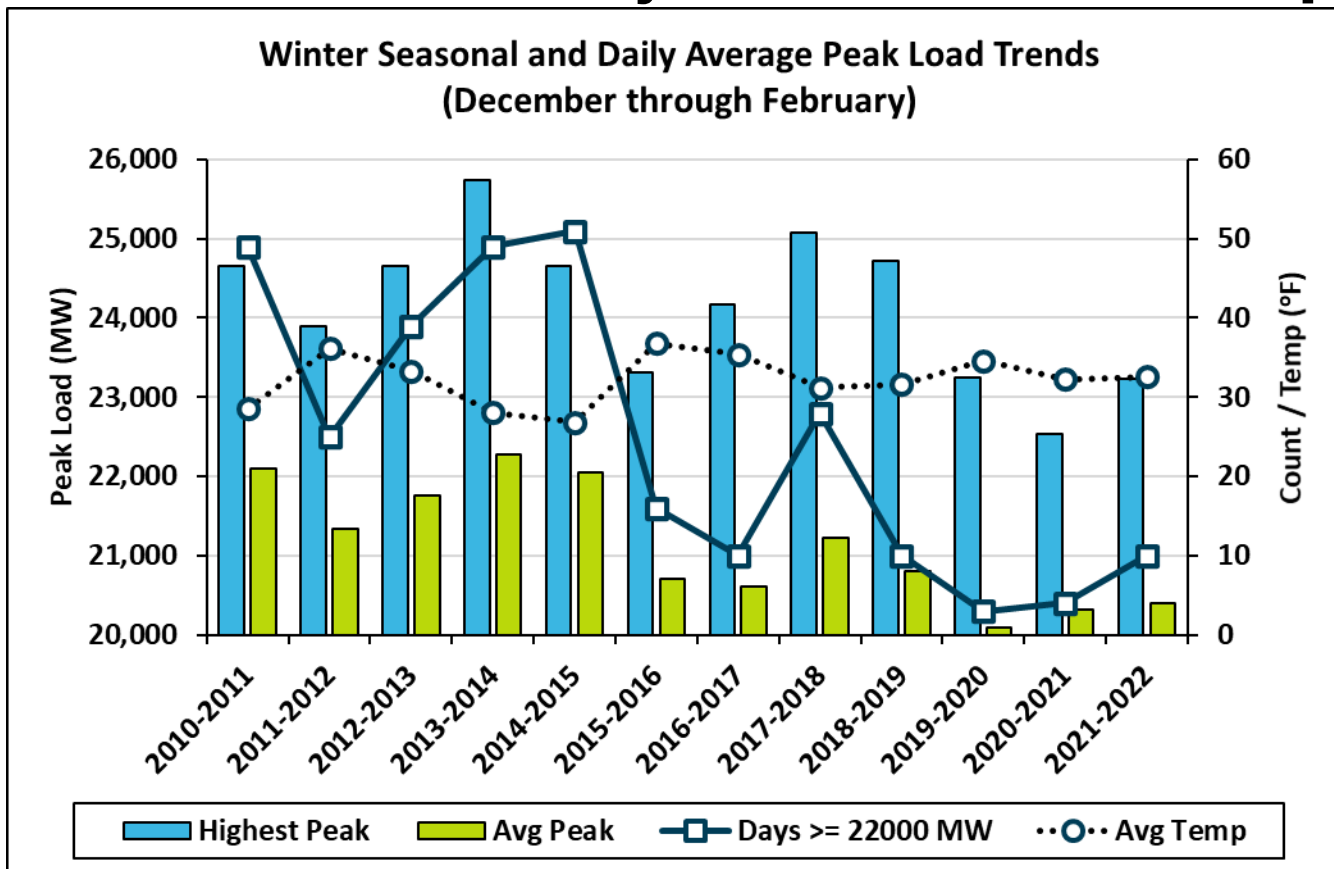
NYISO September 2021 thru March 29, 2022  
Daily Average Day Ahead Locational Based Marginal Price

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

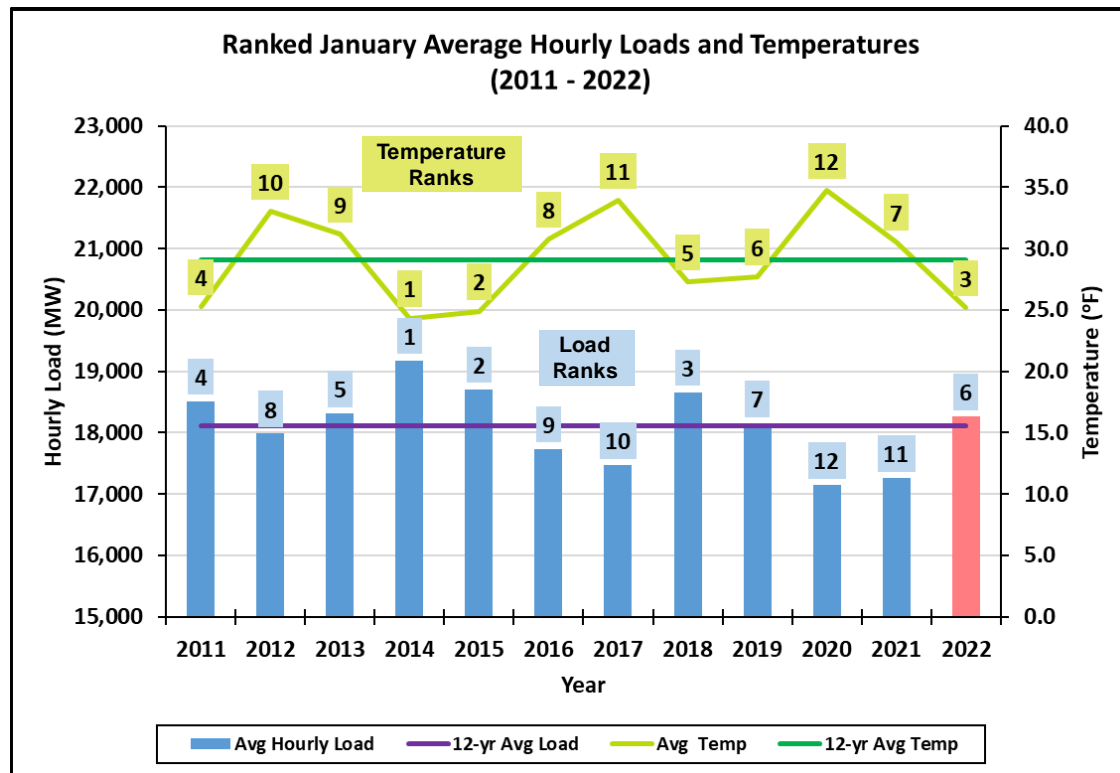


# Appendix

# Winter 2021 – 2022 Daily Peak Loads In Perspective



# January 2022 Hourly Average Loads In Perspective



- Lowest average temperature since 2015 yielded the second highest average hourly loads over the same period
  - Third lowest January average temperature since 2011
  - The average from 1/3 – 1/31 would have been the lowest
- Winter 2021 – 2022 peak load (23,237 MW) occurred on 1/11
- 8 of 10 peak load days above 22,000 MW occurred between 1/10 and 1/31
  - 2/14 and 2/15 were the other days



# MLK Weekend Cold Weather Conditions (1/14 – 1/17)

- Coldest seasonal NYCA Hourly Temperature occurred 1/16/22 HB7 (3.6°F).
- OFOs
  - Con Ed 1/24<sup>th</sup> Hourly OFO, 1/15/22 04:00 - 1/16/22 10:00
  - NG Downstate Tier 1 Interruption, 1/14/22 22:00 – 1/16/22 10:00
  - NG UPNY East and West Gate Interruption 1/14/2022 22:00 – 1/16/22 10:00
- SREs
  - 1/15/22 - Astoria 5, HB00-23 and Empire CC1, HB7-22 for statewide capacity concerns with uncertainty in DAM scheduled imports.
  - 1/16/22 - In-day SRE of Astoria 5 and Empire CC1, HB12-23 for statewide capacity concerns due to generator performance and uncertainty in DAM scheduled imports (IESO issued a Level 3A TLR on the Frontier interface curtailing 1,672MW HB02). Also instituted pumping at Gilboa in-day to restore water levels.
- 1/15/22 - The day-ahead forecast was 21,600 MW. The forecast peak temperature index was 13.4°F. Partly to mostly sunny, breezy, and very cold.
- Forecast highs were in the single digits to lower-teens upstate; mid-teens to lower-20s downstate. Overnight lows were near 0 upstate (colder to the north) and in the lower- to mid-teens downstate. A significant winter storm was expected to impact the area by Sunday evening and last into Monday.

# Mid January Cold Weather Conditions (1/20 – 1/22)

- OFOs
  - Con Ed 1/24<sup>th</sup> Hourly OFO, 1/21/22 04:00 - 1/22/22 10:00
  - NG Downstate Tier 1 Interruption, 1/21/22 08:00 – 1/22/22 10:00
  - NG UPNY East and West Gate Interruption 1/20/2022 22:00 – 1/22/22 12:00
- SREs – 1/20/22, Cricket Valley 1, HB7-22 for statewide capacity (increase in load forecast, uncertainty in DAM scheduled imports, generator performance)
- 1/21/22 - The day-ahead forecast was 22,780 MW. The forecast peak temperature index was 16.0°F. Mostly sunny, breezy, and cold.
- Forecast highs were mainly in the lower- to mid-teens; lower-20s near NYC and Long Island. Overnight lows were near 0 and below upstate (potentially mid-teens below 0 in typically colder spots); lower-teens near NYC and Long Island.

# Early February Cold Weather Conditions (2/4 – 2/6)

- Winter Storm Warnings and Advisories due to a significant winter storm on 2/3-2/4.
- OFOs
  - Con Ed 1/20th Hourly OFO, 2/6/22 04:00 - 2/6/22 10:00
  - NG Downstate Tier 2 Interruption, 2/5/22 22:00 – 2/6/22 12:00
- SREs - None
- 2/5/22 - The day-ahead forecast is 20,730 MW. The forecast peak temperature index was 21.5°F. Mostly sunny, breezy, and cold.
- Forecast highs range from the mid- to upper-teens upstate to upper-20s downstate. Overnight lows range from the single digits (and below in spots, especially to the north) upstate to the teens (near 20 around NYC) downstate.

# Mid February Cold Weather Conditions (2/13 – 2/15)

- February Peak Load occurred on 2/14/22, HB18 at 22,477 MW
- OFOs
  - Con Ed 1/20th Hourly OFO, 2/14/22 & 2/15/22 04:00 - 10:00
  - NG Long Island Tier 2 Interruption, 2/14/22 04:00 – 13:00
  - NG NYC Tier 2 Interruption, 2/14/22 06:00 – 12:00 & 2/15/22 02:00 – 12:00
- SREs - None
- The in-day forecast was 22,600 MW. The forecast peak temperature index was 19.8°F. Partly to mostly sunny, breezy, and cold.
- Forecast highs range from the mid-teens upstate to the mid-20s downstate. Overnight lows range from the single digits to near 10 upstate (colder in northern areas) to the upper-teens downstate.

# Early March Cold Weather Conditions (3/4)

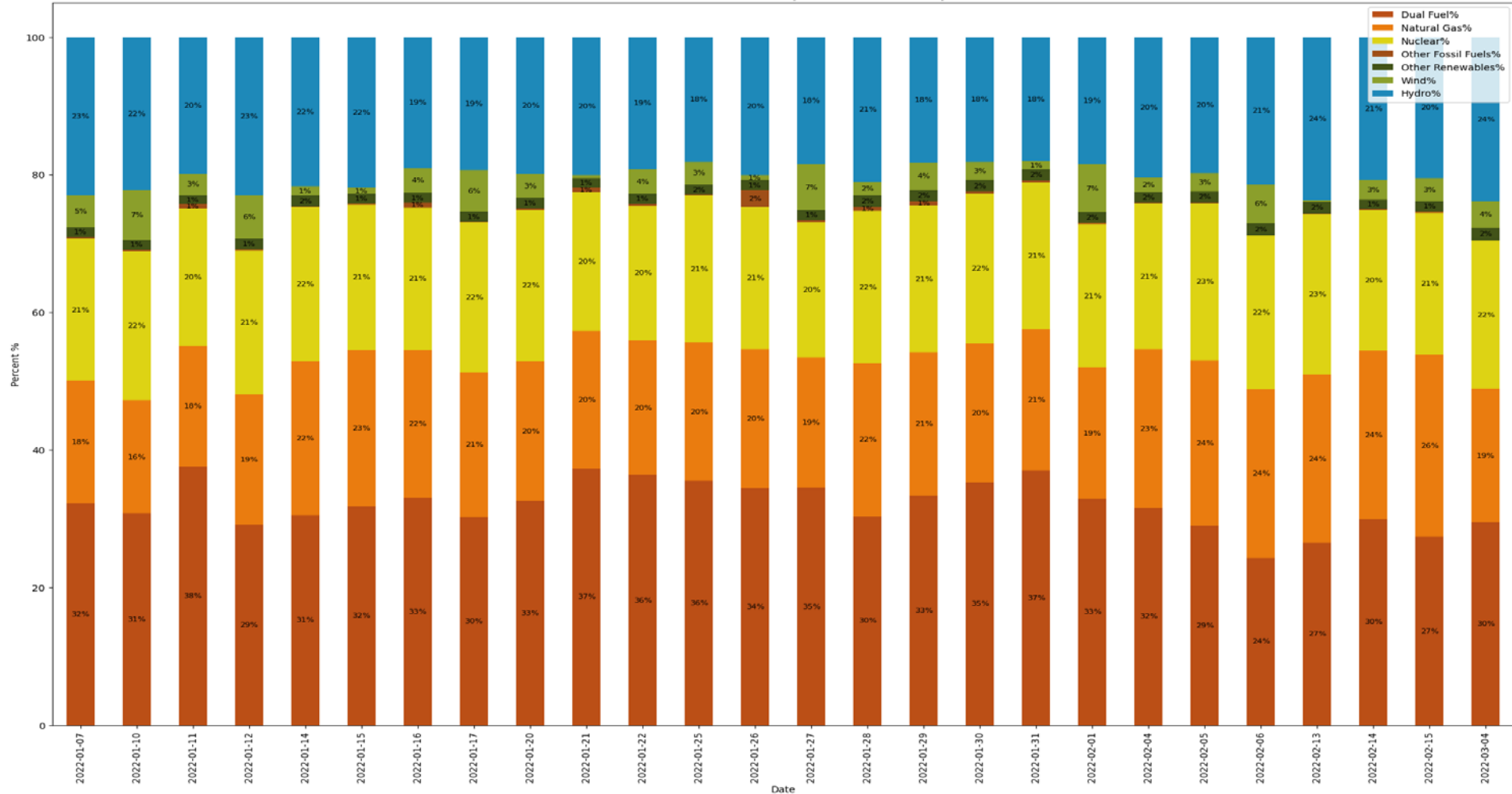
- OFOs
  - NG Long Island Tier 2 Interruption, 3/4/22 05:00 –11:00
- SREs - None
- NYISO weekly fuel surveys indicated sufficient alternate fuel inventory
- The day-ahead forecast was 19,530 MW The forecast peak temperature index was 32.6°F. Mostly sunny and cold on Friday.
- Overnight lows are generally in single digits and teens upstate and lower-20s downstate. Forecast highs in 30s statewide.

# Temperature and Peak Load Statistics for Selected Periods

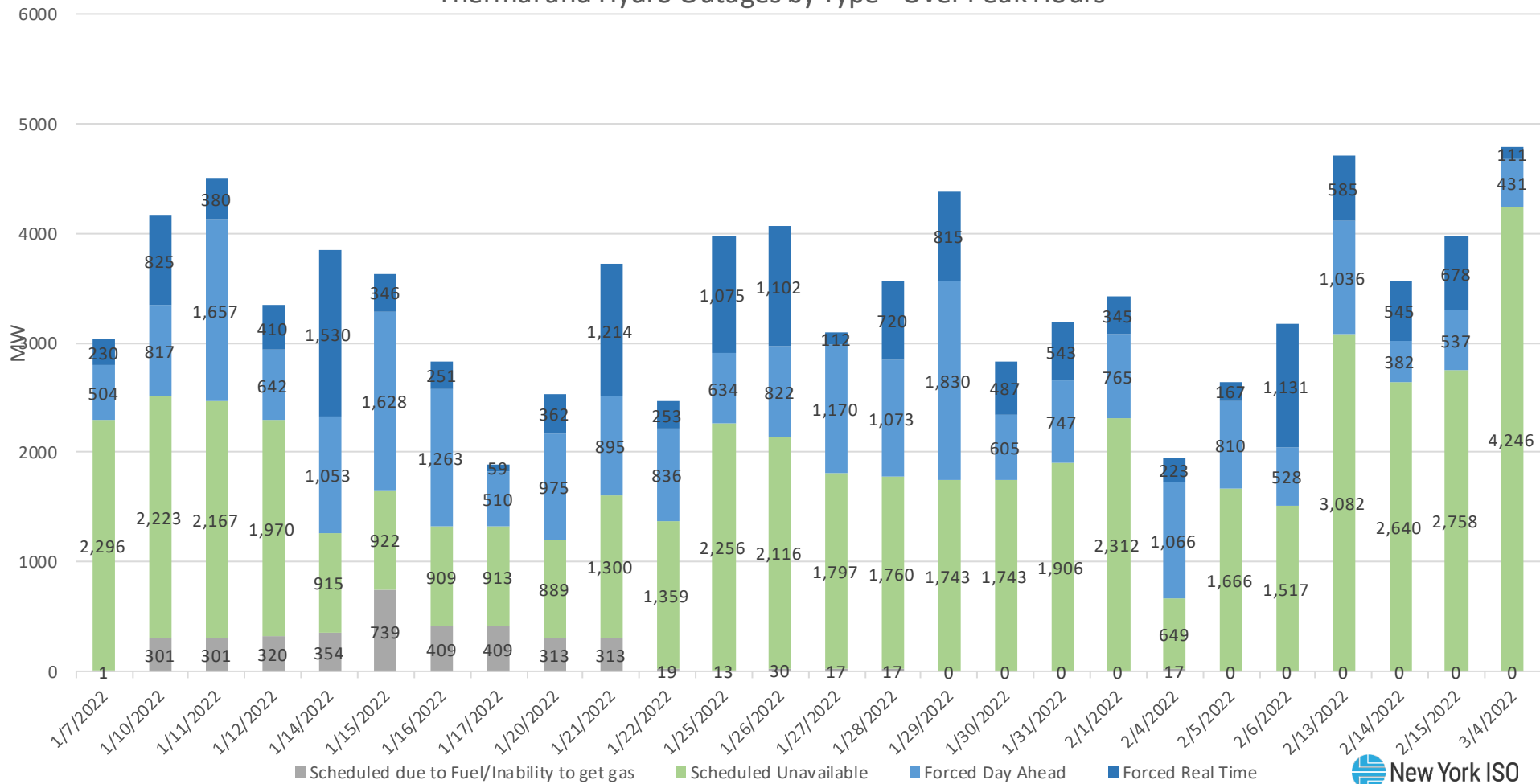
Date	DOW	AM Low Temp	Aft High Temp	HB18 Temp	Avg Temp	Peak Load (MW)
1/10/2022	Mon	23.9	26.1	22.7	25.8	22,220
1/11/2022	Tue	9.9	15.6	14.5	13.8	23,237
1/12/2022	Wed	15.0	37.0	33.9	28.3	21,338
1/13/2022	Thu	30.4	42.0	37.3	35.4	20,312
1/14/2022	Fri	33.5	34.5	25.4	30.4	21,185
1/15/2022	Sat	5.3	13.4	11.0	9.5	22,311
1/16/2022	Sun	3.6	28.6	27.7	16.7	21,409
1/17/2022	Mon	31.9	35.4	32.6	34.1	21,320
1/18/2022	Tue	27.1	30.6	26.3	27.6	21,710
1/19/2022	Wed	21.9	44.3	42.7	35.1	20,583
1/20/2022	Thu	25.8	26.7	23.3	27.6	21,820
1/21/2022	Fri	7.9	18.5	15.4	13.0	22,611
1/22/2022	Sat	5.0	25.7	24.0	15.9	21,184
1/23/2022	Sun	22.2	30.7	28.1	25.7	20,590
1/24/2022	Mon	17.7	26.8	26.0	23.7	21,850
1/25/2022	Tue	29.8	34.7	29.2	30.5	21,313
1/26/2022	Wed	13.9	22.9	19.1	18.2	22,492
1/27/2022	Thu	8.4	28.7	28.5	19.6	22,094
1/28/2022	Fri	25.9	27.1	24.0	25.9	21,498
1/29/2022	Sat	11.9	15.6	14.7	14.1	22,245
1/30/2022	Sun	6.2	22.9	19.9	14.4	21,749
1/31/2022	Mon	11.1	29.7	24.8	19.8	22,175
2/1/2022	Tue	15.1	35.8	33.5	26.0	21,386
2/13/2022	Sun	24.0	26.0	23.8	25.2	20,147
2/14/2022	Mon	12.2	20.6	18.7	16.5	22,477
2/15/2022	Tue	12.6	27.5	25.7	20.0	22,013
2/16/2022	Wed	20.4	43.7	42.7	34.6	20,312

All temperatures listed represent the NYCA load-weighted composite values.

Total Actual Generator by Fuel Mix Across Day



# Thermal and Hydro Outages by Type - Over Peak Hours





# Transmission Infrastructure Performance

## ■ Continuing Forced Outages

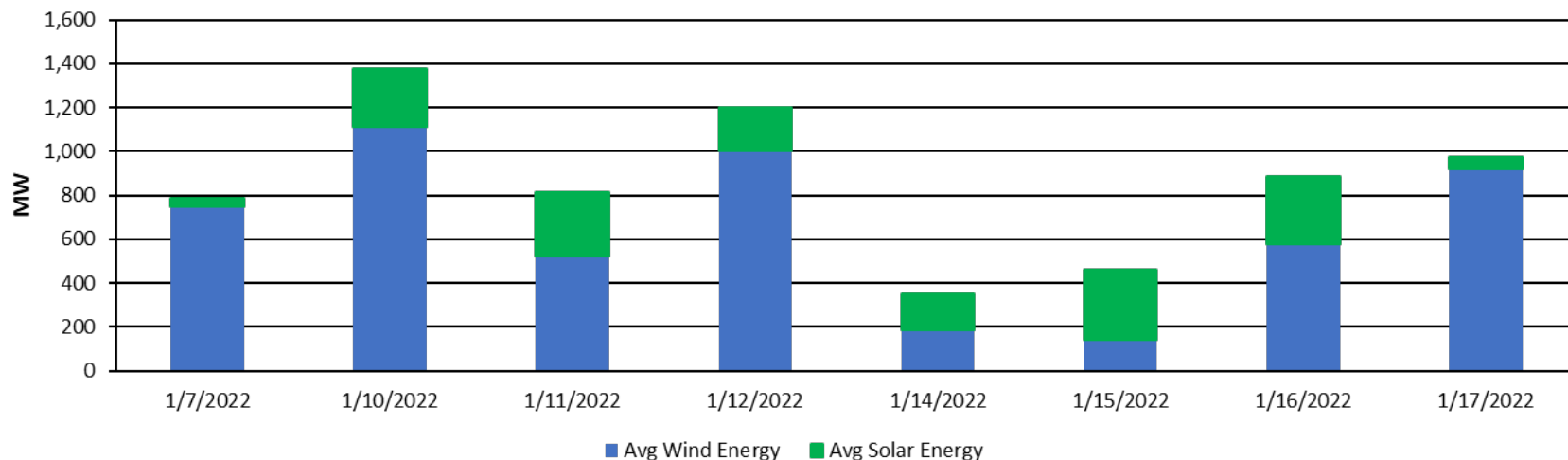
- B and C lines from NJ to NYC, Hudson-Farragut 345 kV B3402 and Marion-Farragut 345 kV C3403
- One Phase Angle Regulator (PAR) at the Ontario border, L33P St. Lawrence – Moses

## ■ Other impactful outages throughout the season (not all occurring concurrently)

- Newbridge 345kV/138kV Bk 1
- Mortimer-Shelby 115kV 114
- Northport-Pilgrim 138kV 679
- Niagara-Packard 115kV 191
- Moses-Adirondack 230kV MA1
- Beck-Niagara 345kV PA301
- Leeds-Pleasant Valley 345kV 92

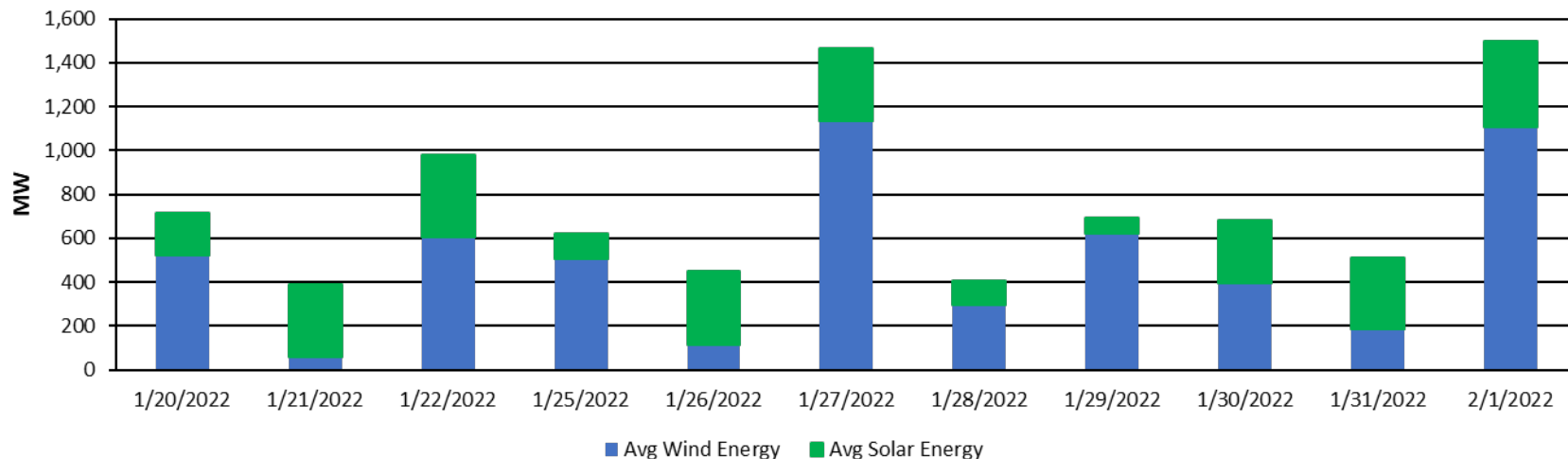
# 1/7, 1/10 – 1/12, 1/14 – 1/17 Renewable Chart #1

Daily Wind & Solar Production  
1/7, 1/10 - 1/12, 1/14 - 1/17



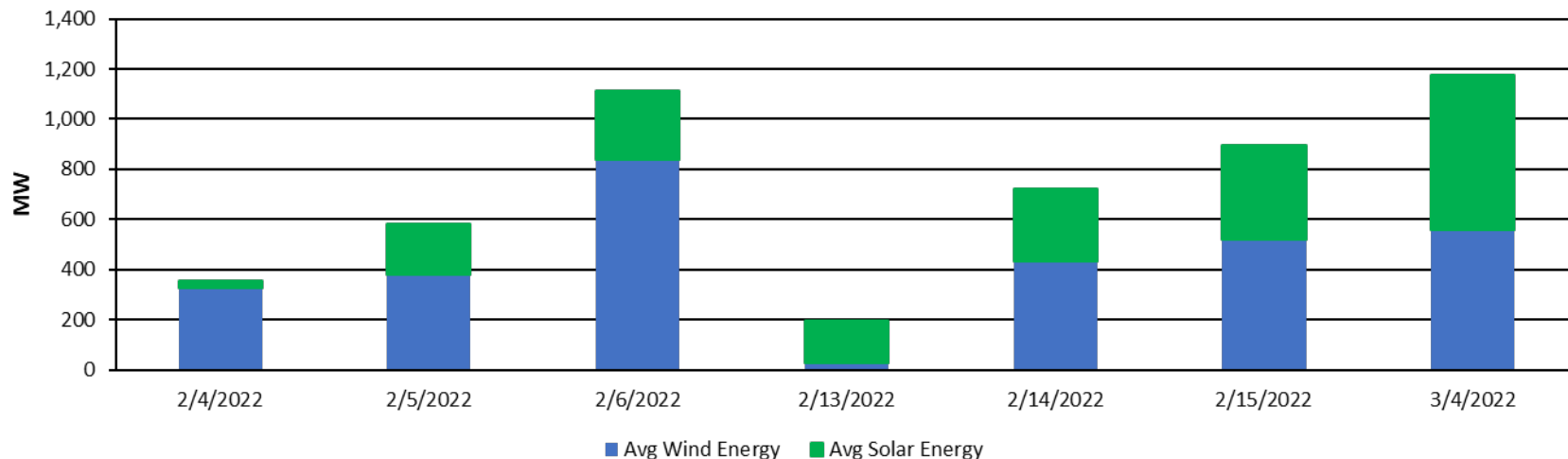
# 1/20 - 1/22, 1/25 - 2/1 Renewable Chart #1

Daily Wind & Solar Production  
1/20 - 1/22, 1/25 - 2/1

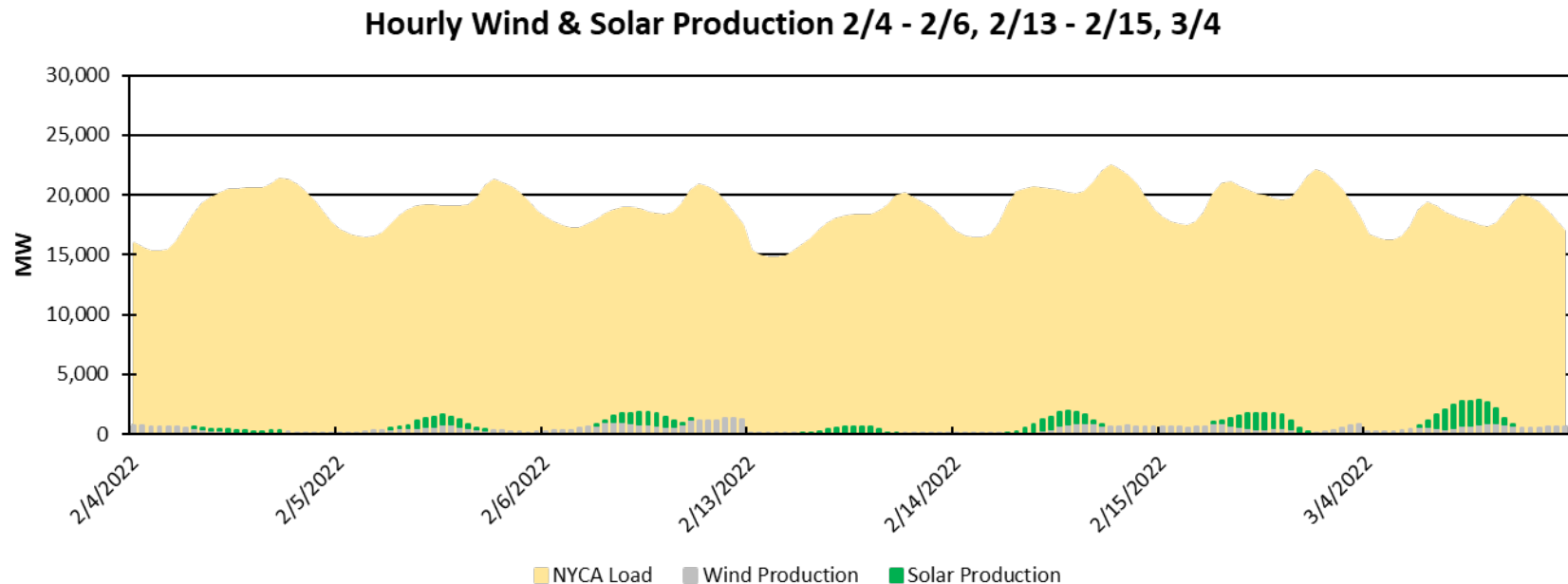


# 2/4 - 2/6, 2/13 - 2/15, 3/4 Renewable Chart #1

Daily Wind & Solar Production  
2/4 - 2/6, 2/13 - 2/15, 3/4

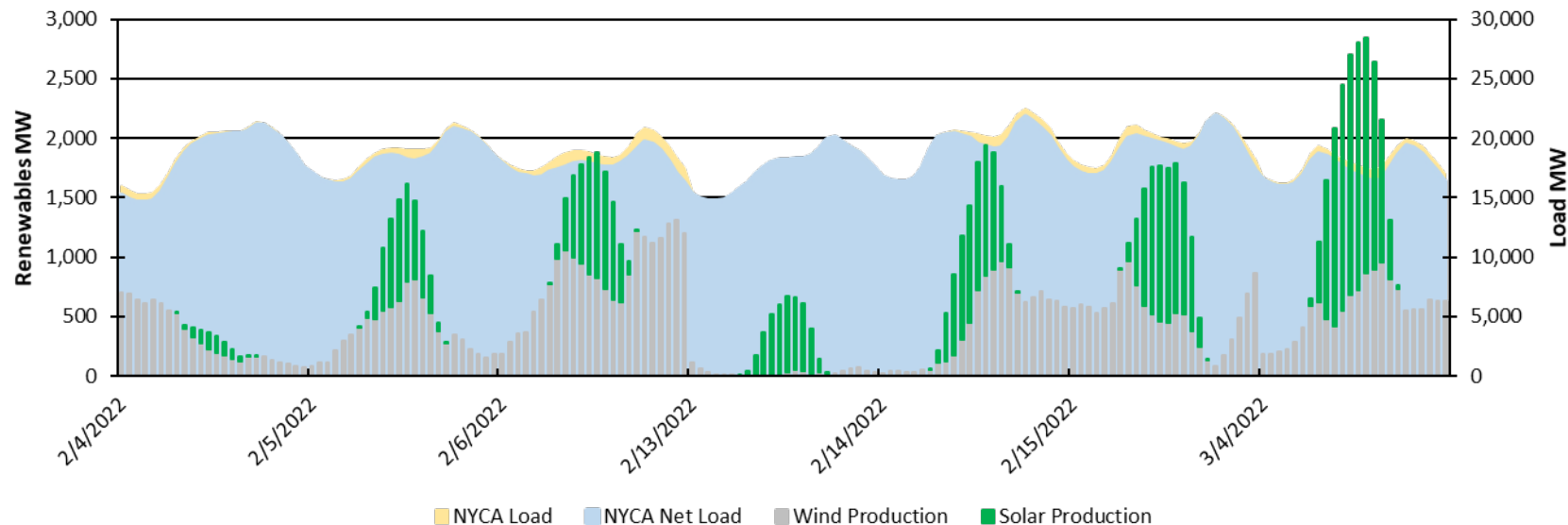


## 2/4 - 2/6, 2/13 - 2/15, 3/4 Renewable Chart #2b

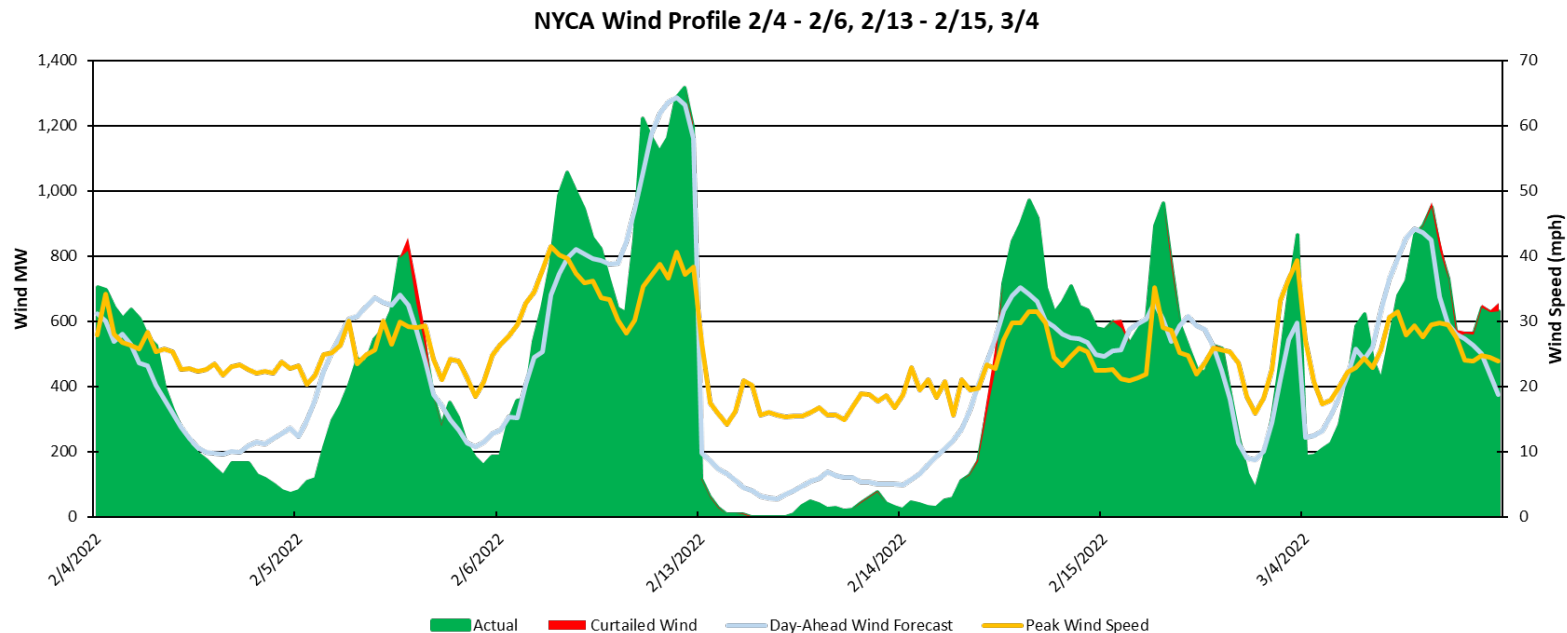


## 2/4 - 2/6, 2/13 - 2/15, 3/4 Renewable Chart #3

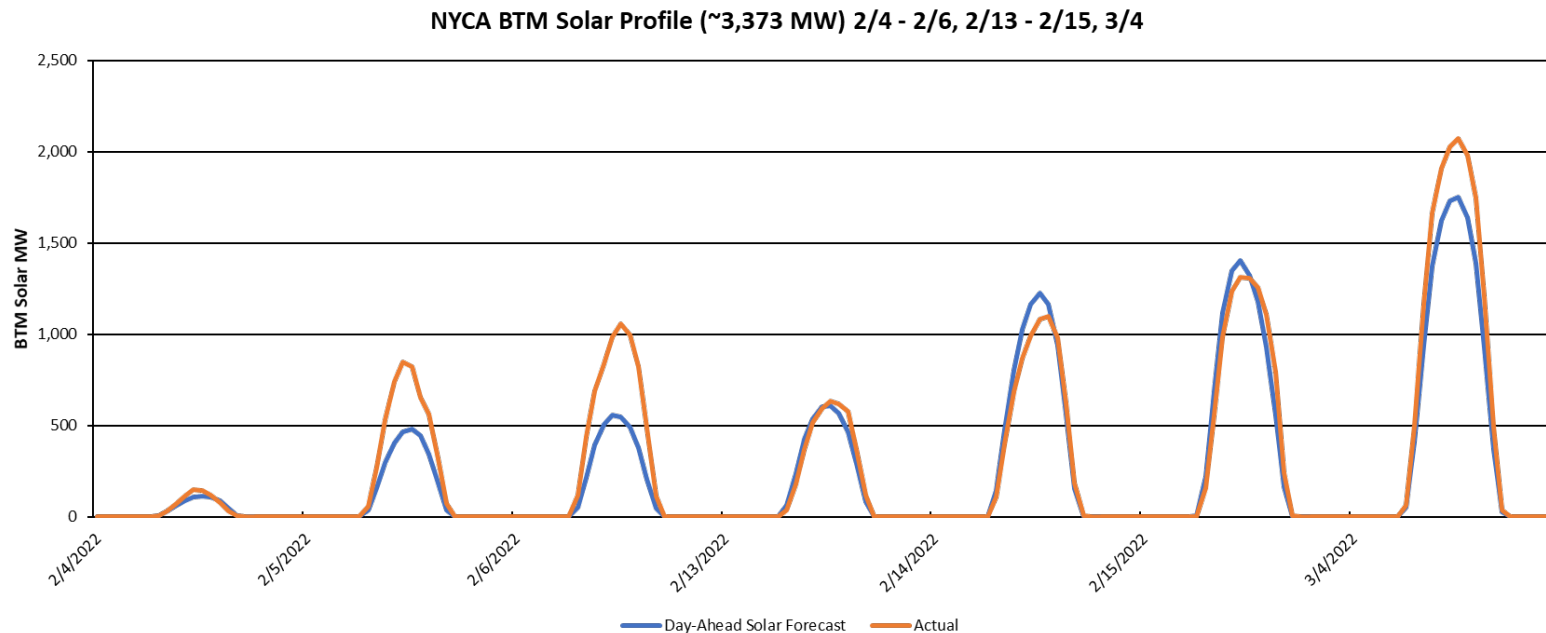
Hourly Wind & Solar Production 2/4 - 2/6, 2/13 - 2/15, 3/4



## 2/4 – 2/6, 2/13 – 2/15, 3/4 Wind Chart



## 2/4 - 2/6, 2/13 - 2/15, 3/4 Solar Chart





# Questions?

# Our Mission & Vision



## Mission

Ensure power system reliability  
and competitive markets for New  
York in a clean energy future



## Vision

Working together with stakeholders  
to build the cleanest, most reliable  
electric system in the nation