New York ISO
Independent System Operator

NYCA Renewables 2023

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ICAPWG/MIWG

April 22nd, 2024

Agenda

- Overview of NY Wind
- Economic Wind Curtailments
- Overview of NY BTM and FTM Solar
- Coincident Wind and Solar
- Load Ramps
- Questions

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Background on Metrics

- Wind and FTM solar data accounts for all units installed in the NYCA, however offshore wind is not yet represented in these metrics.
- Unless otherwise stated, Wind and Solar Capacity Factors are inclusive of ALL hours in 2023 and do not adjust for periods of resource outages or derates.
- Behind-the-meter (BTM) Solar production and capacity factors are based on estimates from NYISO's Solar/PV monitoring vendor. They are influenced by the pitch and tilt of the sampled installations being used to scale up production estimates. They are not a direct measurement of total solar production.
- Capacity Factors are calculated as follows:

$$\text{Wind and FTM Solar Capacity Factor} = \frac{\text{Total Generated AC MW Energy}}{(\text{AC MW Nameplate Capacity})(\text{Total Hours})}$$

$$\text{BTM Solar Capacity Factor} = \frac{\text{Total Generated AC MW Energy}}{(\text{DC MW Nameplate Capacity})(\text{Total Hours})}$$

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Past Presentations and Datasets

For those interested, Annual Renewable Presentations and hourly data sets from prior years can be found at the locations below.

https://www.nyiso.com/reports-information

- **Under 'Links'**
  - BTM Solar Information
- **Under 'Reports'**
  - Annual Wind and Solar Information

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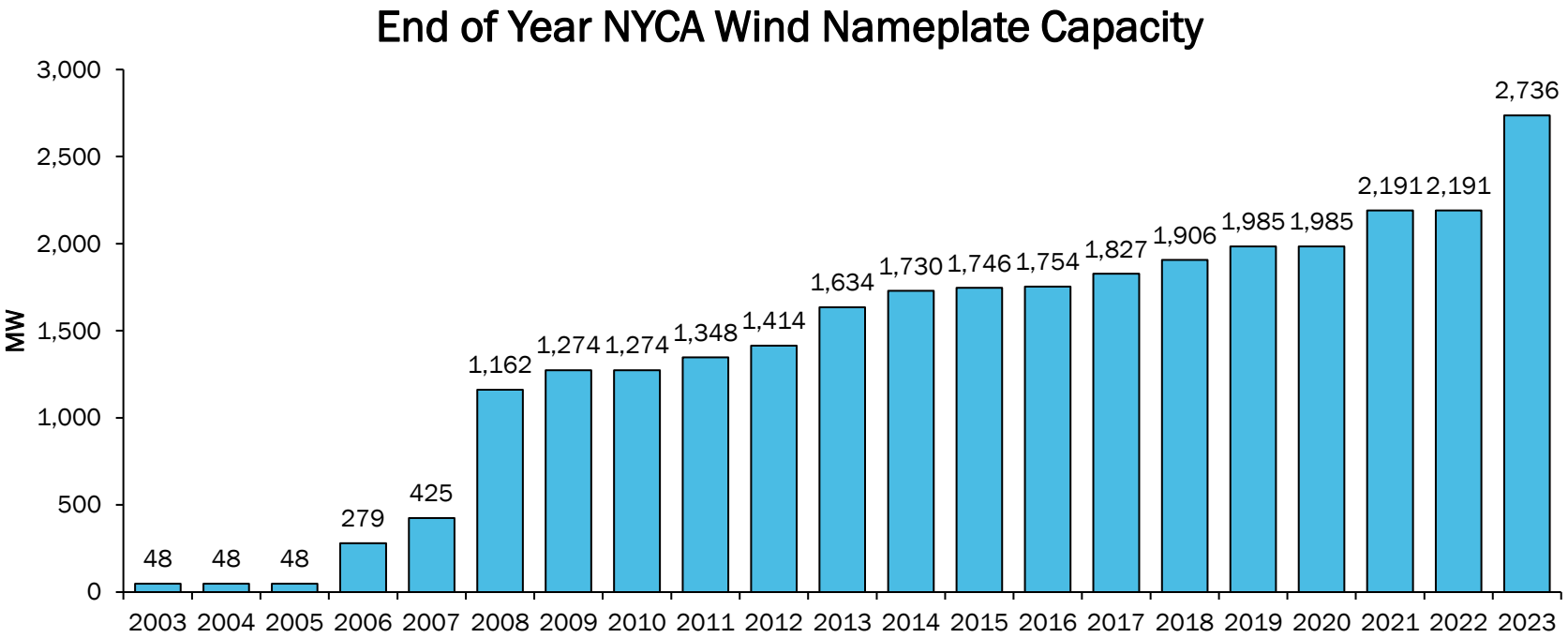
NYCA Wind 2023

Wind Overview



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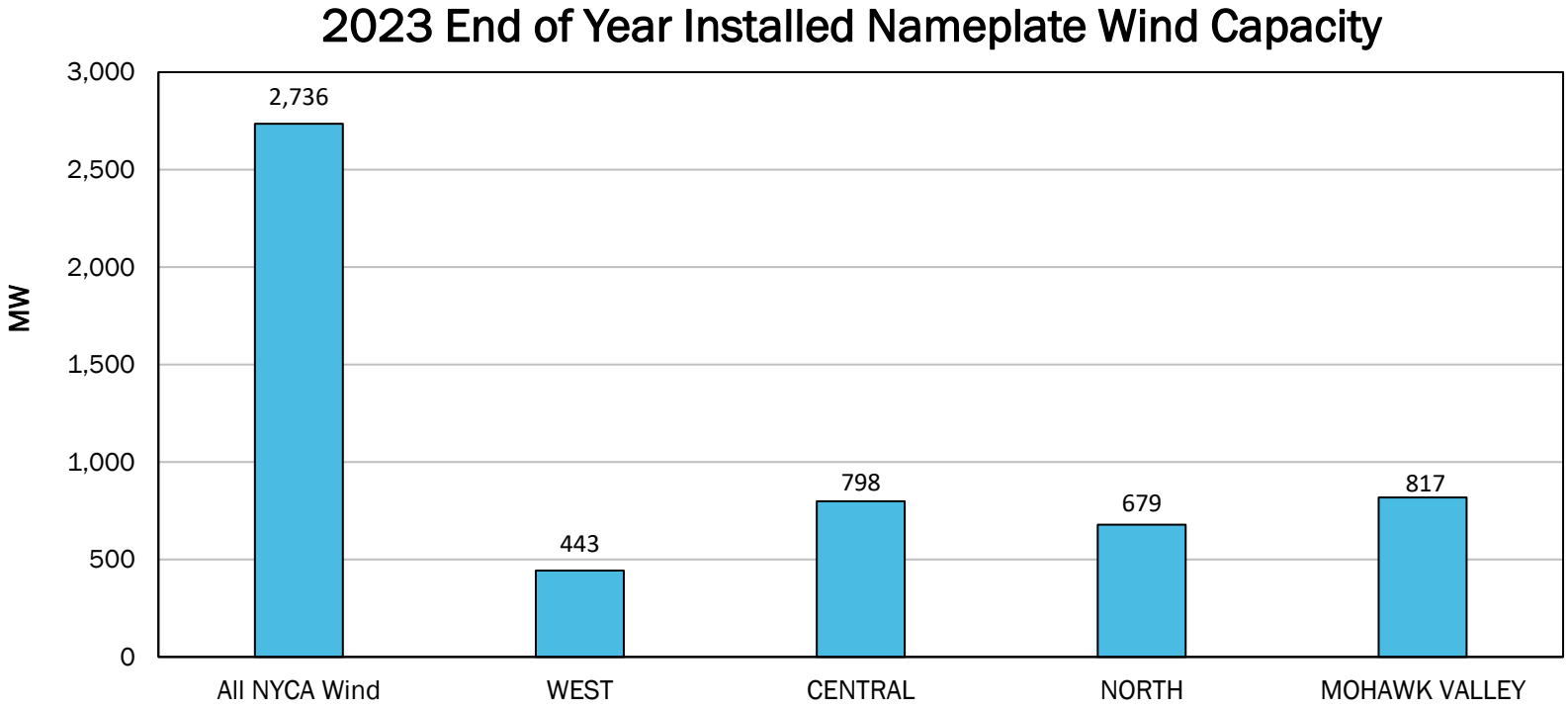
Zonal Wind Capacity



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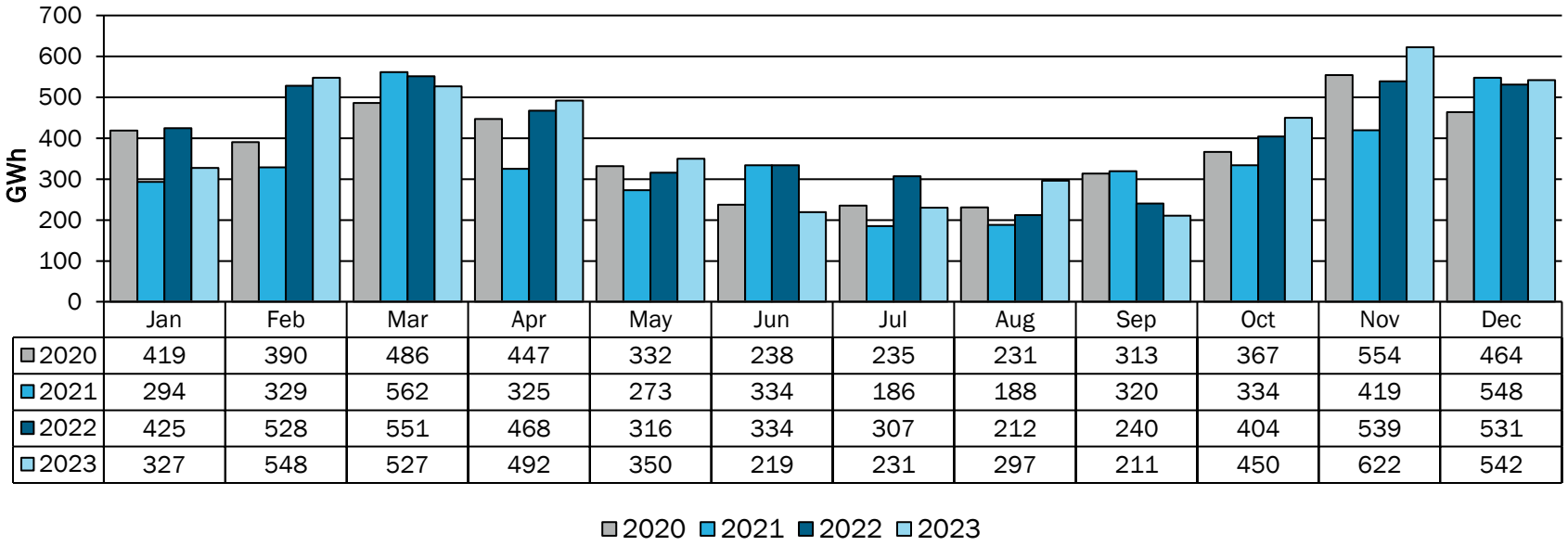
NY Wind Generation

Total Annual Wind Production (GWh)			
2020	2021	2022	2023
4,476	4,111	4,856	4,815

NYCA Wind Plants - Monthly Production



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2020	419	390	486	447	332	238	235	231	313	367	554	464
2021	294	329	562	325	273	334	186	188	320	334	419	548
2022	425	528	551	468	316	334	307	212	240	404	539	531
2023	327	548	527	492	350	219	231	297	211	450	622	542

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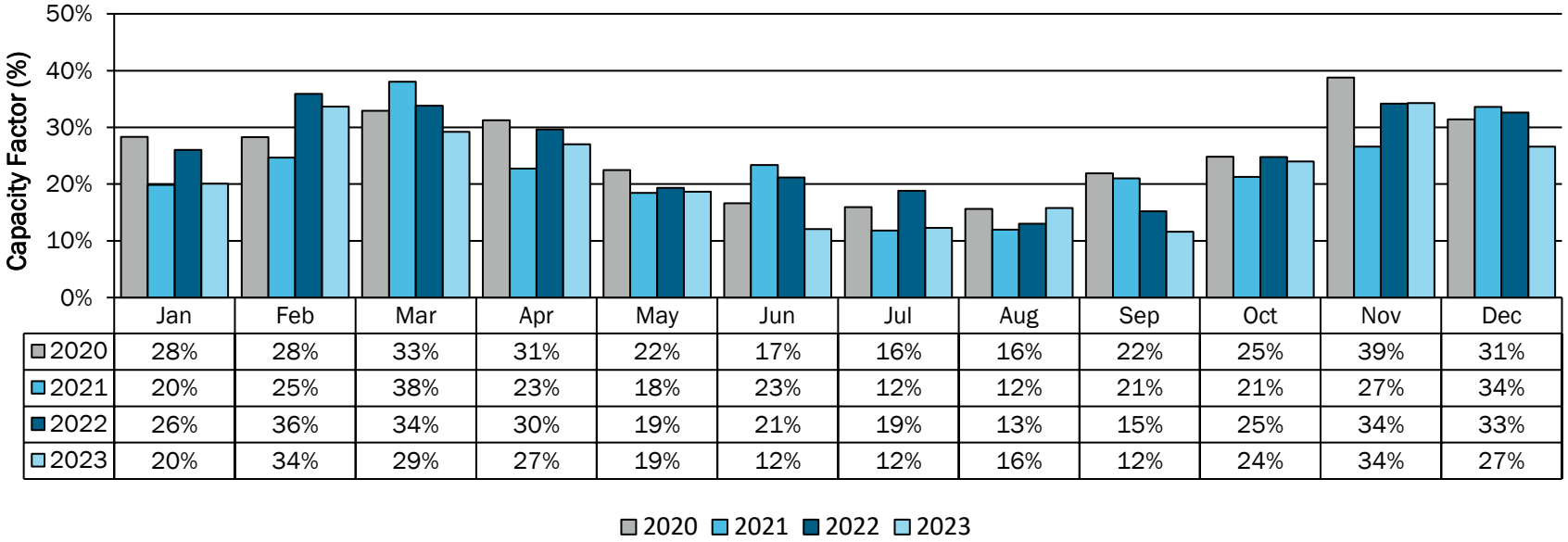
NY Wind Capacity Factors

Annual Wind Capacity Factor			
2020	2021	2022	2023
26%	23%	25%	22%

NYCA Wind Generation – Monthly Capacity Factor



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2020	28%	28%	33%	31%	22%	17%	16%	16%	22%	25%	39%	31%
2021	20%	25%	38%	23%	18%	23%	12%	12%	21%	21%	27%	34%
2022	26%	36%	34%	30%	19%	21%	19%	13%	15%	25%	34%	33%
2023	20%	34%	29%	27%	19%	12%	12%	16%	12%	24%	34%	27%

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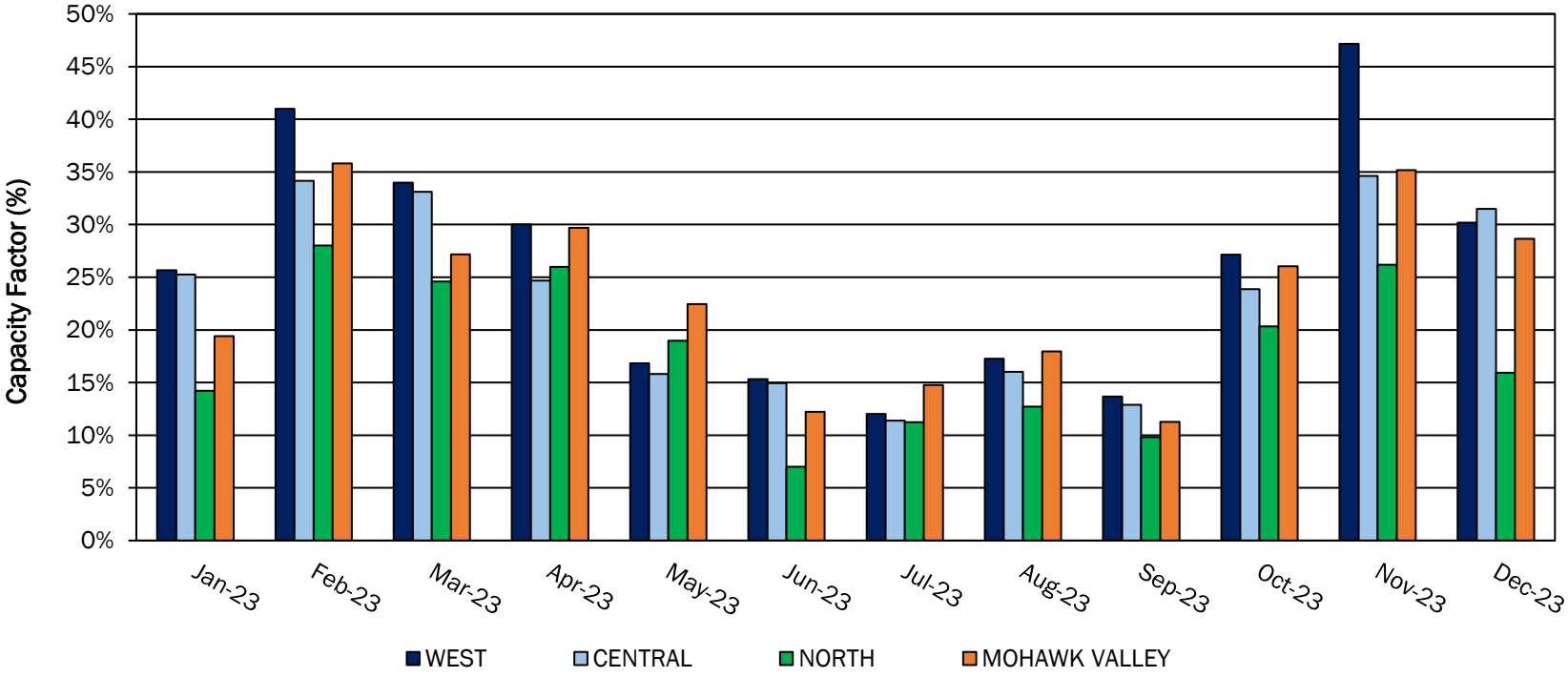
Monthly Wind Capacity Factors by Zone



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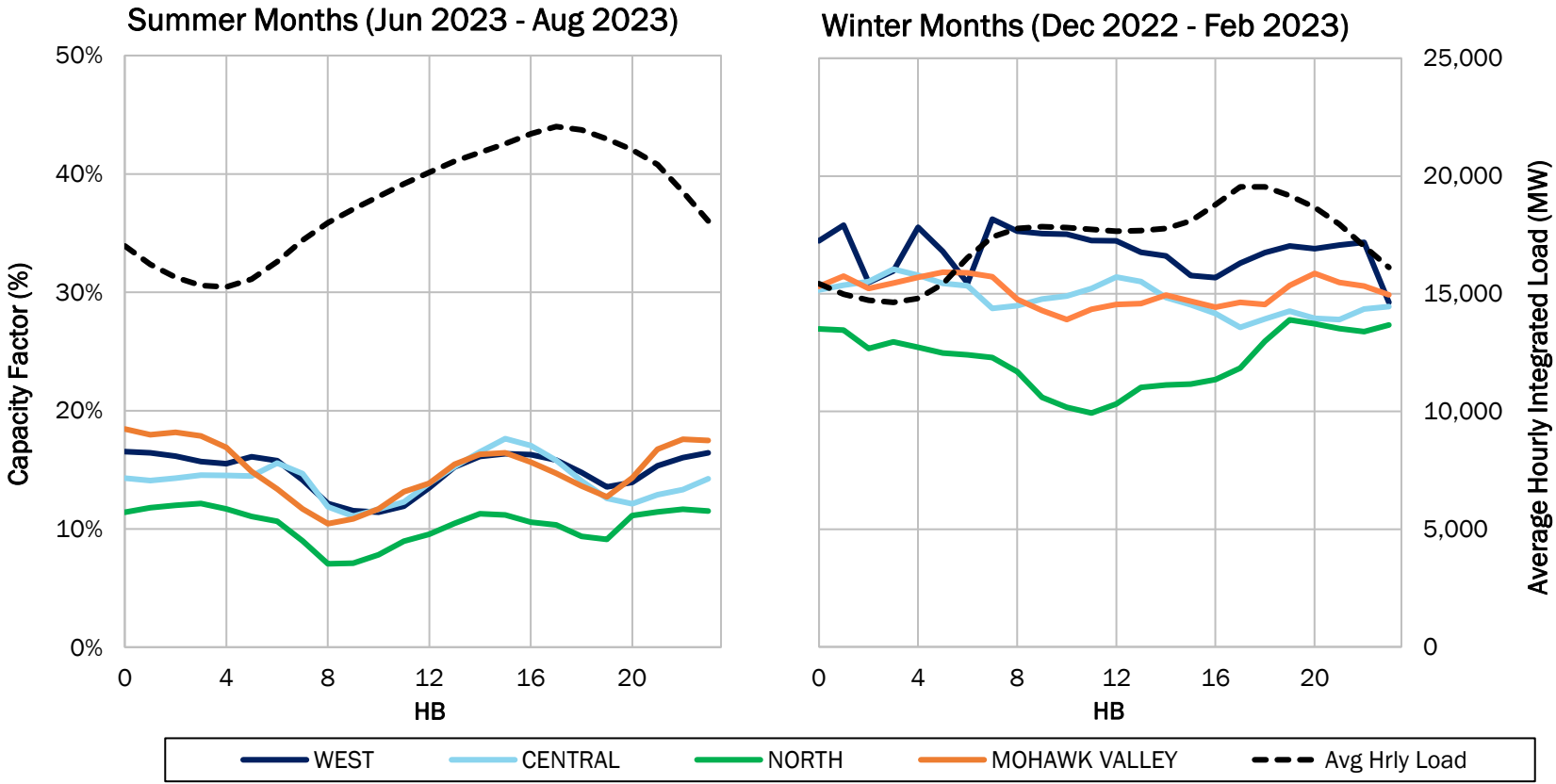
2023 Seasonal Average Hourly Wind Capacity Factors by Zone



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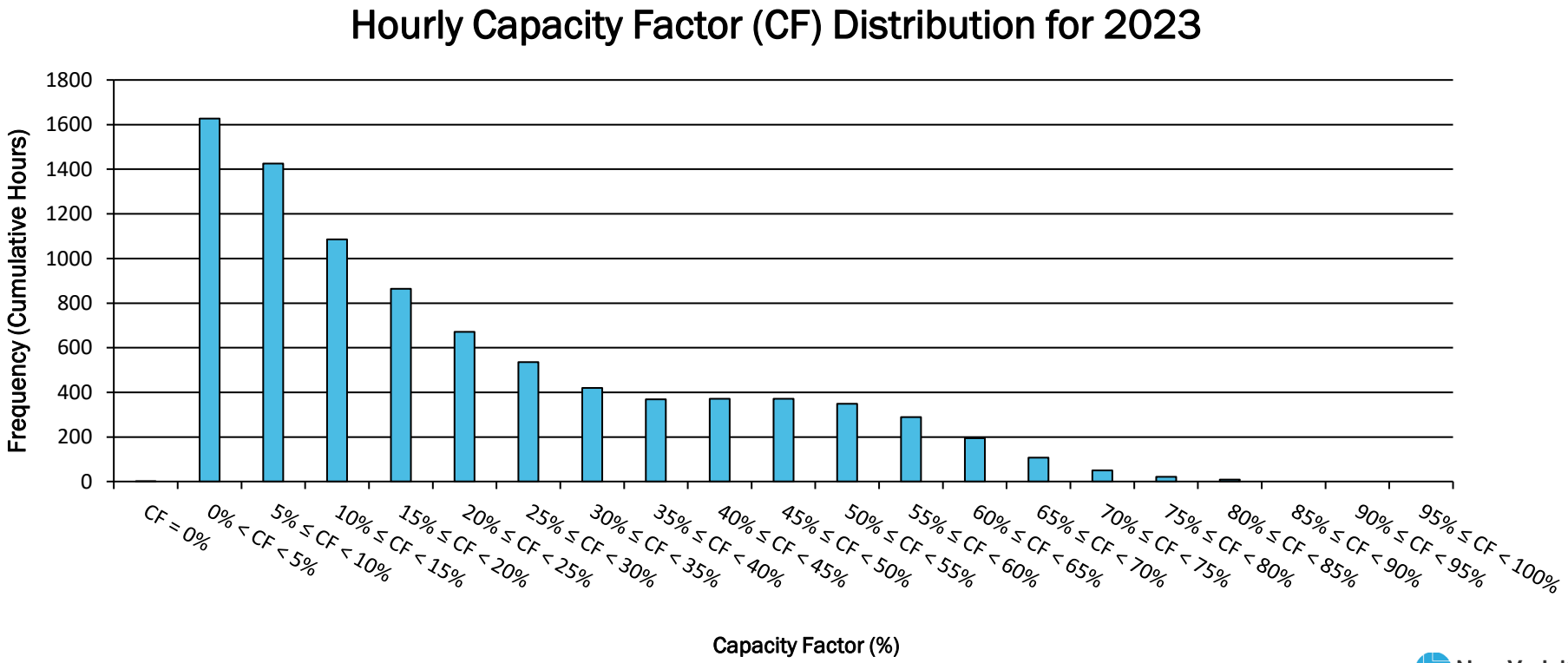
2023 NY Wind Capacity Factor Distribution



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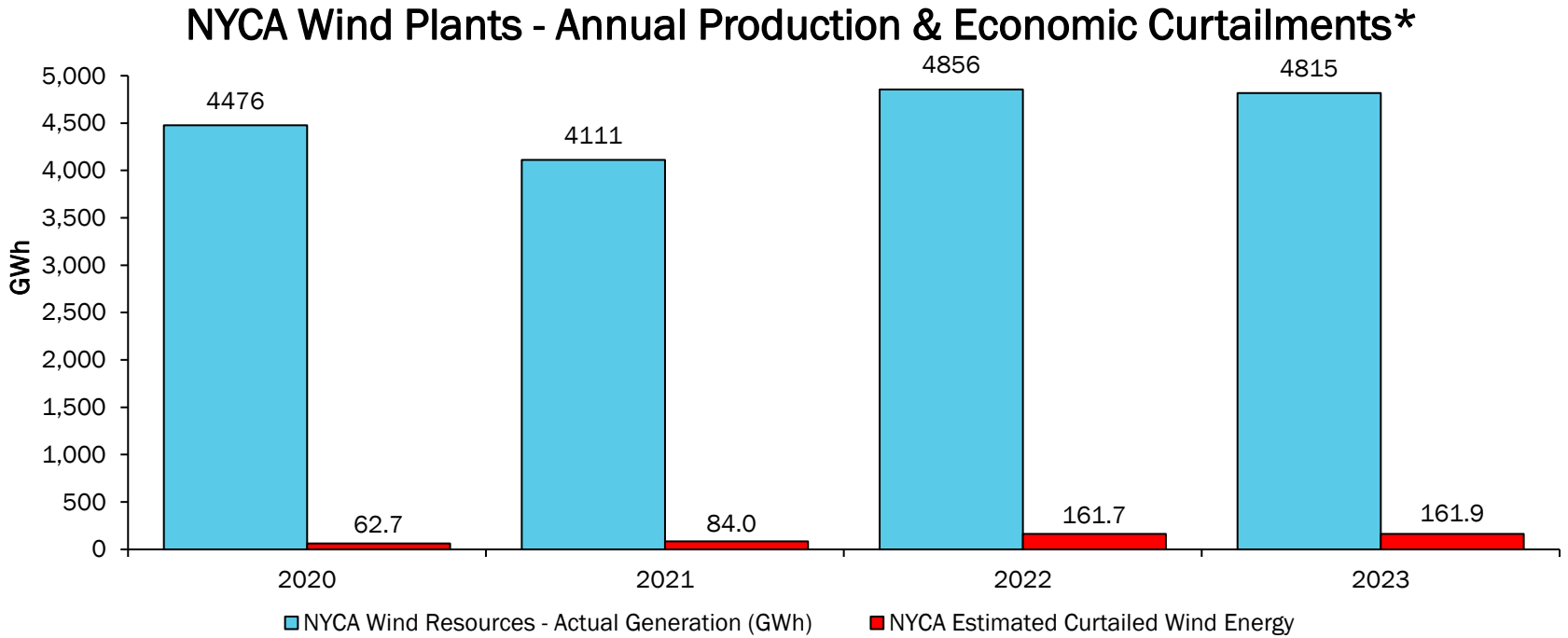
NY Economic Wind Curtailments



*Economic Curtailments are instructions sent to Wind Units to limit their output. The instructions come from NYISO's real-time dispatch market evaluation and are most often associated with transmission constraints or gen-to-load balancing constraints.

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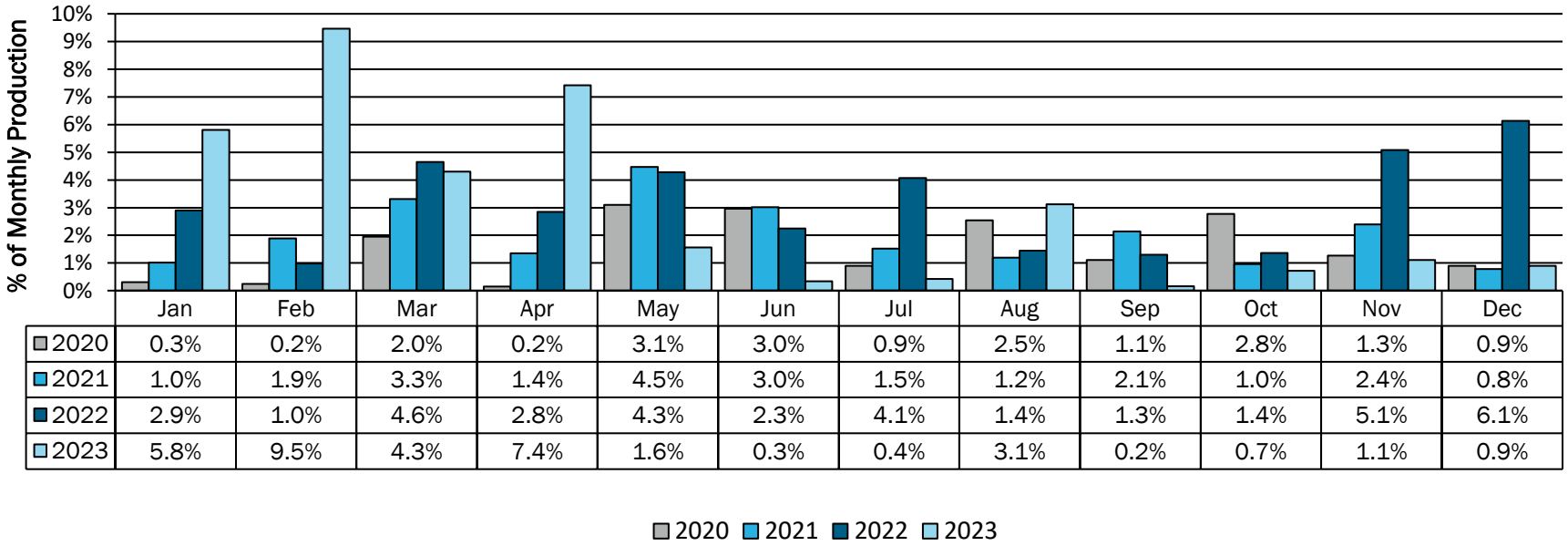
NY Economic Wind Curtailments

Total Estimated Curtailed Energy %			
2020	2021	2022	2023
1.4%	2.0%	3.3%	3.4%

NYCA Wind Plants - Monthly Estimated Curtailed Energy %



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2020	0.3%	0.2%	2.0%	0.2%	3.1%	3.0%	0.9%	2.5%	1.1%	2.8%	1.3%	0.9%
2021	1.0%	1.9%	3.3%	1.4%	4.5%	3.0%	1.5%	1.2%	2.1%	1.0%	2.4%	0.8%
2022	2.9%	1.0%	4.6%	2.8%	4.3%	2.3%	4.1%	1.4%	1.3%	1.4%	5.1%	6.1%
2023	5.8%	9.5%	4.3%	7.4%	1.6%	0.3%	0.4%	3.1%	0.2%	0.7%	1.1%	0.9%

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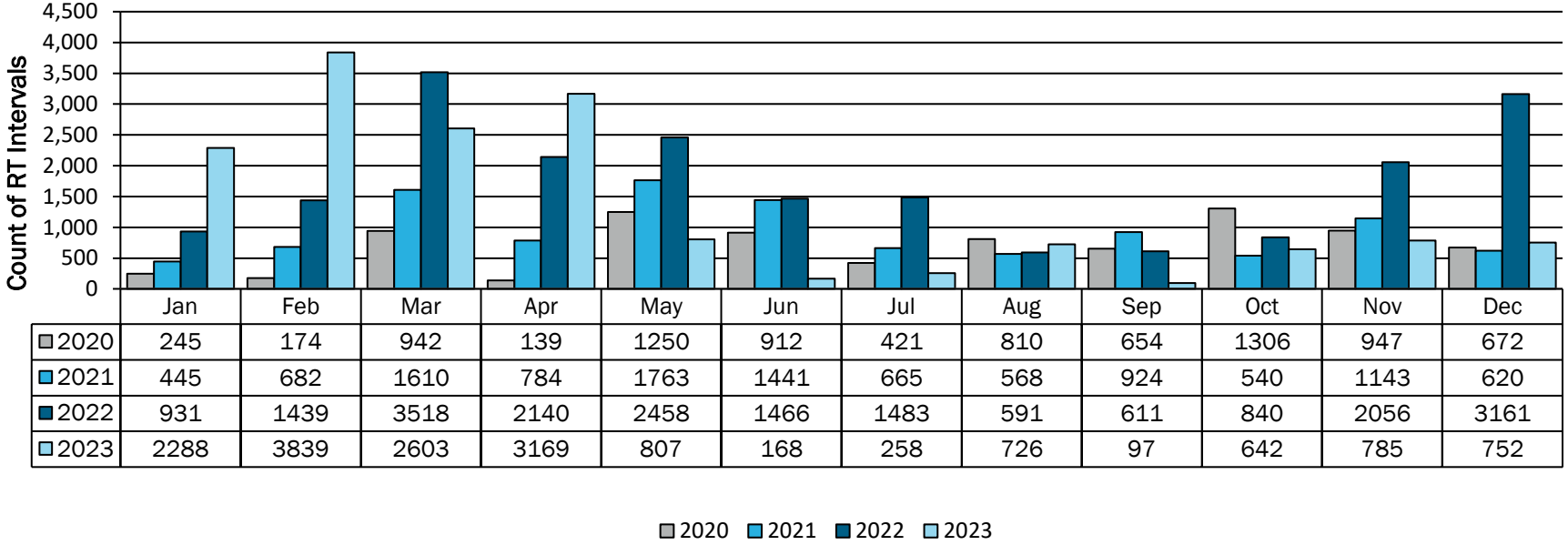
NY Economic Wind Curtailments

Total Estimated Curtailed Interval Count			
2020	2021	2022	2023
8,472	11,185	20,694	16,134

NYCA Wind Plants - Monthly Estimated Curtailed Interval Count

(12 Intervals = 1 Hour)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2020	245	174	942	139	1250	912	421	810	654	1306	947	672
2021	445	682	1610	784	1763	1441	665	568	924	540	1143	620
2022	931	1439	3518	2140	2458	1466	1483	591	611	840	2056	3161
2023	2288	3839	2603	3169	807	168	258	726	97	642	785	752

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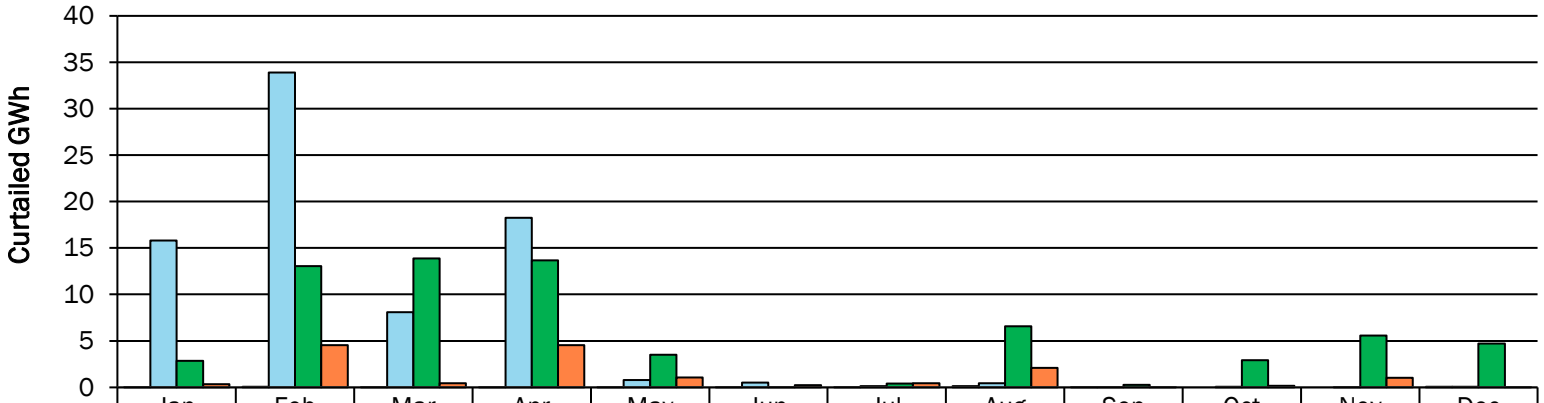
NY Economic Wind Curtailments

Total Annual Estimated Curtailed Energy (GWh)			
West	Central	North	Mohawk Valley
0.36	78.07	67.39	14.89

NYCA Zones - Monthly Estimated Curtailed Energy for 2023



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
WEST	0.02	0.06	0.03	0.03	0.02	0.00	0.00	0.12	0.00	0.00	0.00	0.07
CENTRAL	15.81	33.88	8.09	18.26	0.80	0.50	0.13	0.45	0.03	0.07	0.01	0.05
NORTH	2.83	13.04	13.86	13.68	3.51	0.01	0.42	6.57	0.27	2.91	5.56	4.72
MOHAWK VALLEY	0.32	4.53	0.43	4.53	1.07	0.23	0.43	2.10	0.02	0.17	1.03	0.02

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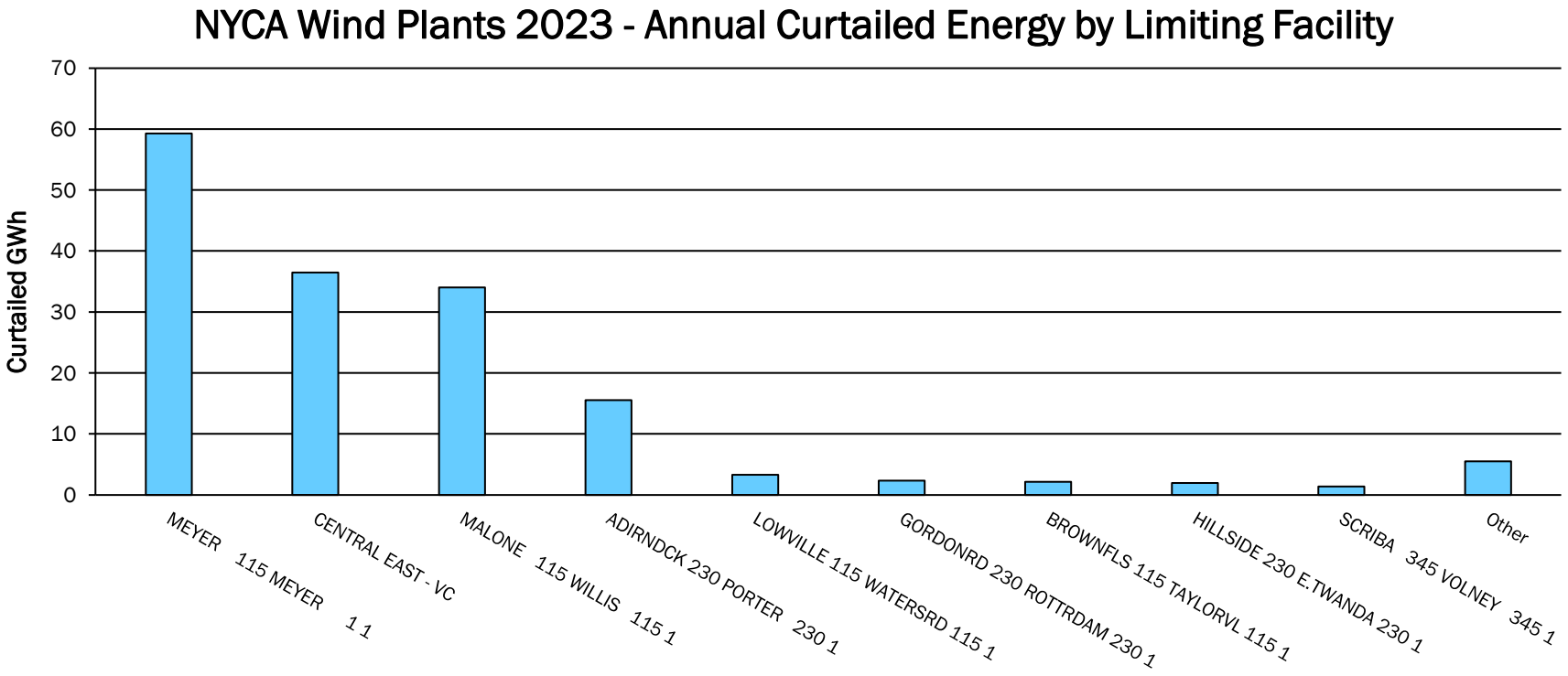
NY Economic Wind Curtailments



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Solar 2023

Behind-the-Meter (BTM) & Front-of-the-Meter (FTM)

BTM Solar Data Monitoring

- The NYISO's Solar/PV monitoring vendor automatically tracks the real-time power output of a sampling of solar production sites across NY
- The sampled sites are geographically distributed substantially the same as the total BTM facilities in the state
- BTM solar production, at the zonal level, is calculated by scaling up the vendor's readings to the estimated BTM solar installed capacity
- NYISO closely tracks BTM solar PV installed capacity in the NY SUN (MW DC) and NY DPS Standard Interconnection Request (SIR) databases (MW AC) to develop an accurate estimate of BTM solar installed capacity in MW DC
- Inverter and module information are available from the NYSERDA NY Sun database and California Energy Commission datasets. The latter two datasets are used to estimate the total DC installed capacity in the NYCA.
- At the end of 2023, BTM Solar Capacity was estimated to be 5,227 MW (DC)

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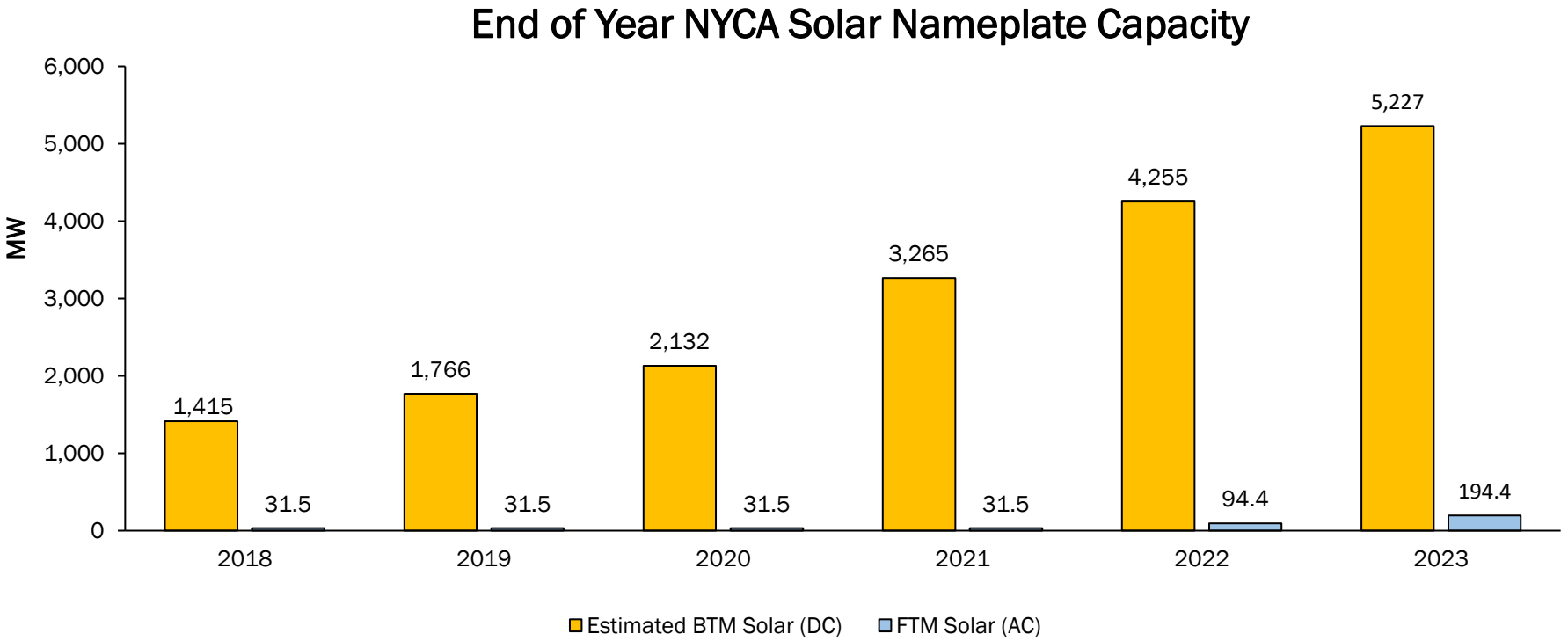
Solar Overview



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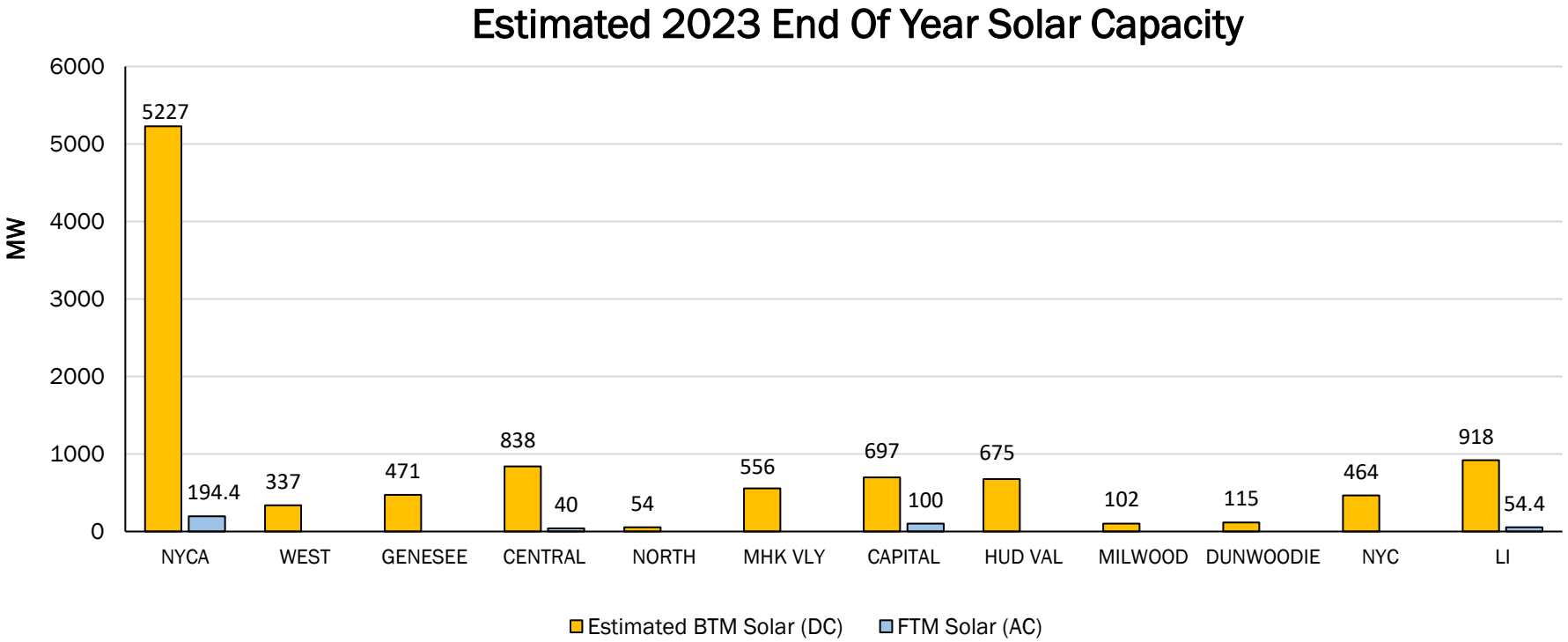
Zonal Solar Capacity



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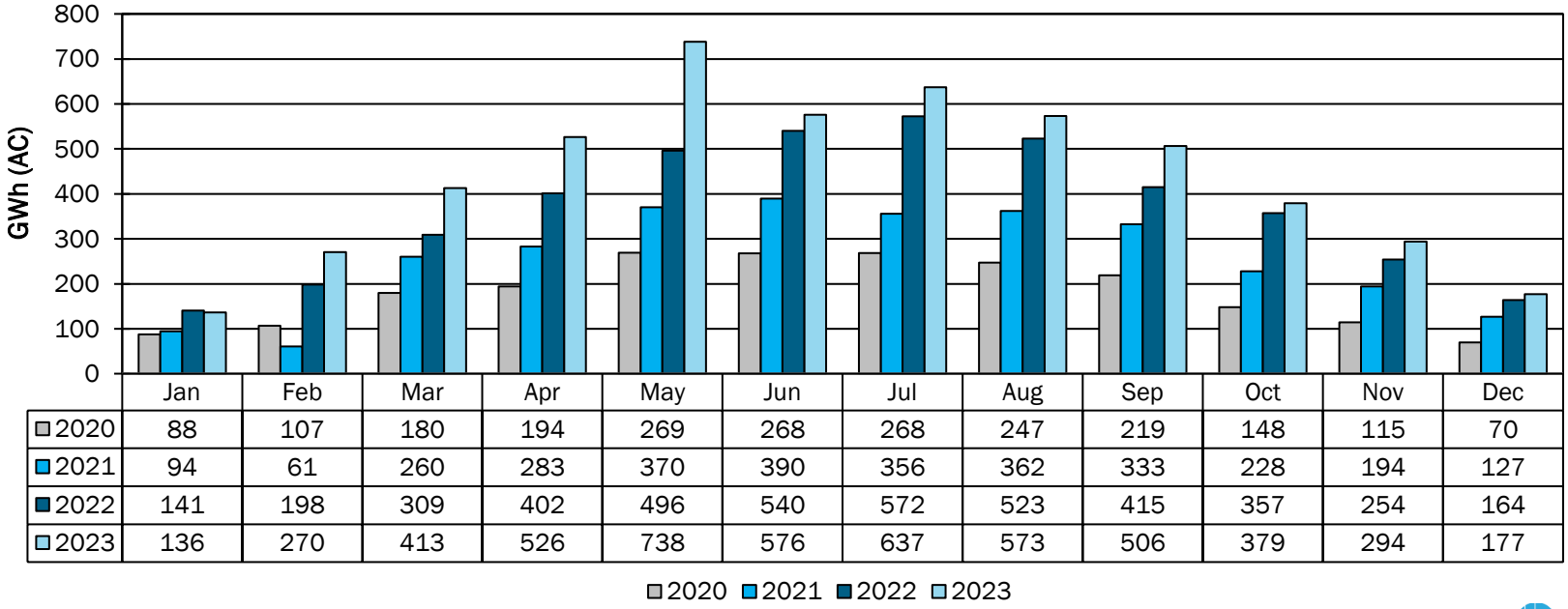
NY BTM Solar Generation

Total Annual BTM Solar Production (GWh)			
2020	2021	2022	2023
2,172	3,057	4,372	5,228

NYCA BTM Solar - Estimated Monthly Production



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2020	88	107	180	194	269	268	268	247	219	148	115	70
2021	94	61	260	283	370	390	356	362	333	228	194	127
2022	141	198	309	402	496	540	572	523	415	357	254	164
2023	136	270	413	526	738	576	637	573	506	379	294	177

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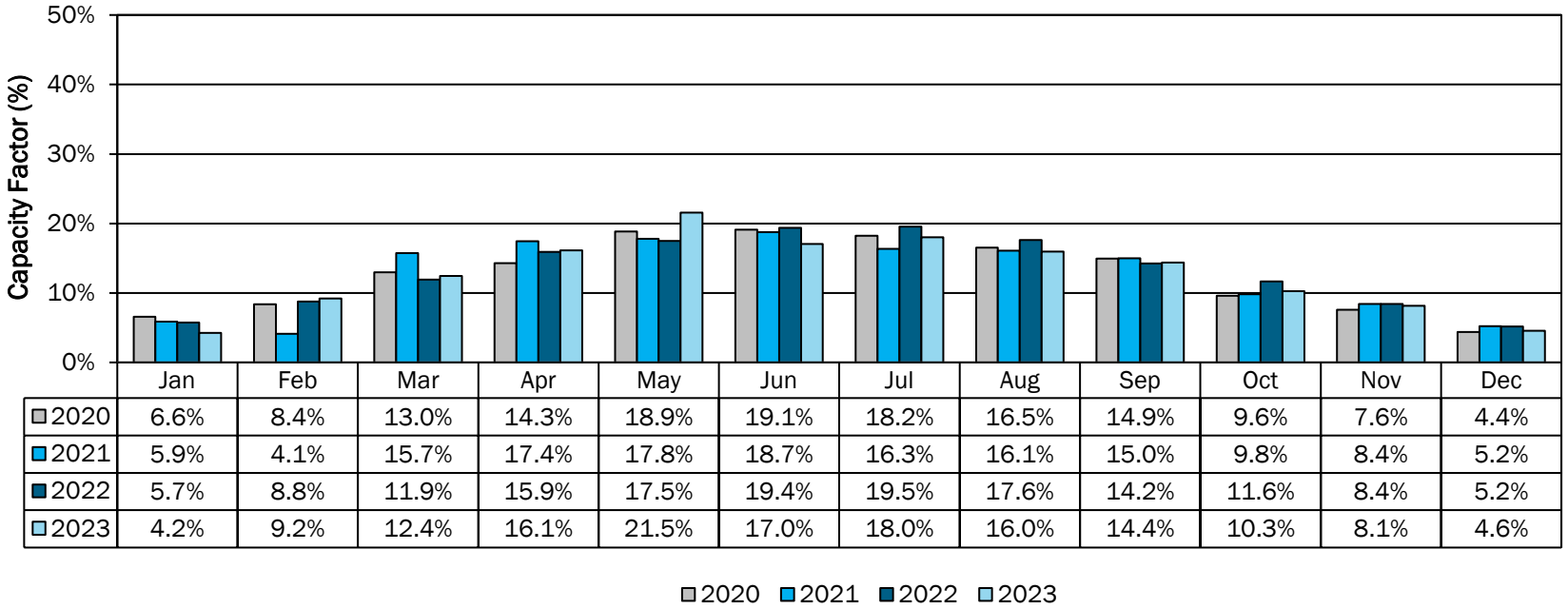
NY BTM Solar Capacity Factors

Annual BTM Solar Capacity Factor			
2020	2021	2022	2023
12.6%	12.5%	13.0%	12.7%

NYCA BTM Solar Generation - Estimated Capacity Factor



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2020	6.6%	8.4%	13.0%	14.3%	18.9%	19.1%	18.2%	16.5%	14.9%	9.6%	7.6%	4.4%
2021	5.9%	4.1%	15.7%	17.4%	17.8%	18.7%	16.3%	16.1%	15.0%	9.8%	8.4%	5.2%
2022	5.7%	8.8%	11.9%	15.9%	17.5%	19.4%	19.5%	17.6%	14.2%	11.6%	8.4%	5.2%
2023	4.2%	9.2%	12.4%	16.1%	21.5%	17.0%	18.0%	16.0%	14.4%	10.3%	8.1%	4.6%

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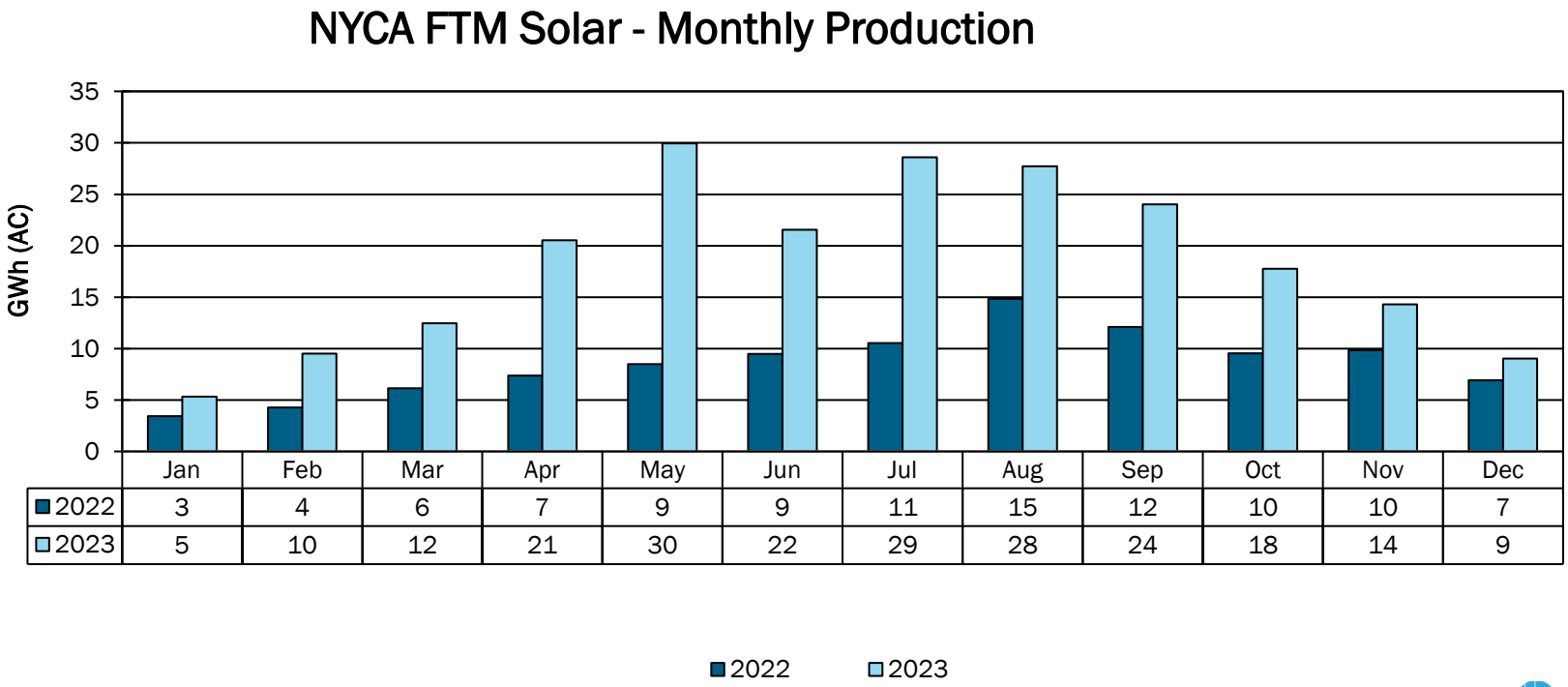
NY FTM Solar Generation

Total Annual FTM Solar Production (GWh)	
2022	2023
103	221



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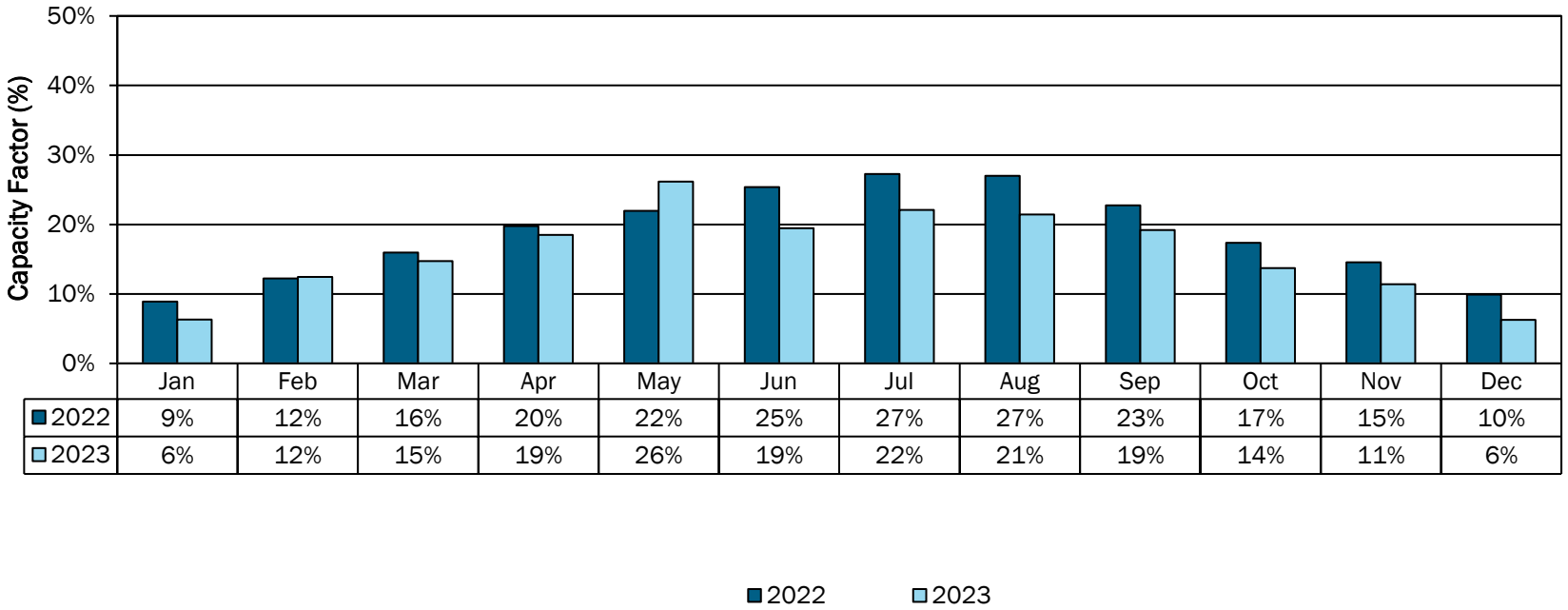
NY FTM Solar Capacity Factors

Annual FTM Solar Capacity Factor	
2022	2023
19%	16%

NYCA FTM Solar Generation - Capacity Factor



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2022	9%	12%	16%	20%	22%	25%	27%	27%	23%	17%	15%	10%
2023	6%	12%	15%	19%	26%	19%	22%	21%	19%	14%	11%	6%

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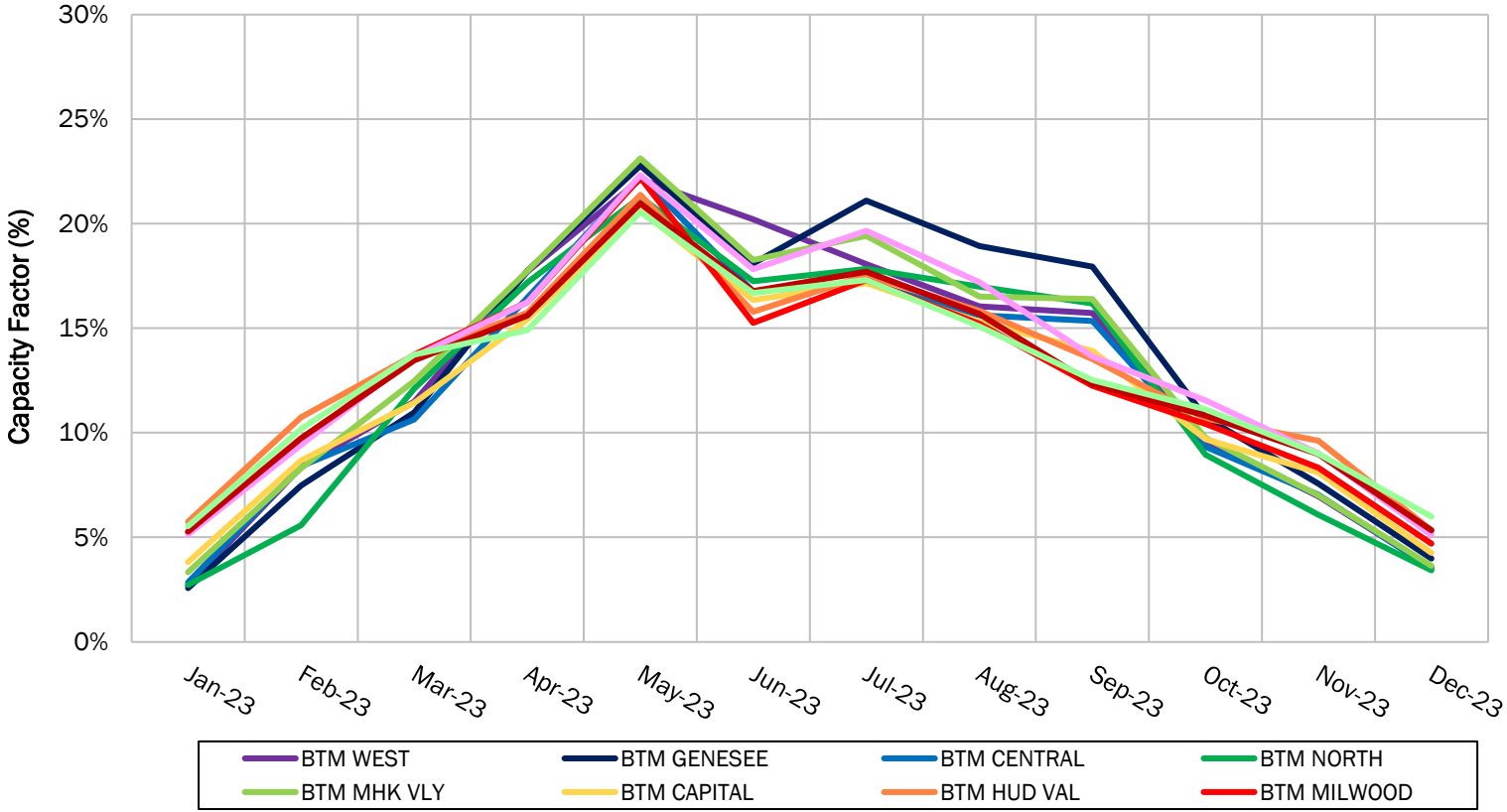
Monthly BTM Solar Capacity Factors by Zone



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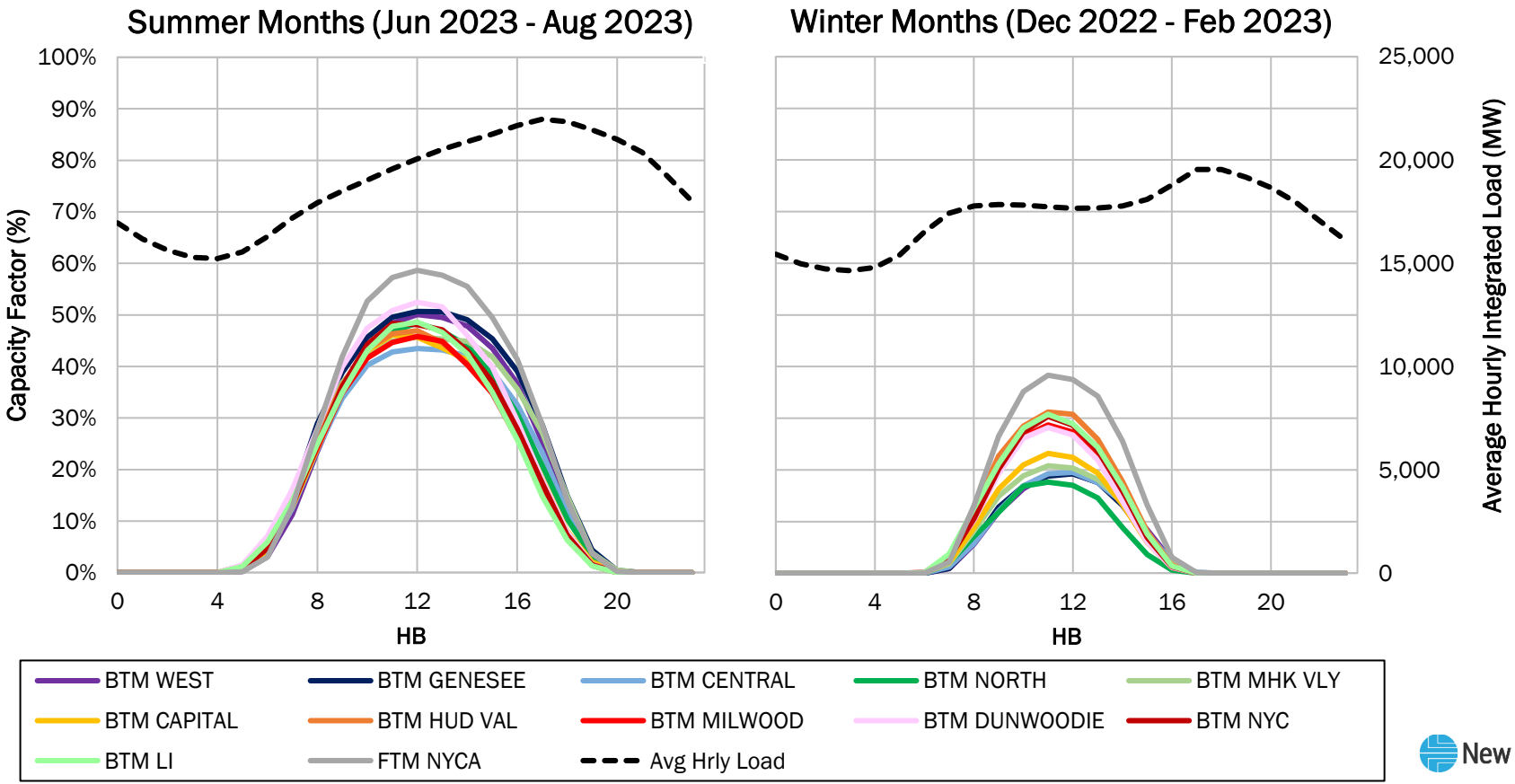
2023 Seasonal Average Hourly Solar Capacity Factors by Zone



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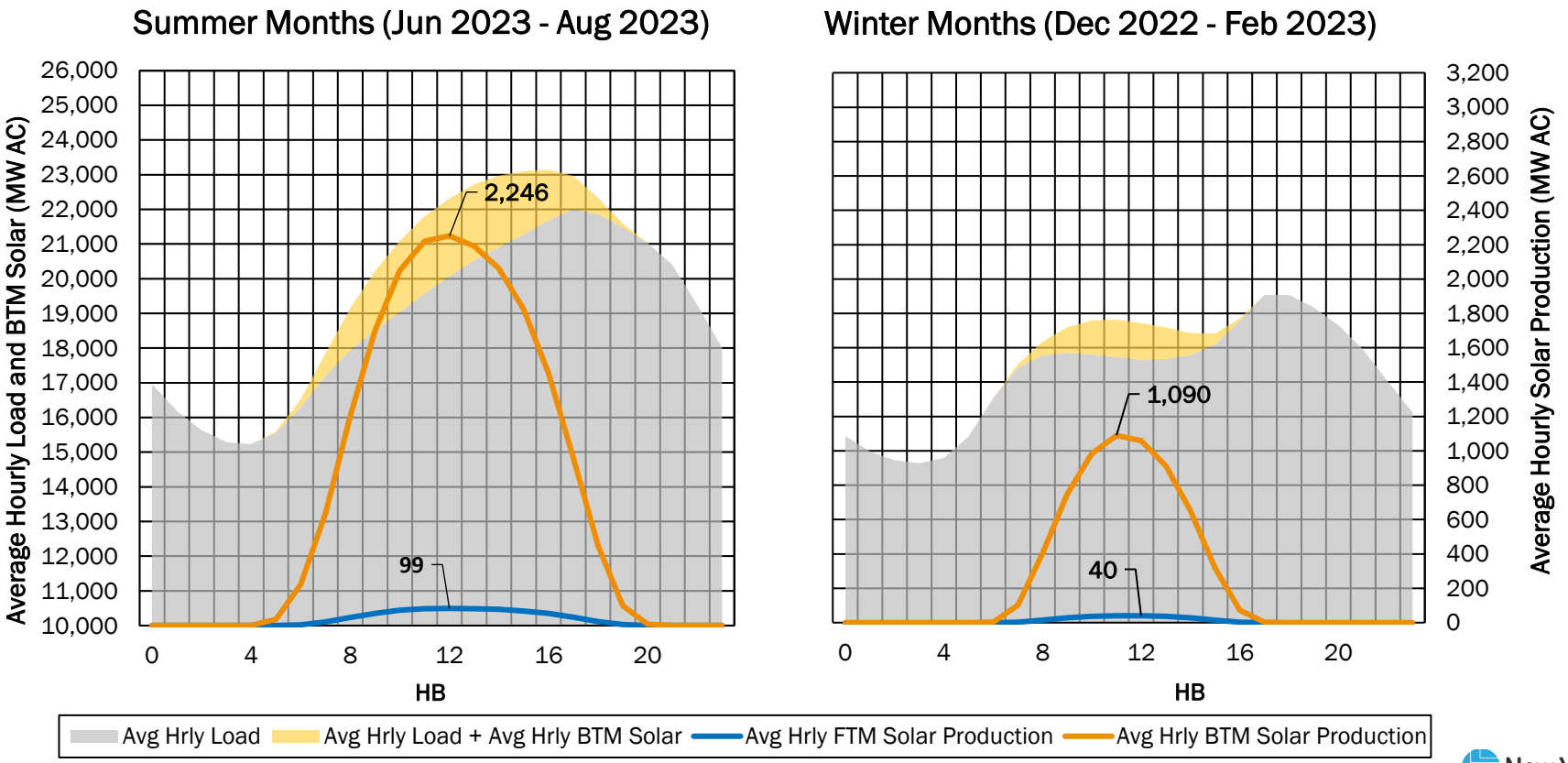
2023 Seasonal Average Hourly Load with Solar Production



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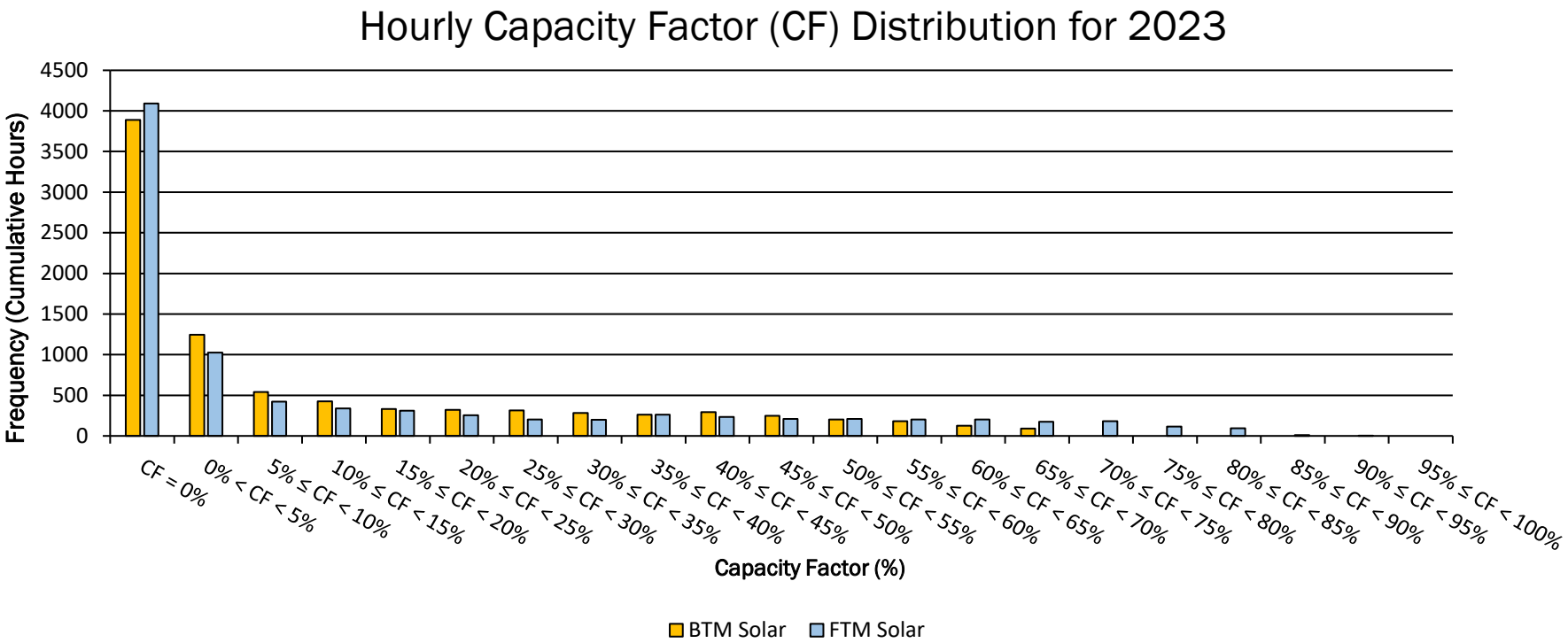
Solar Capacity Factor Distribution



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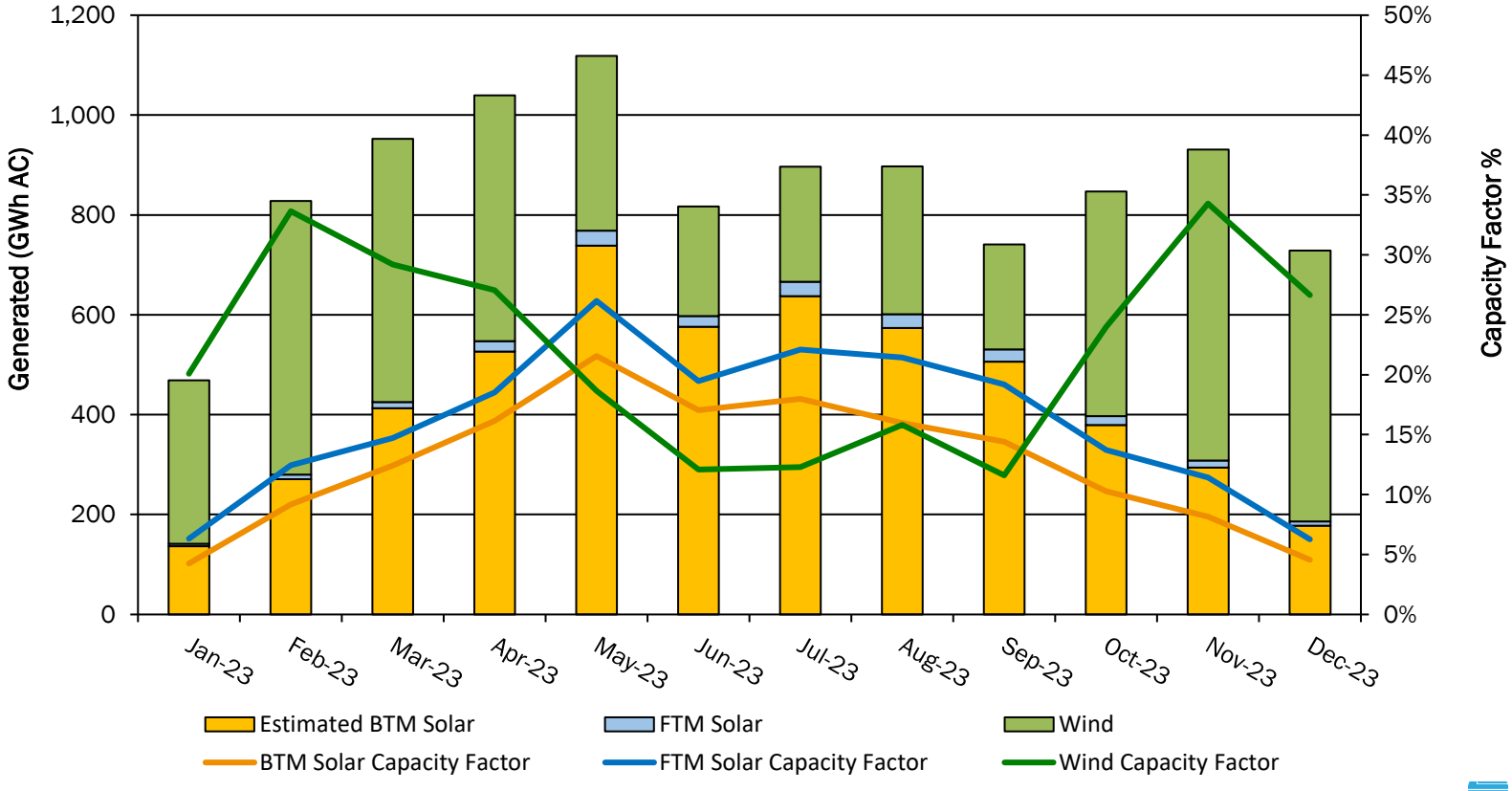
Coincident Wind and Solar

Monthly Wind and Solar Performance (2023)



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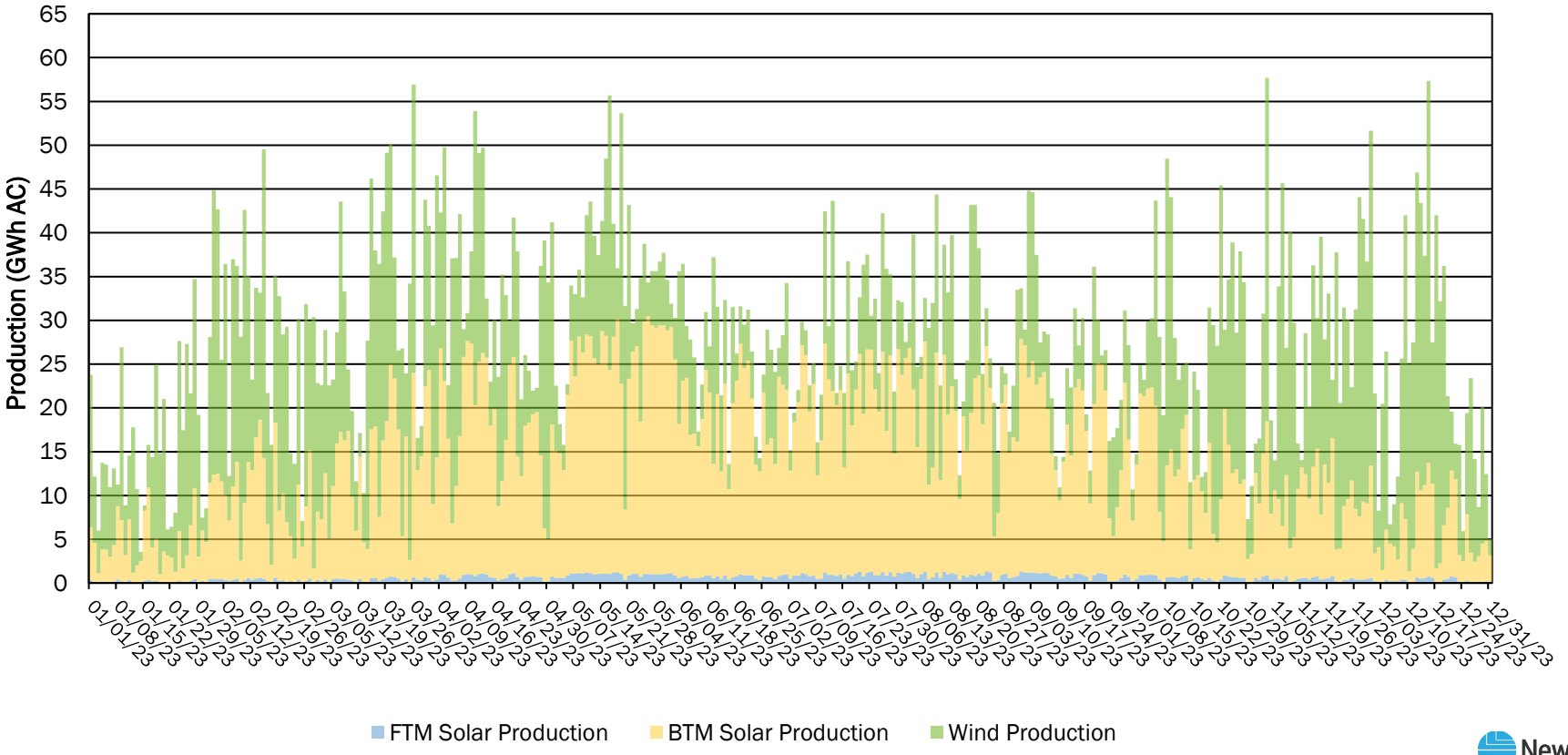
Daily Wind and Solar Performance (2023)



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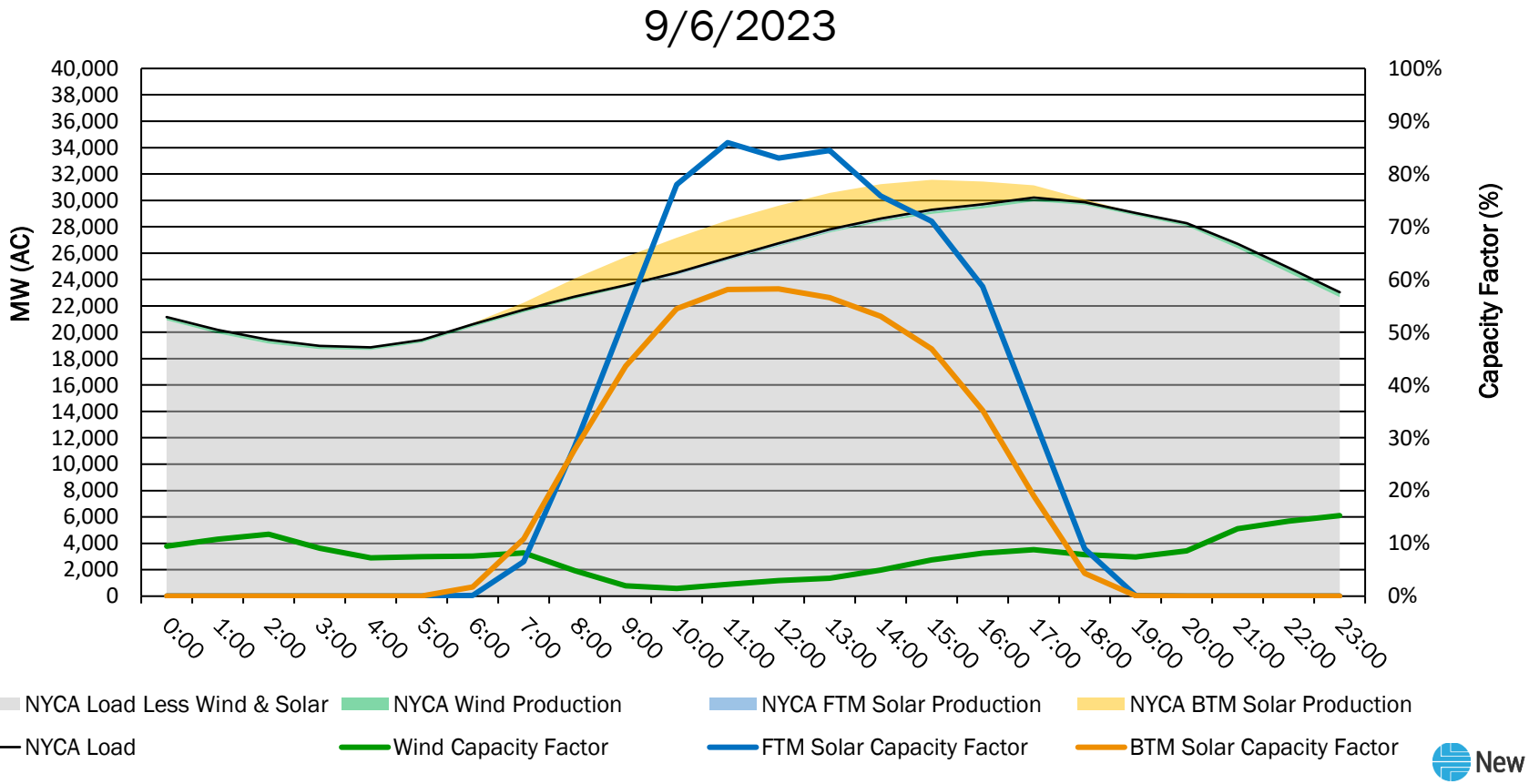
Wind and Solar Performance During Summer Peak Load



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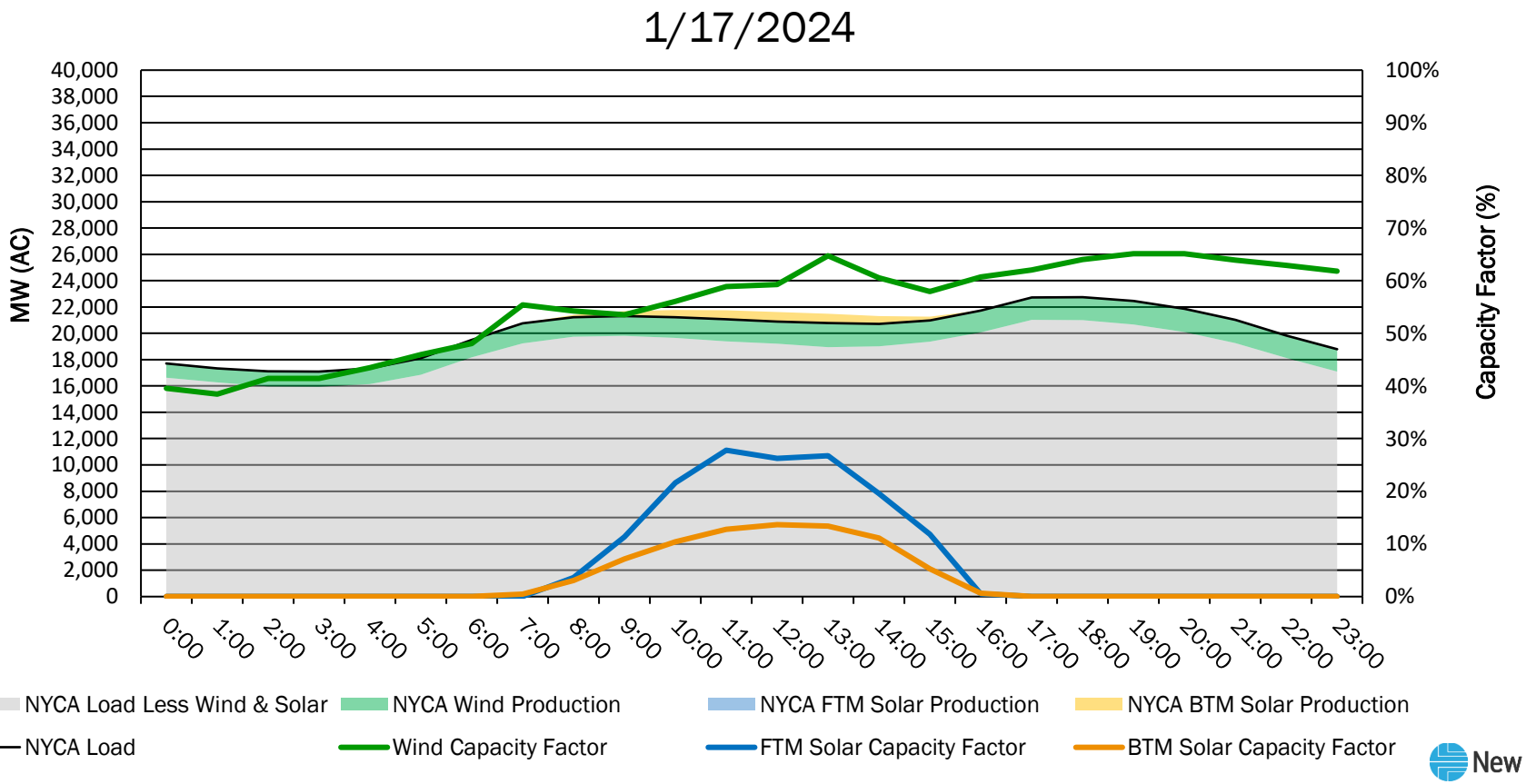
Wind and Solar Performance During Winter Peak Load



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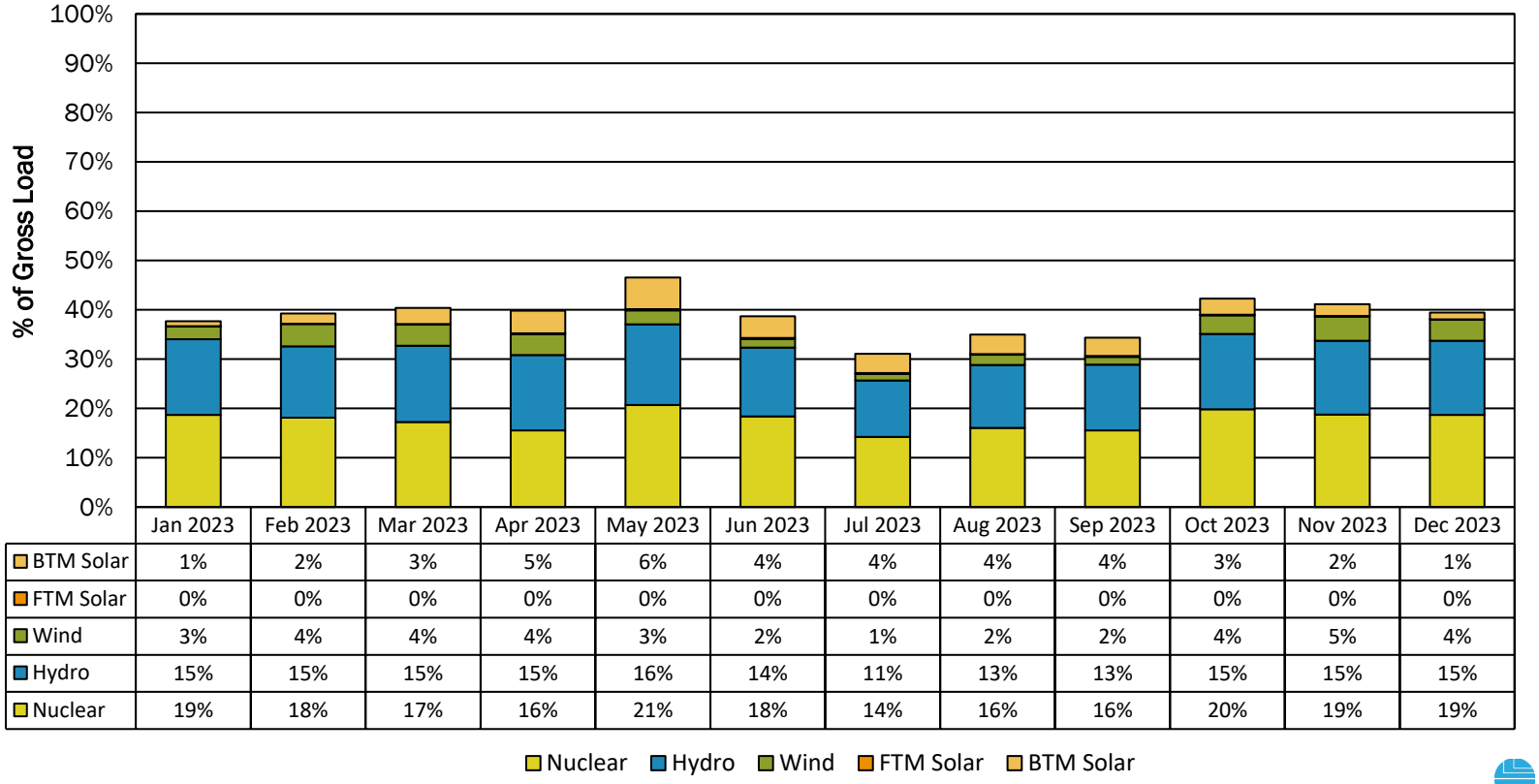
NYCA Emissions-Free Generation

Annual Contribution to Gross Load (38.46%)				
Nuclear	Hydro	Wind	FTM Solar	BTM Solar
17.51%	14.34%	3.09%	0.14%	3.37%



	Jan 2023	Feb 2023	Mar 2023	Apr 2023	May 2023	Jun 2023	Jul 2023	Aug 2023	Sep 2023	Oct 2023	Nov 2023	Dec 2023
BTM Solar	1%	2%	3%	5%	6%	4%	4%	4%	4%	3%	2%	1%
FTM Solar	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Wind	3%	4%	4%	4%	3%	2%	1%	2%	2%	4%	5%	4%
Hydro	15%	15%	15%	15%	16%	14%	11%	13%	13%	15%	15%	15%
Nuclear	19%	18%	17%	16%	21%	18%	14%	16%	16%	20%	19%	19%

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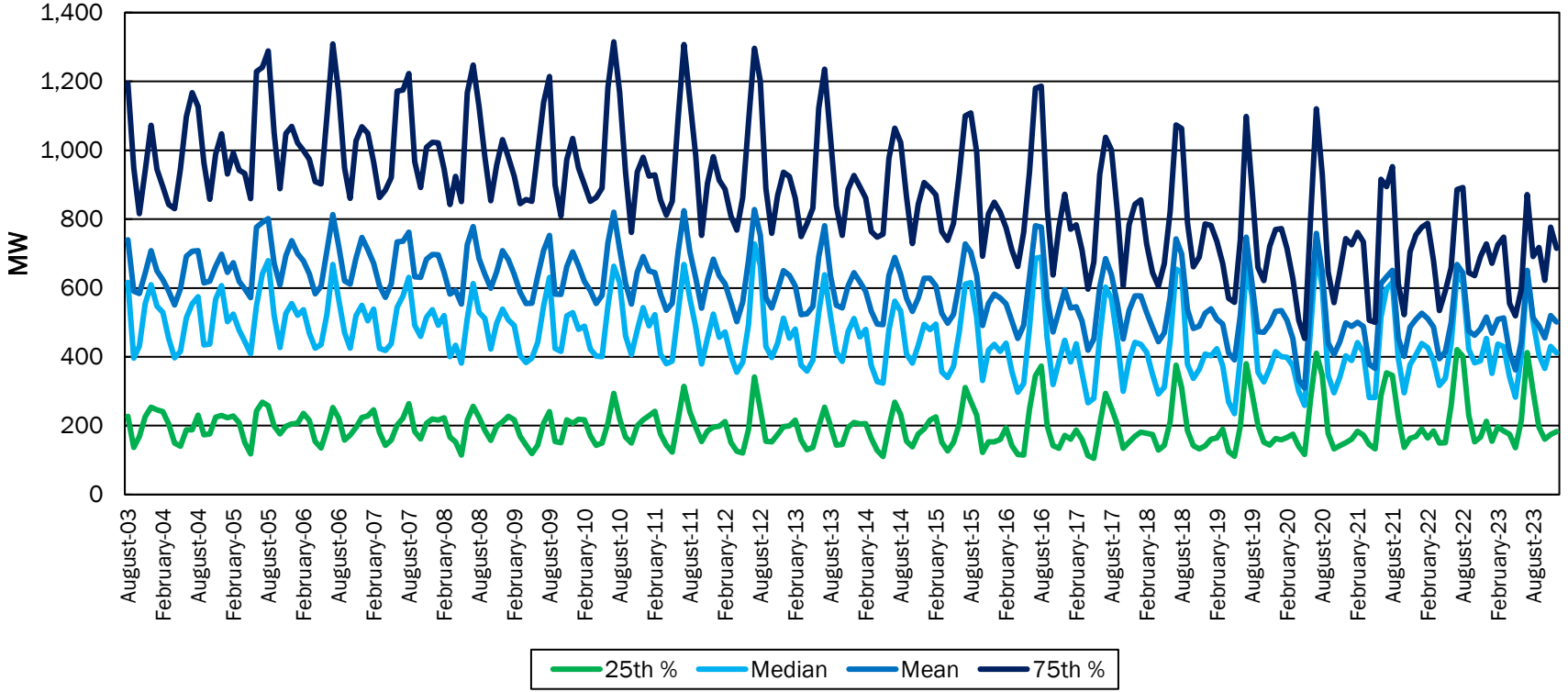
Load Ramps

Hourly Metered Load Ramps

(Gross Load less BTM Solar - Upward Ramps Only)



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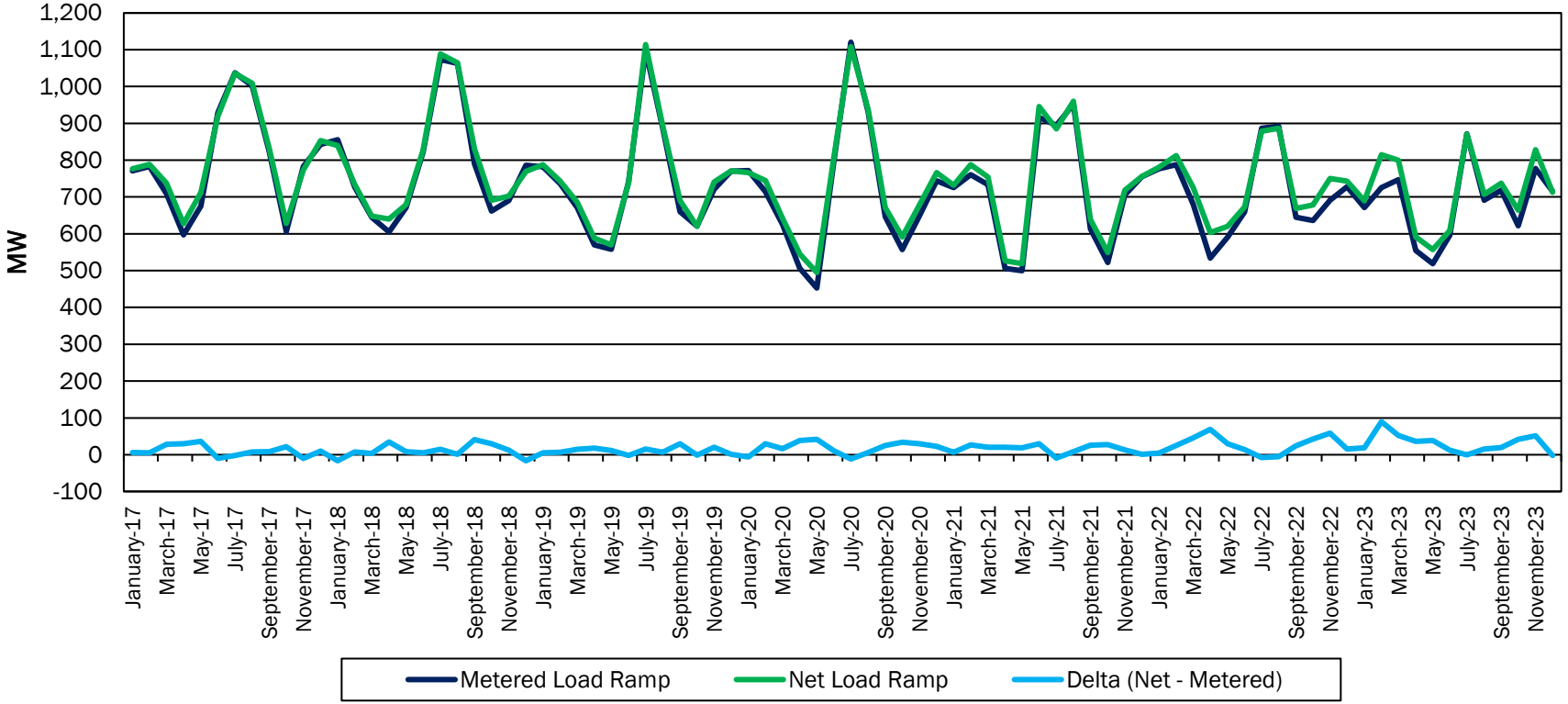
Metered Load vs Net Load Hourly Ramps

(75th Percentile Upward Ramps Only)



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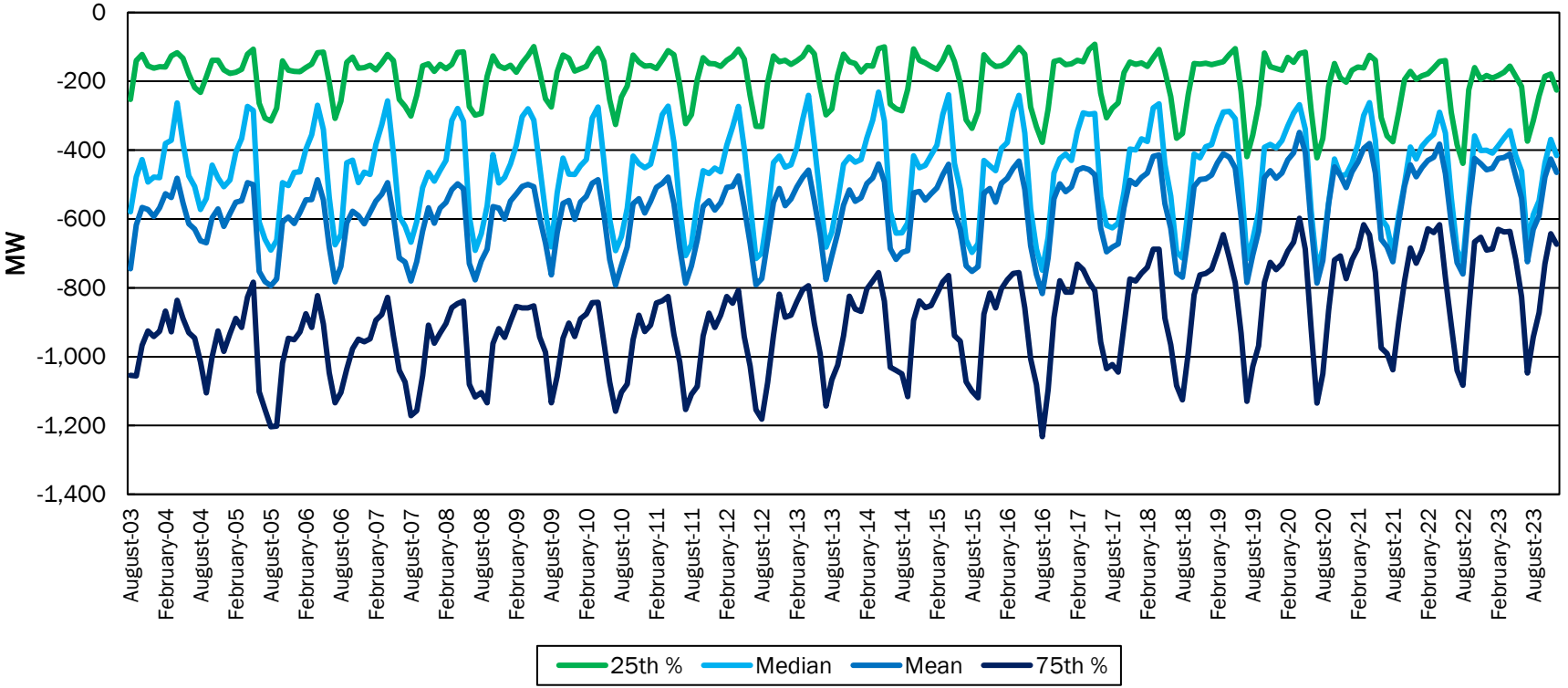
Hourly Metered Load Ramps

(Gross Load less BTM Solar - Downward Ramps Only)



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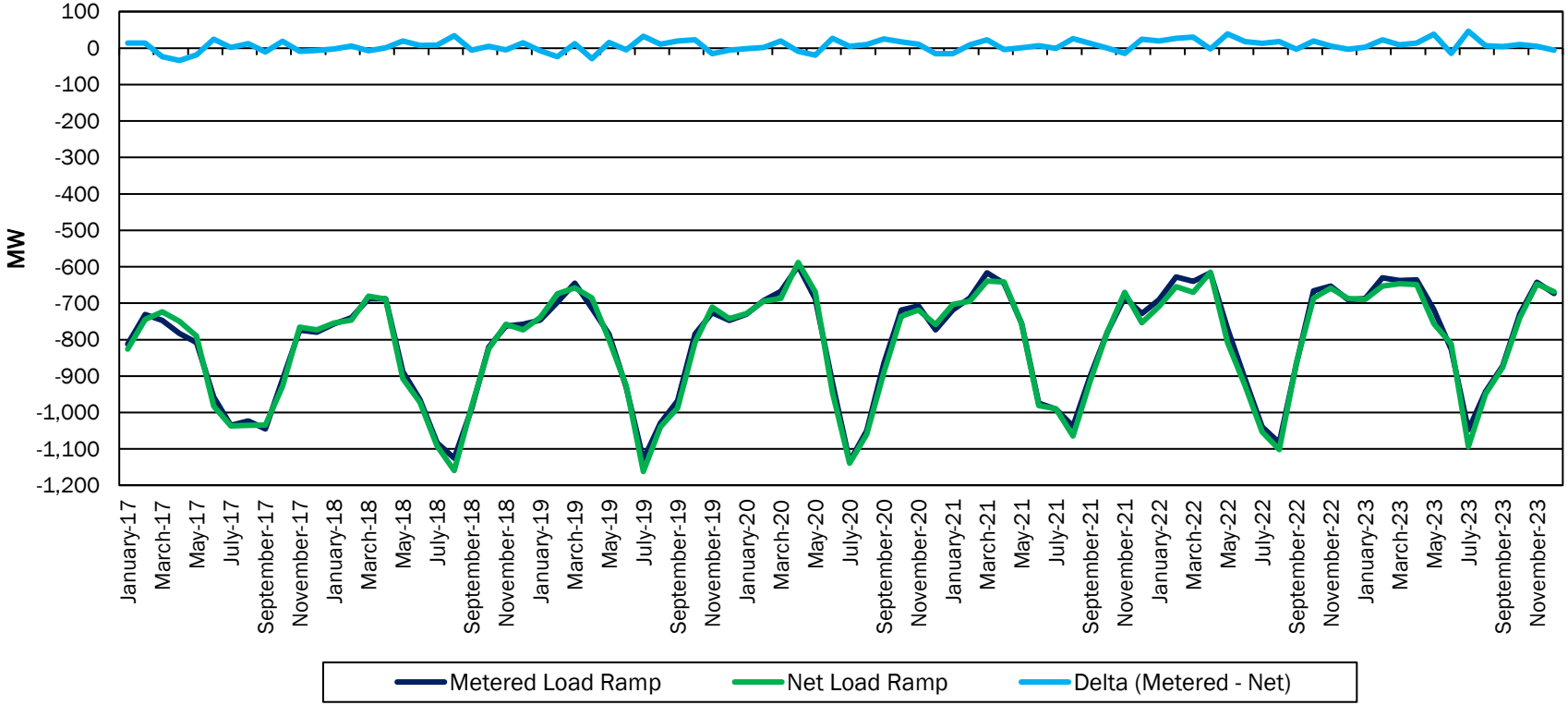
Metered Load vs Net Load Hourly Ramps

(75th Percentile Downward Ramps Only)



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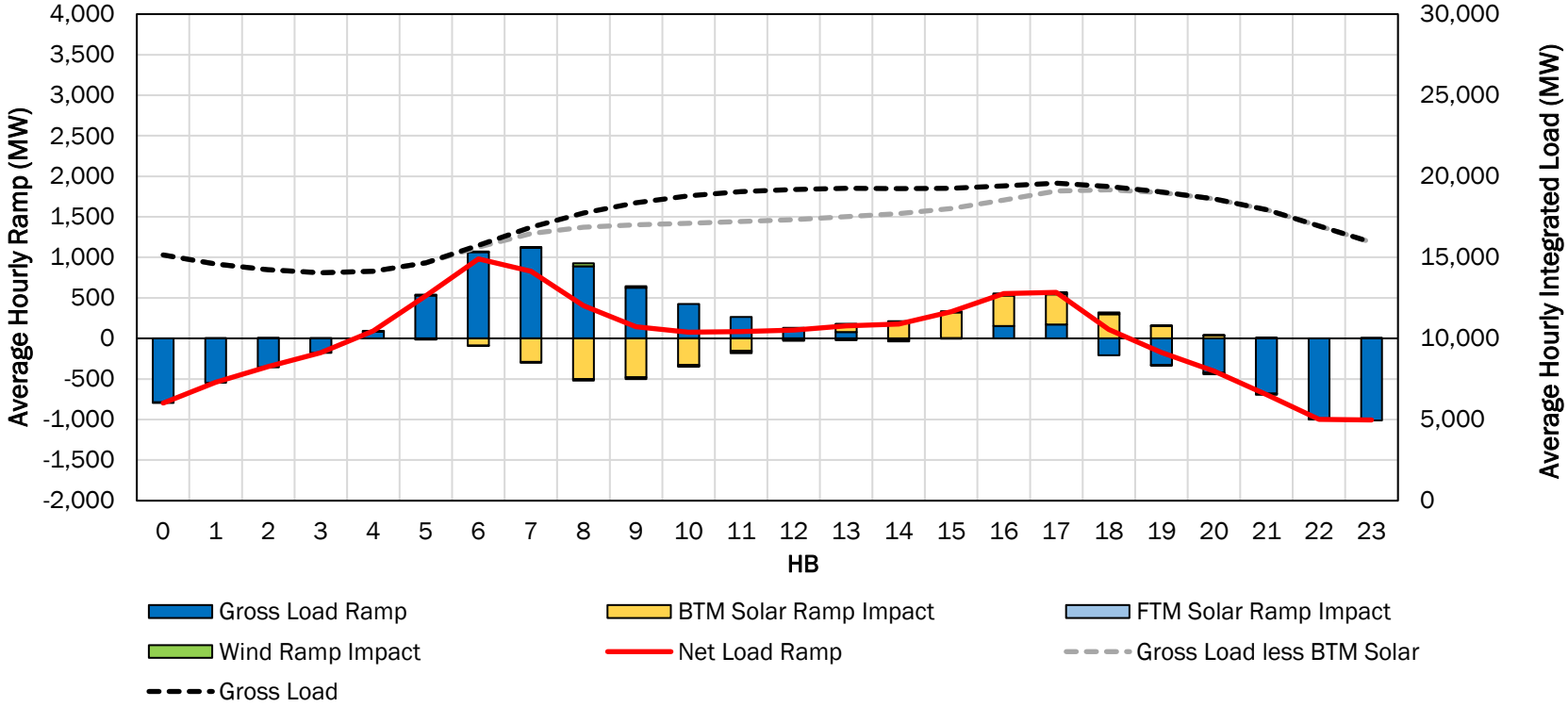
Average Hourly Net Load Ramps (2023)



Ramps are calculated as the difference between the previous and current hour (HB)
Net Load is defined as Gross Load less Wind and Solar Generation
Wind and Solar ramps are negated to indicate their impact on Net Load Ramp

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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

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