New York ISO
Independent System Operator

Overview of NY Renewables in 2022

Reposted in Response to Stakeholder Feedback – Content with Green Text is New or Revised Material

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MIWG

04/04/2023, Rensselaer, NY

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

- Unless otherwise stated, Wind data accounts for all wind plants installed in the NYCA.
- Unless otherwise stated, Wind and Solar Capacity Factors are inclusive of ALL hours in 2022 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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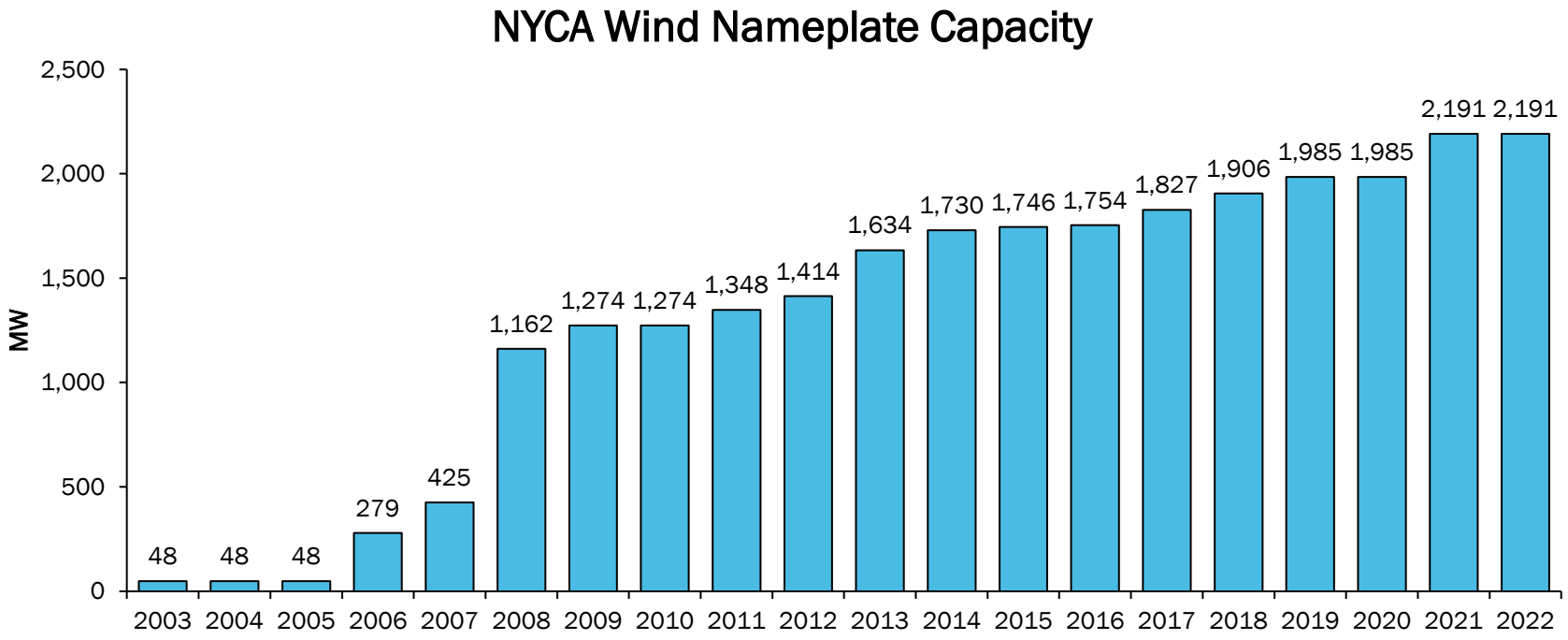
NYCA Wind 2022

Wind Overview



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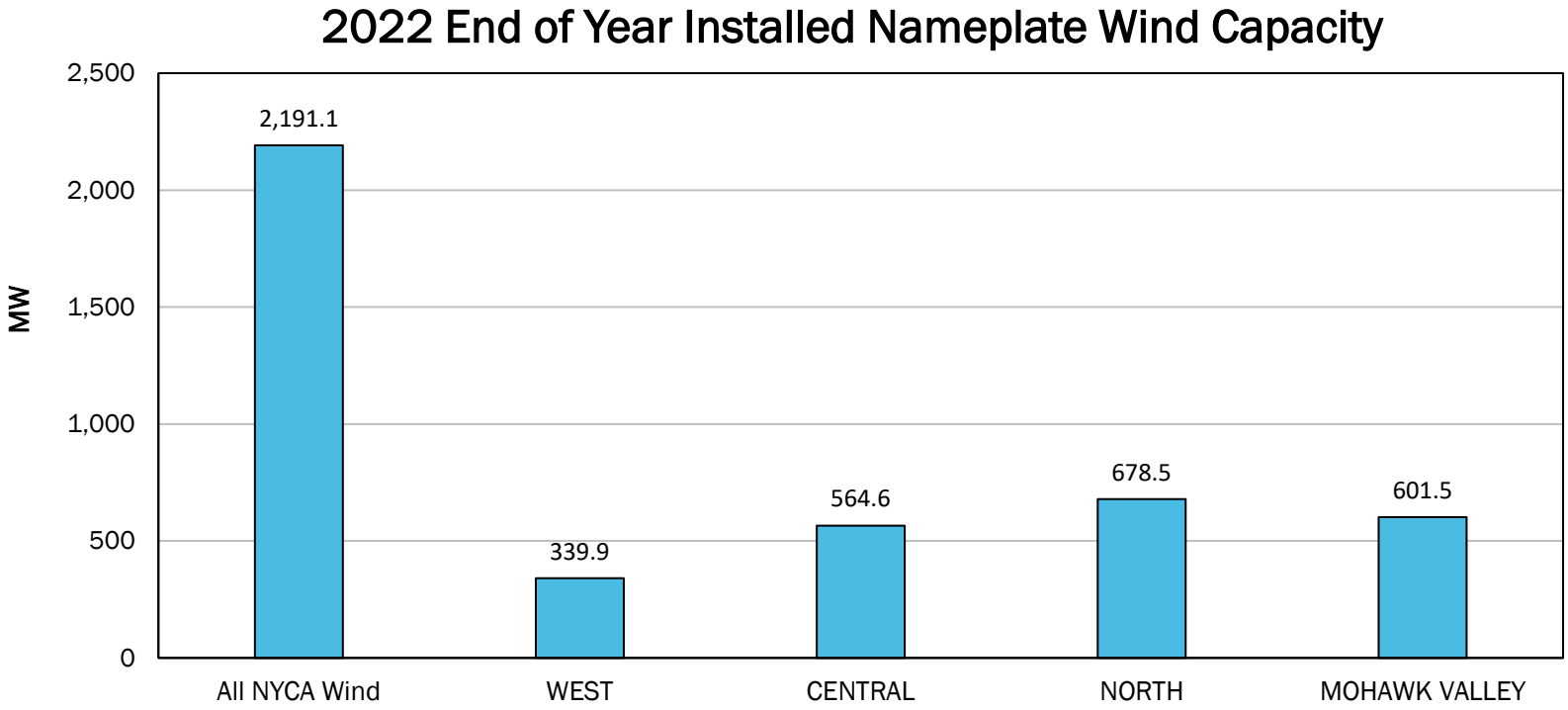
Zonal Wind Capacity



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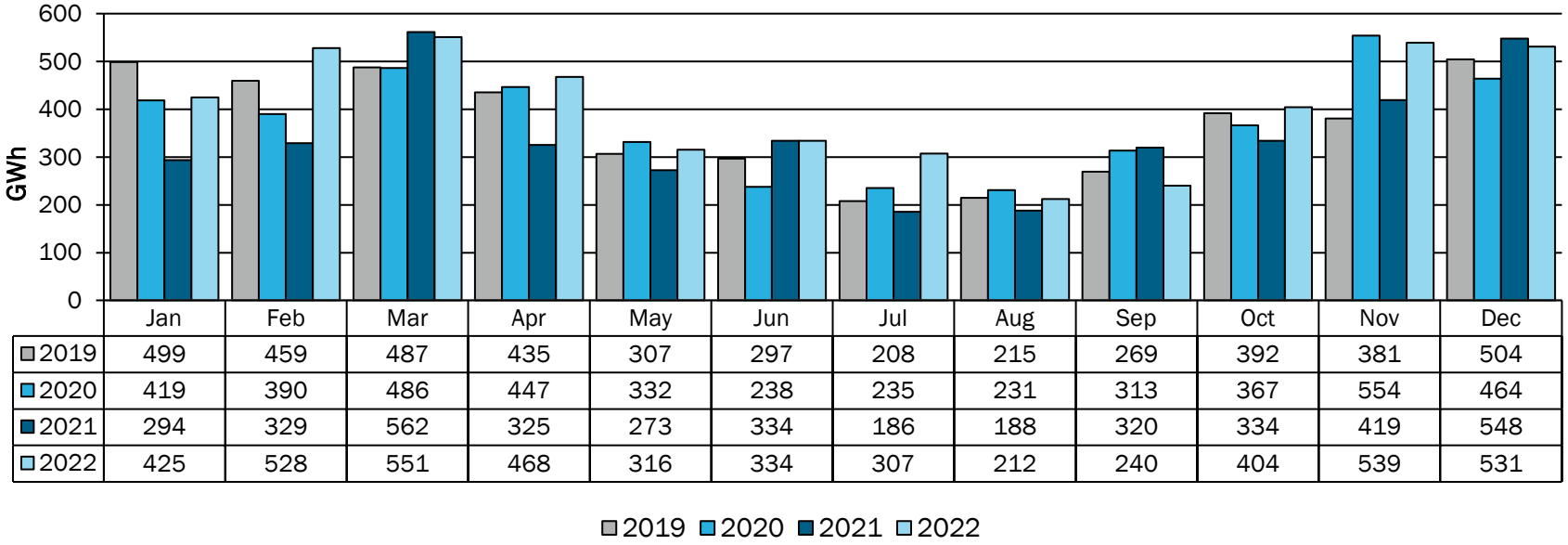
NY Wind Generation

Total Annual Wind Production (GWh)			
2019	2020	2021	2022
4,453	4,476	4,111	4,856

NYCA Wind Plants - Monthly Production



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2019	499	459	487	435	307	297	208	215	269	392	381	504
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

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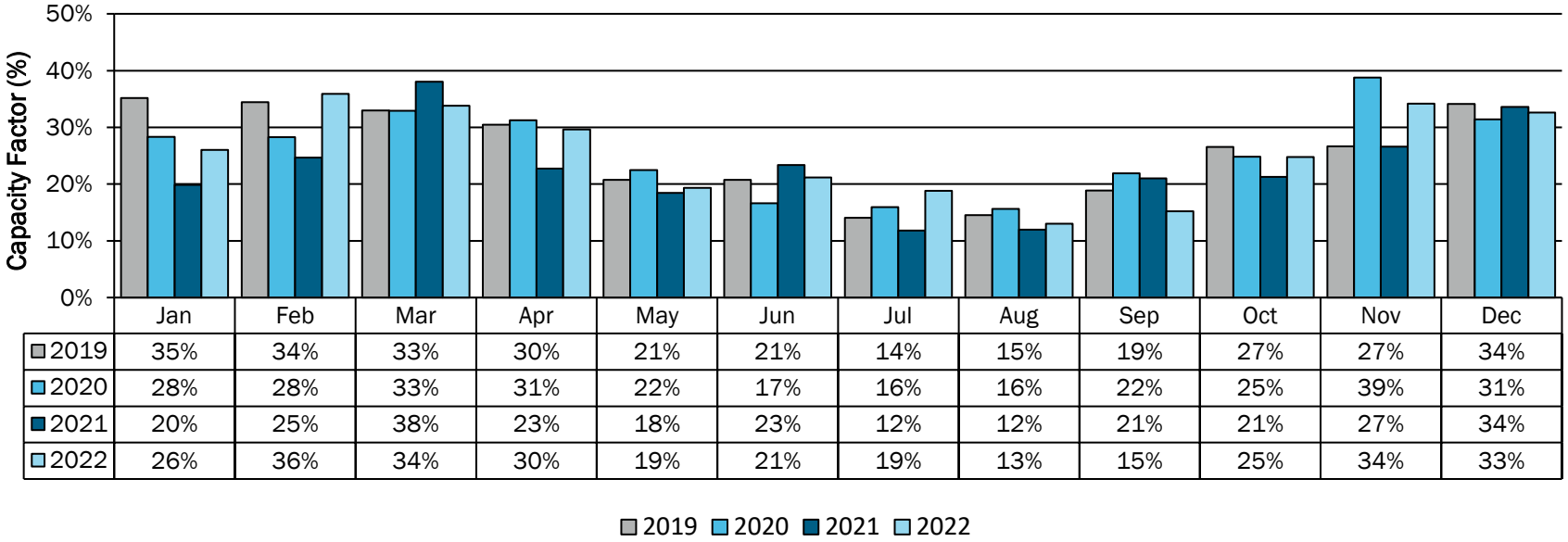
NY Wind Capacity Factors

Annual Wind Capacity Factor			
2019	2020	2021	2022
26%	26%	23%	25%

NYCA Wind Generation – Monthly Capacity Factor



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2019	35%	34%	33%	30%	21%	21%	14%	15%	19%	27%	27%	34%
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%

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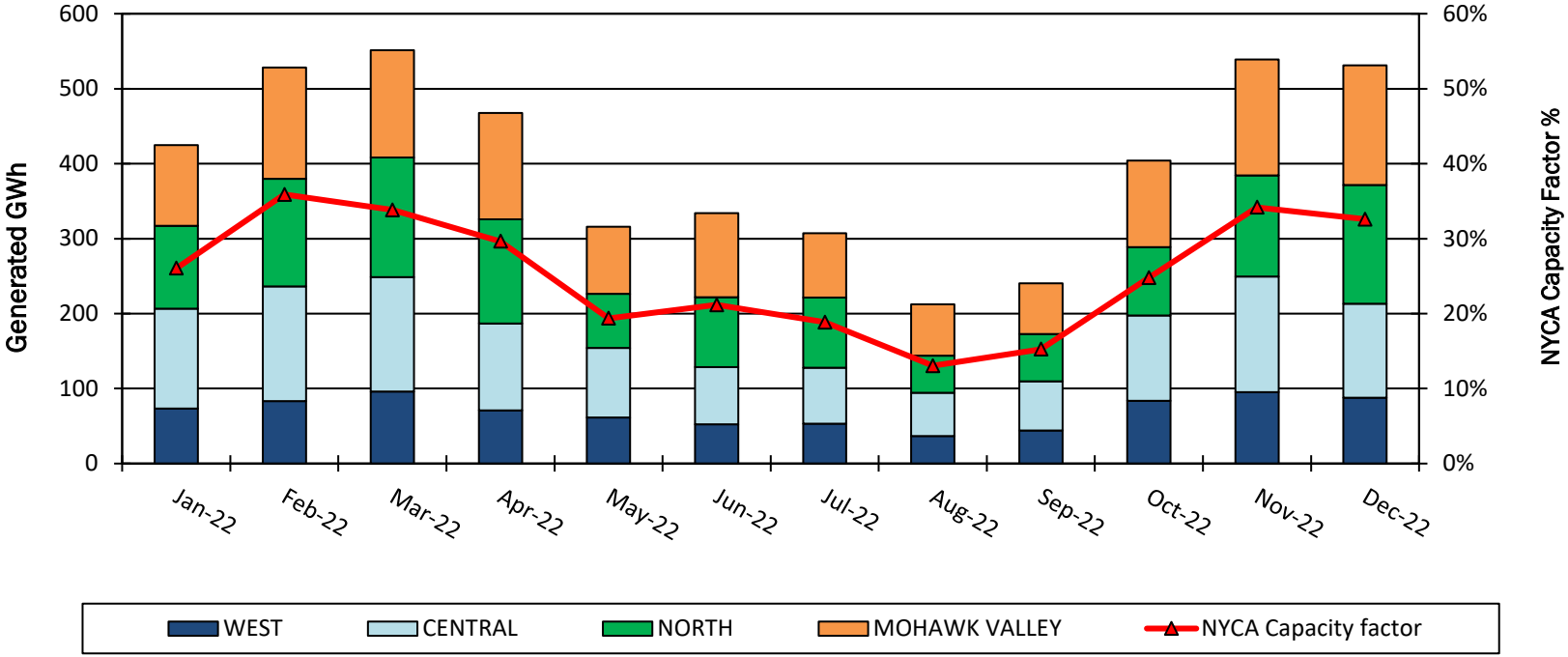
Monthly Wind Production by Zone



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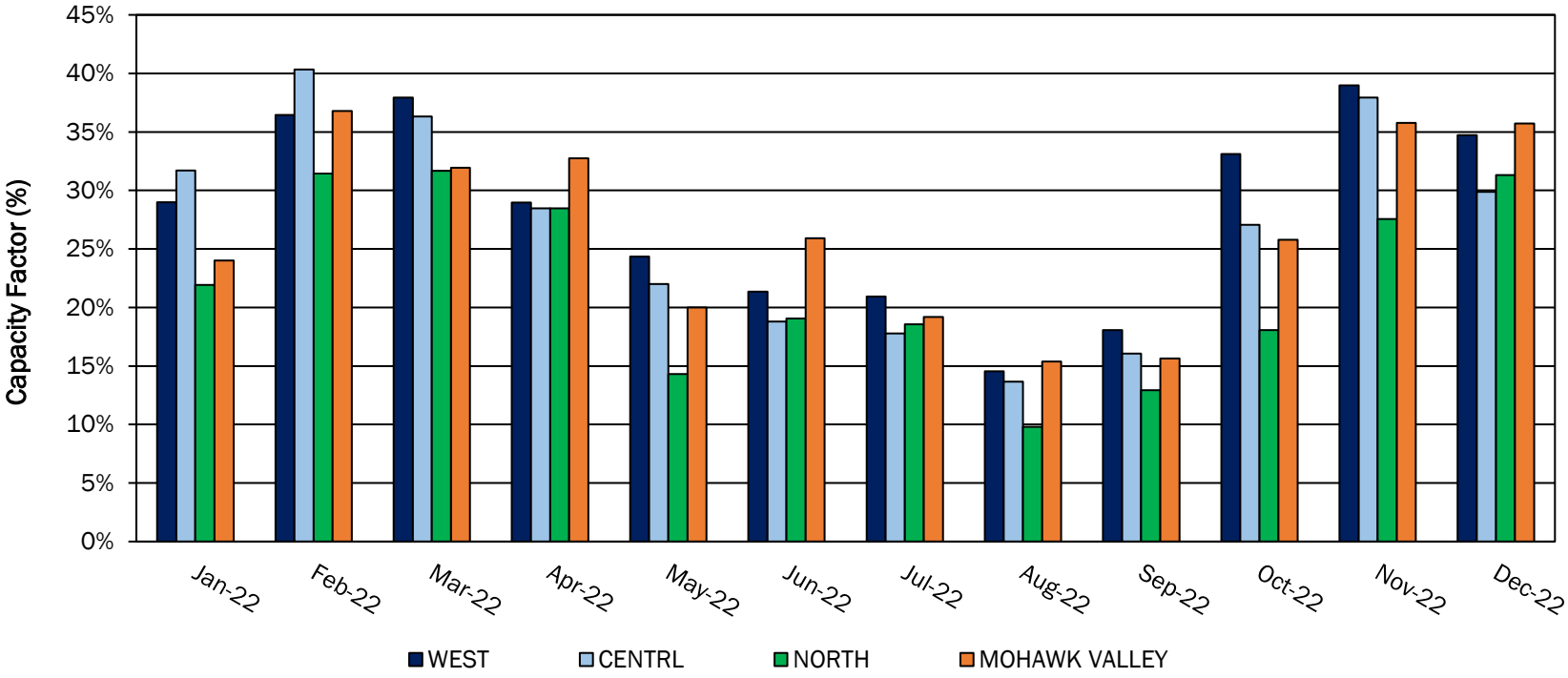
Monthly Wind Capacity Factors by Zone



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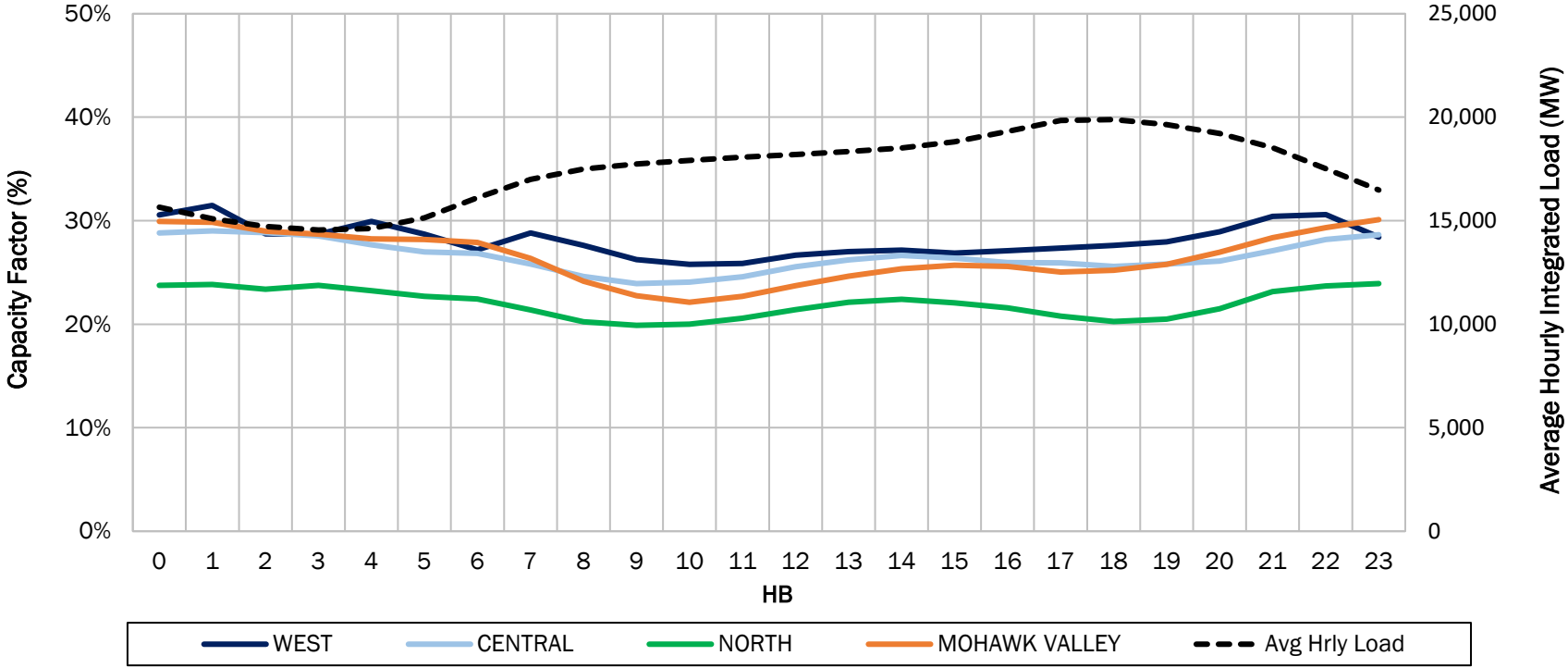
2022 Average Hourly Wind Capacity Factors by Zone



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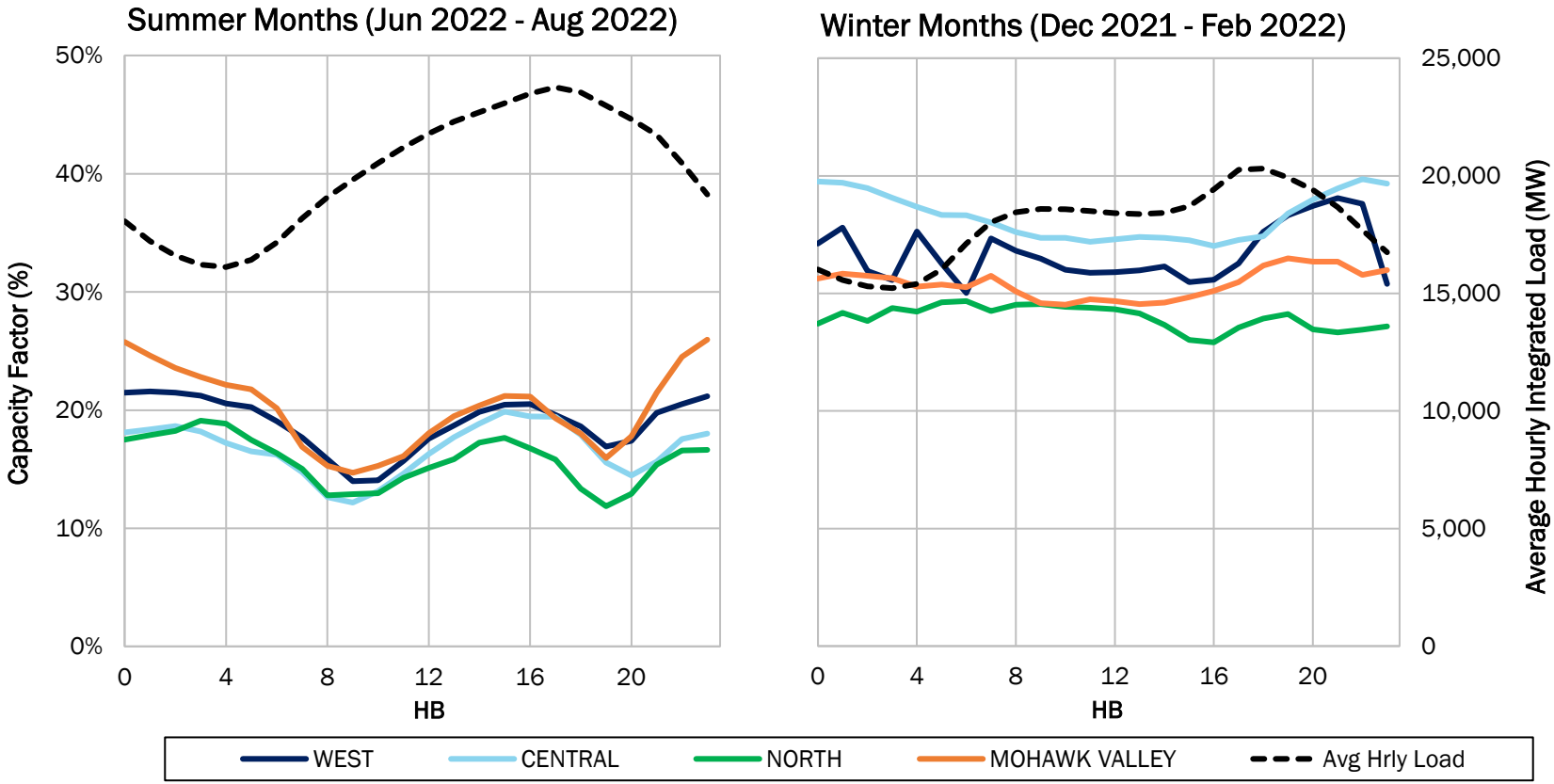
2022 Seasonal Average Hourly Wind Capacity Factors by Zone



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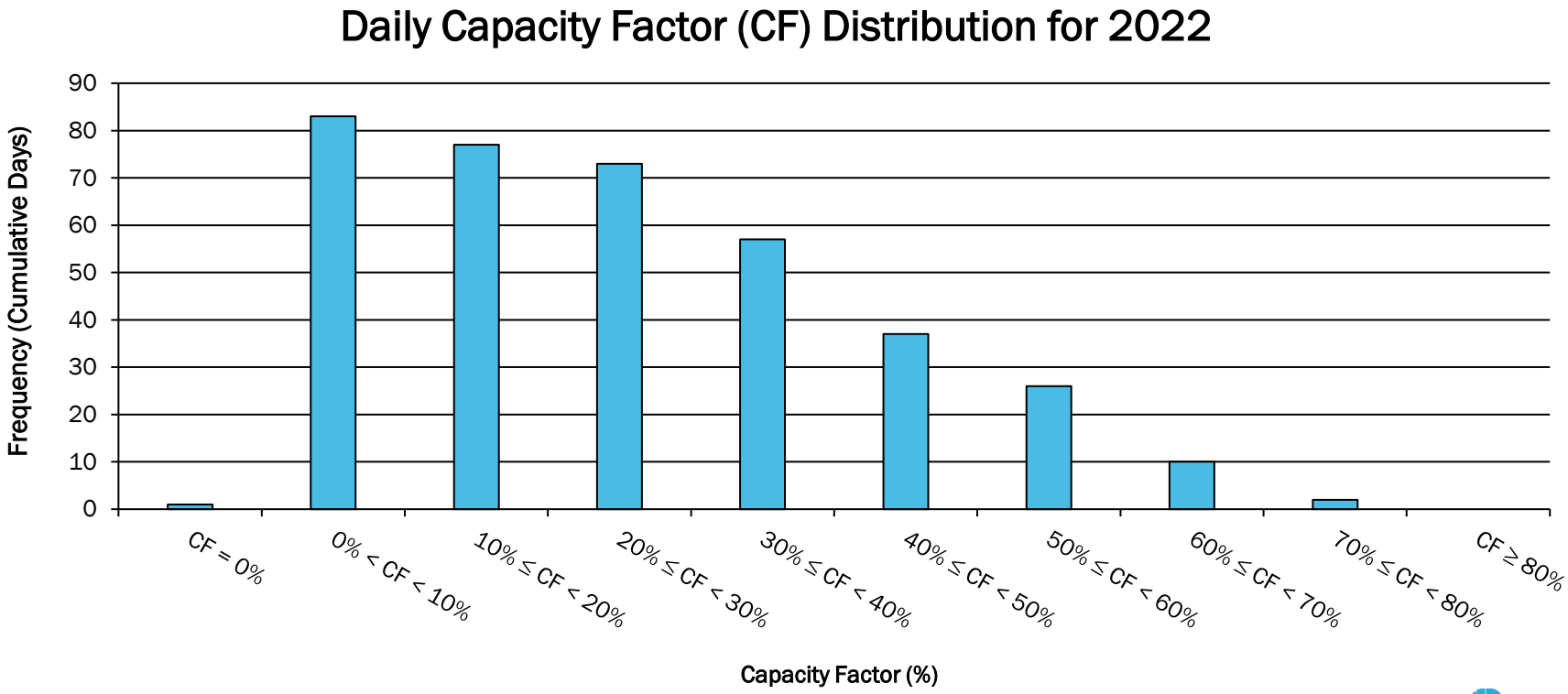
2022 NY Wind Capacity Factor Distribution



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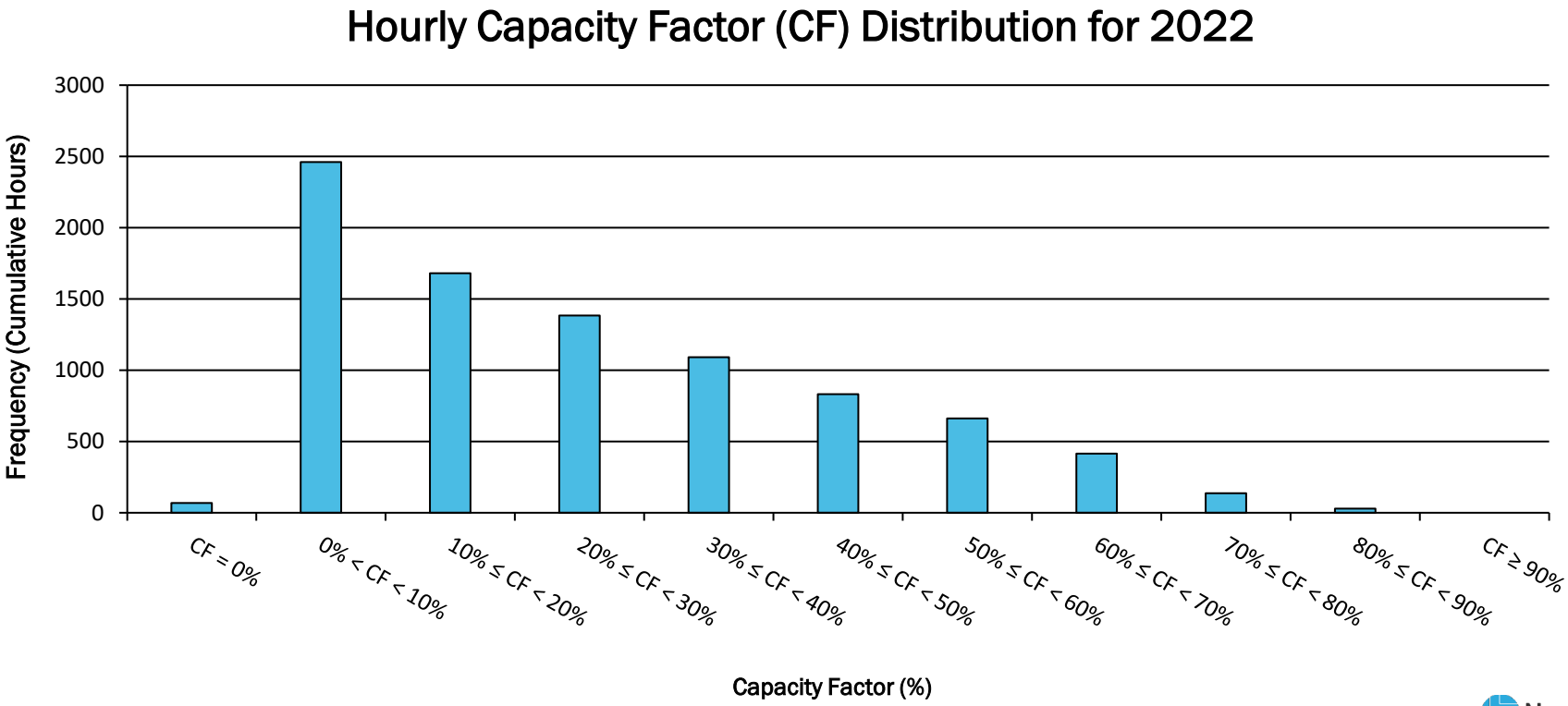
2022 NY Wind Capacity Factor Distribution



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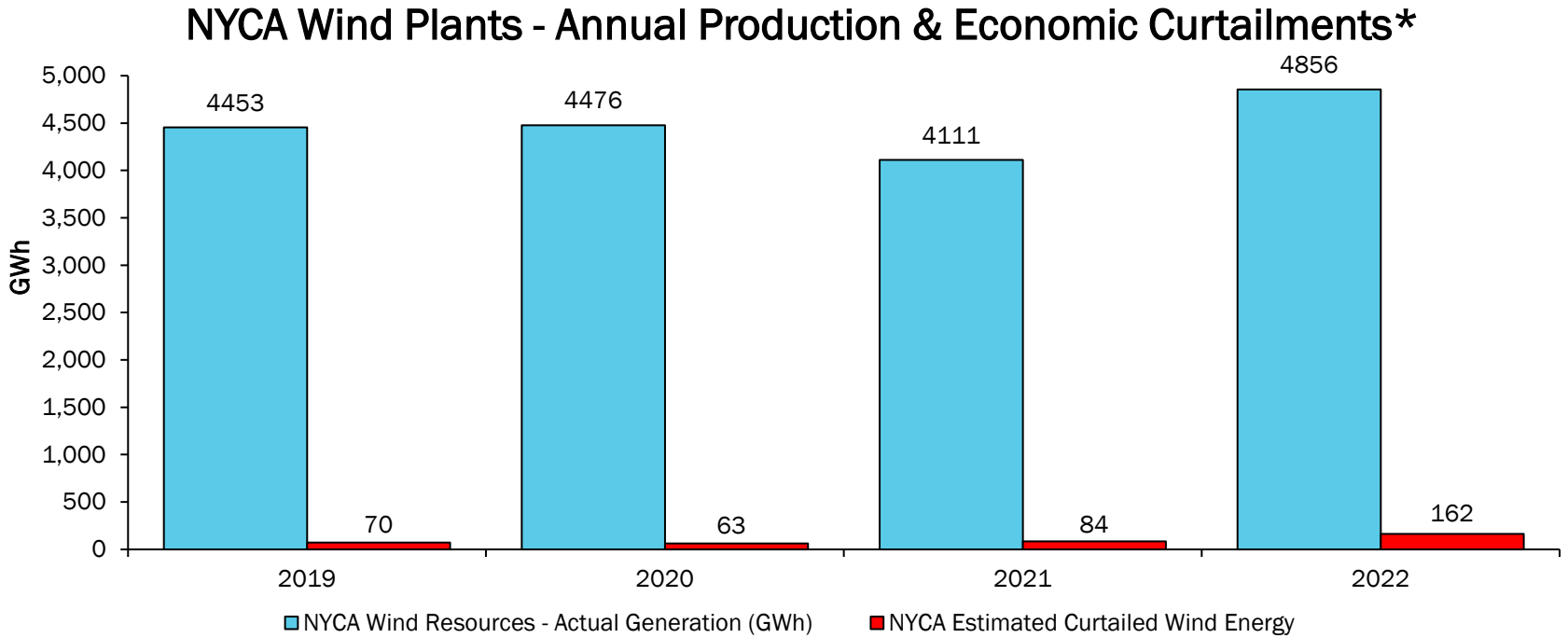
NY Economic Wind Curtailments



*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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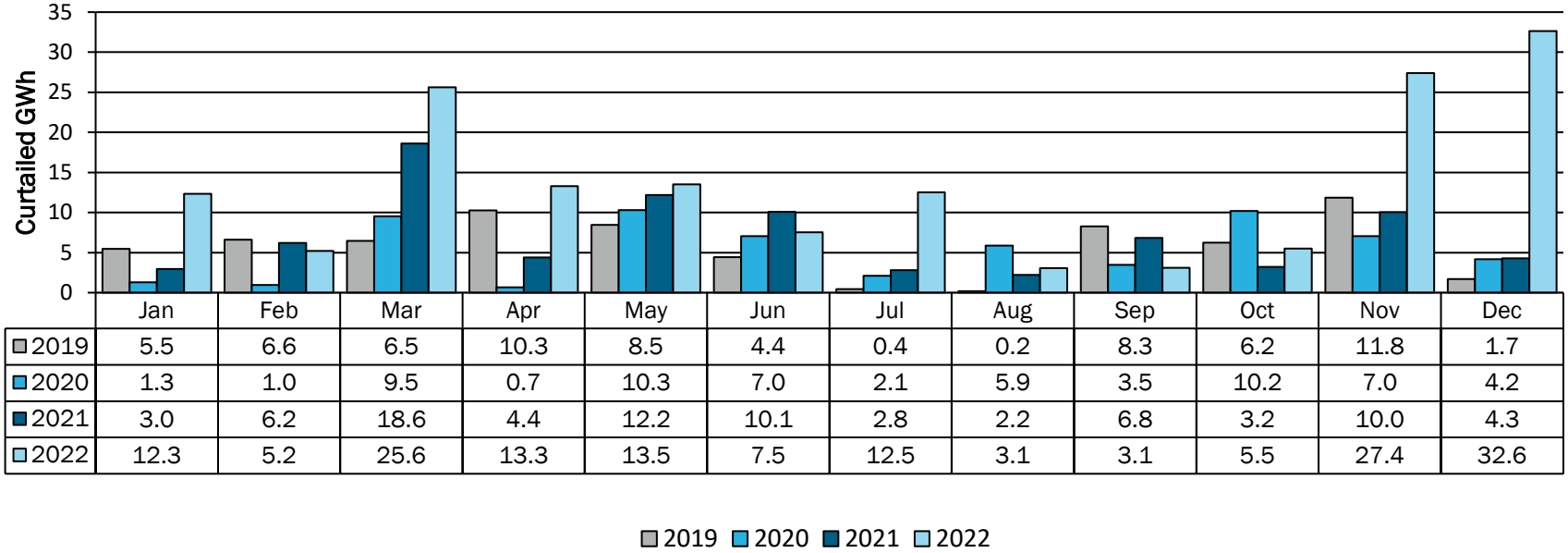
NY Economic Wind Curtailments

Total Annual Wind Curtailments (GWh)			
2019	2020	2021	2022
70.5	62.7	84.0	161.7

NYCA Wind Plants - Monthly Estimated Curtailed Energy



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2019	5.5	6.6	6.5	10.3	8.5	4.4	0.4	0.2	8.3	6.2	11.8	1.7
2020	1.3	1.0	9.5	0.7	10.3	7.0	2.1	5.9	3.5	10.2	7.0	4.2
2021	3.0	6.2	18.6	4.4	12.2	10.1	2.8	2.2	6.8	3.2	10.0	4.3
2022	12.3	5.2	25.6	13.3	13.5	7.5	12.5	3.1	3.1	5.5	27.4	32.6

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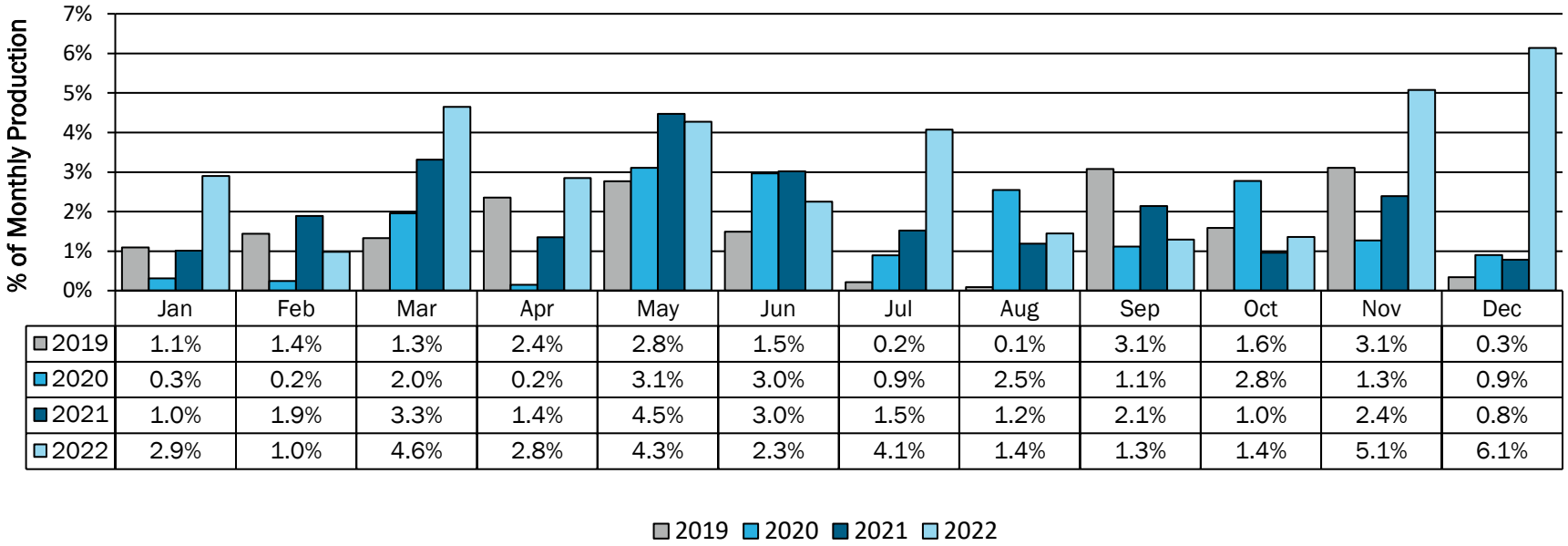
NY Economic Wind Curtailments

Total Estimated Curtailed Energy %			
2019	2020	2021	2022
1.6%	1.4%	2.0%	3.3%

NYCA Wind Plants - Monthly Estimated Curtailed Energy %



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2019	1.1%	1.4%	1.3%	2.4%	2.8%	1.5%	0.2%	0.1%	3.1%	1.6%	3.1%	0.3%
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%

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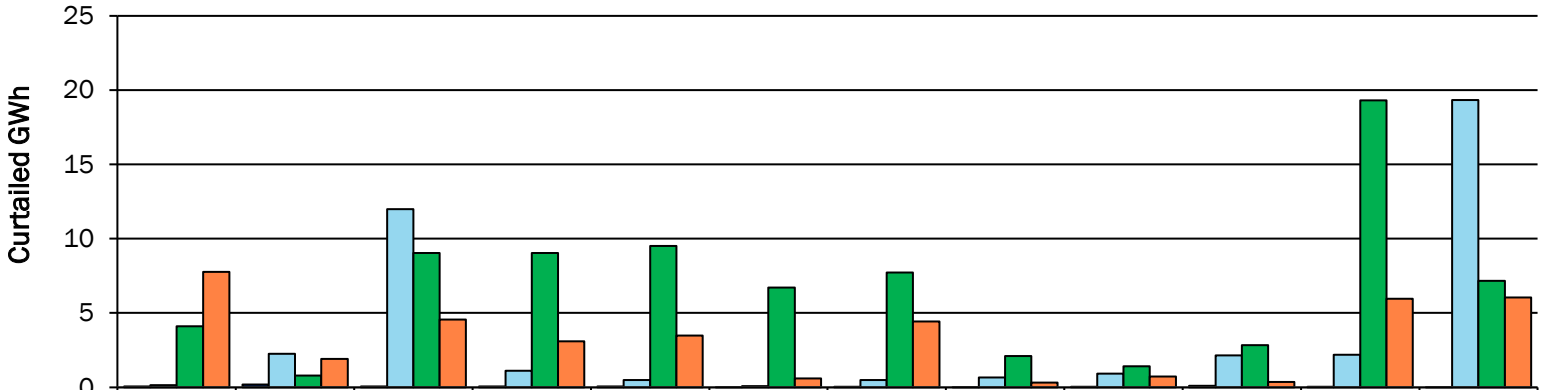
NY Economic Wind Curtailments

Total Annual Estimated Curtailed Energy (GWh)			
West	Central	North	Mohawk Valley
0.67	41.79	79.72	39.23

NYCA Zones - Monthly Estimated Curtailed Energy for 2022



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
WEST	0.07	0.18	0.05	0.07	0.06	0.00	0.03	0.01	0.04	0.11	0.05	0.01
CENTRAL	0.15	2.26	11.99	1.12	0.48	0.08	0.49	0.66	0.92	2.15	2.18	19.33
NORTH	4.10	0.78	9.03	9.04	9.50	6.72	7.73	2.11	1.42	2.83	19.31	7.17
MOHAWK VALLEY	7.77	1.91	4.55	3.10	3.49	0.60	4.44	0.31	0.73	0.35	5.95	6.03

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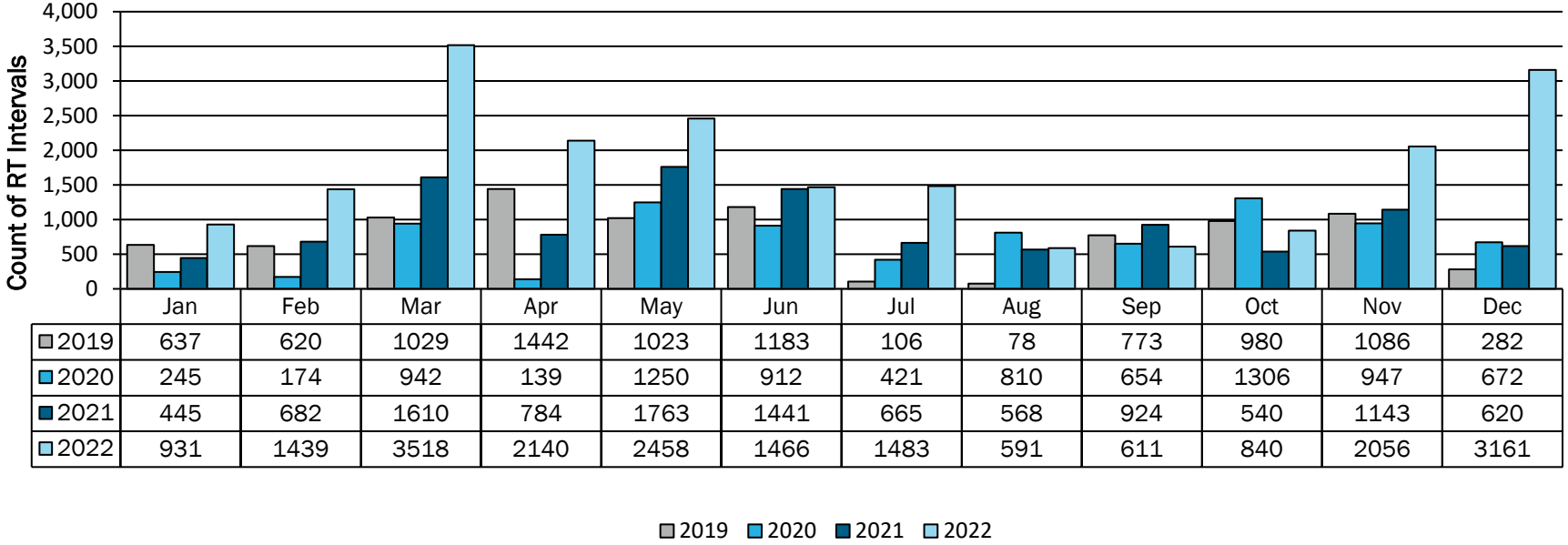
NY Economic Wind Curtailments

Total Estimated Curtailed Interval Count			
2019	2020	2021	2022
9,239	8,472	11,185	20,694

NYCA Wind Plants - Monthly Estimated Curtailed Interval Count

(12 Intervals = 1 Hour)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2019	637	620	1029	1442	1023	1183	106	78	773	980	1086	282
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

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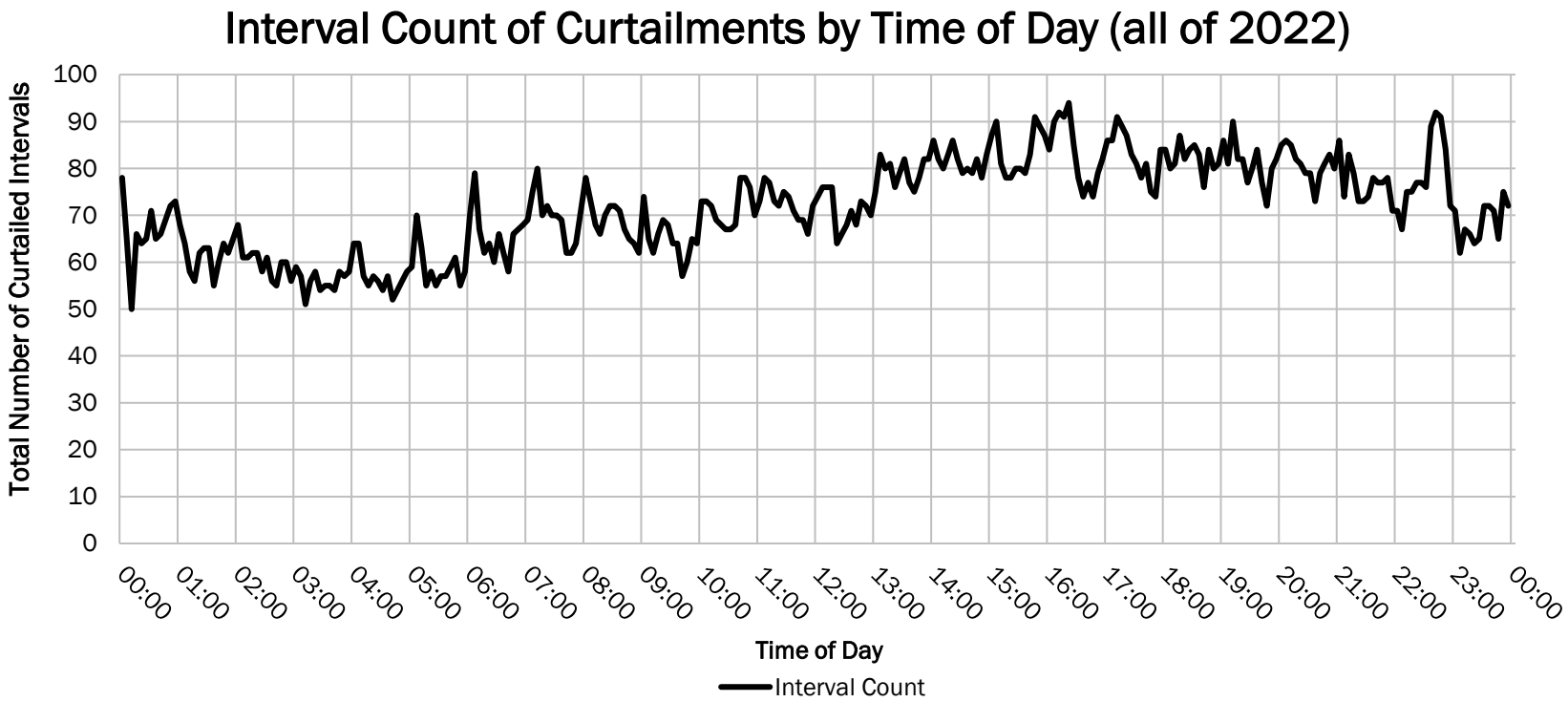
NY Economic Wind Curtailments



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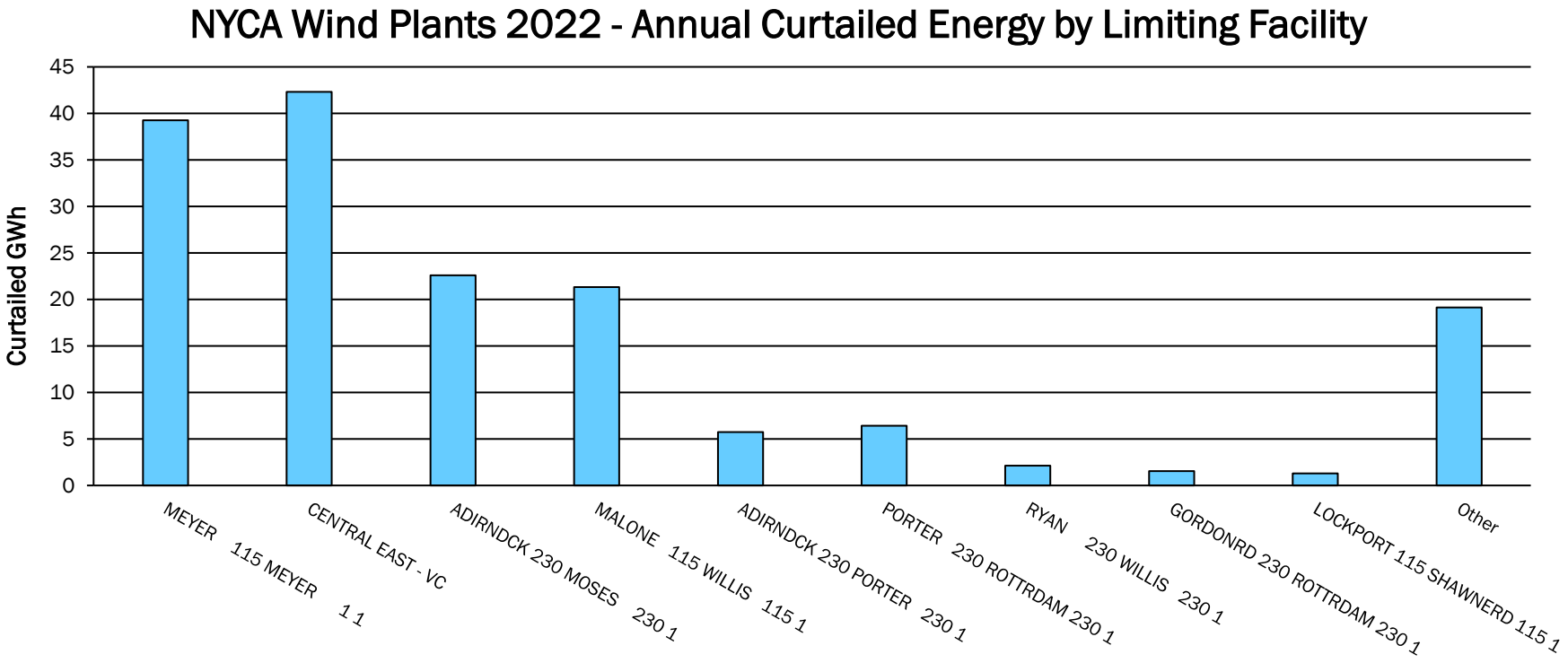
NY Economic Wind Curtailments



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Solar 2022

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 2022, BTM Solar Capacity was estimated to be 4,255 MW (DC)

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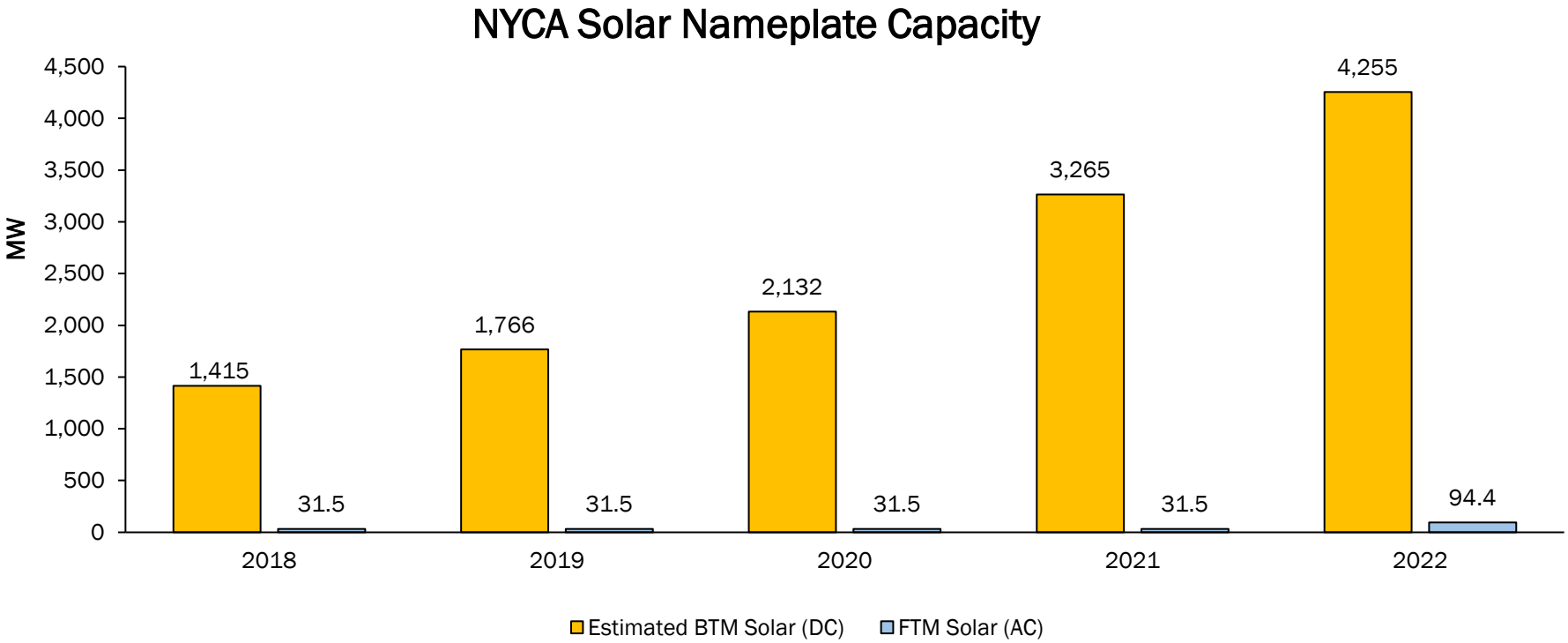
Solar Overview



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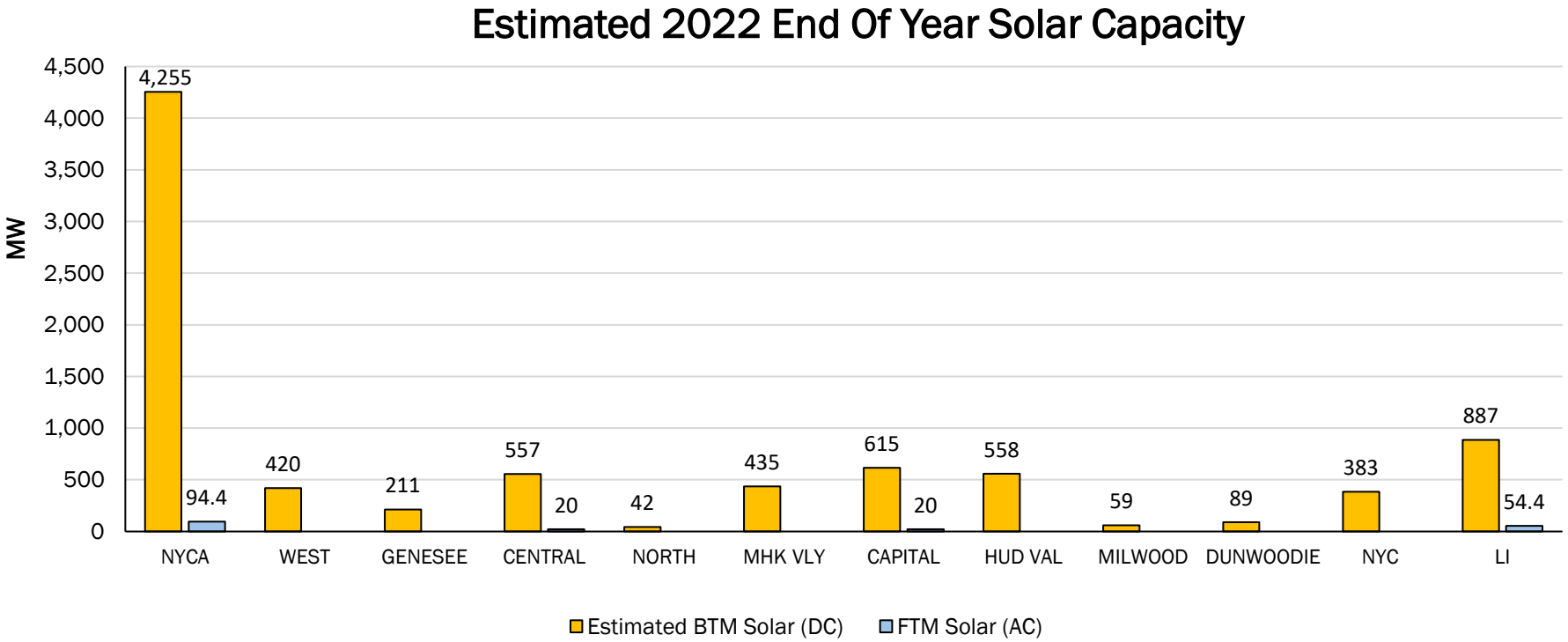
Zonal Solar Capacity



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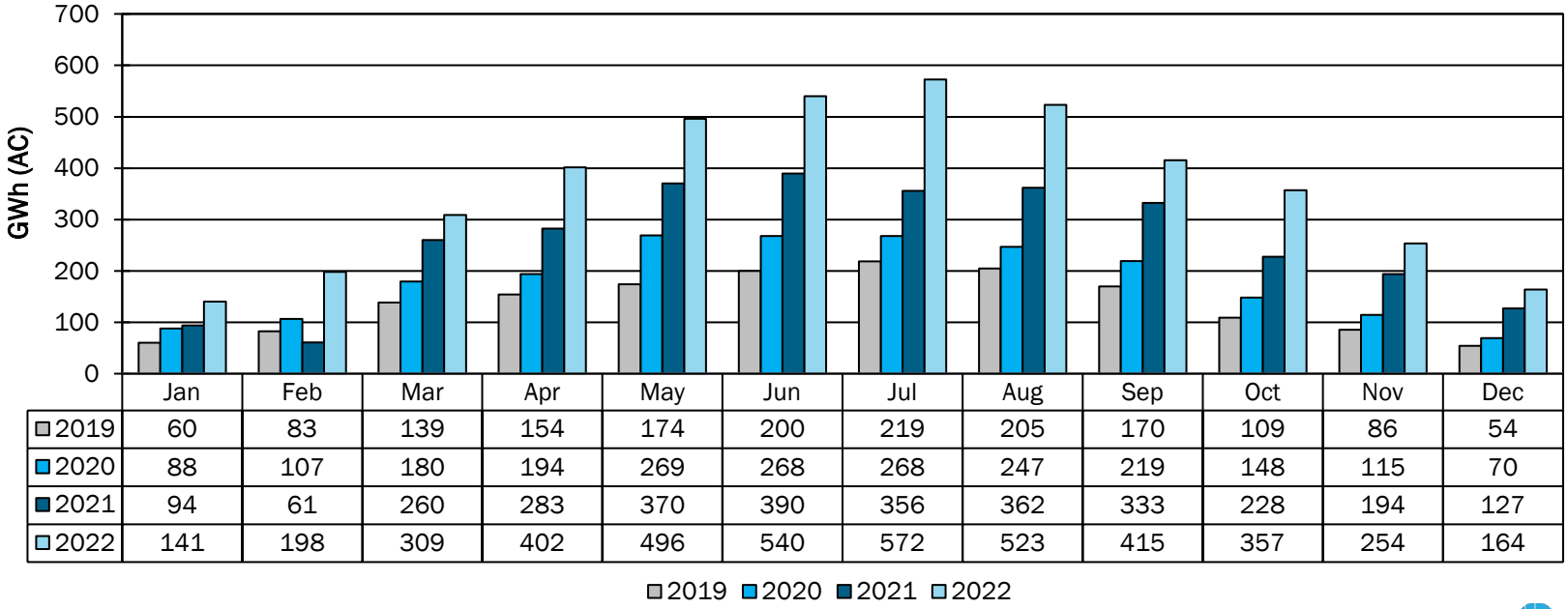
NY BTM Solar Generation

Total Annual BTM Solar Production (GWh)			
2019	2020	2021	2022
1,652	2,172	3,057	4,372

NYCA BTM Solar - Estimated Monthly Production



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2019	60	83	139	154	174	200	219	205	170	109	86	54
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

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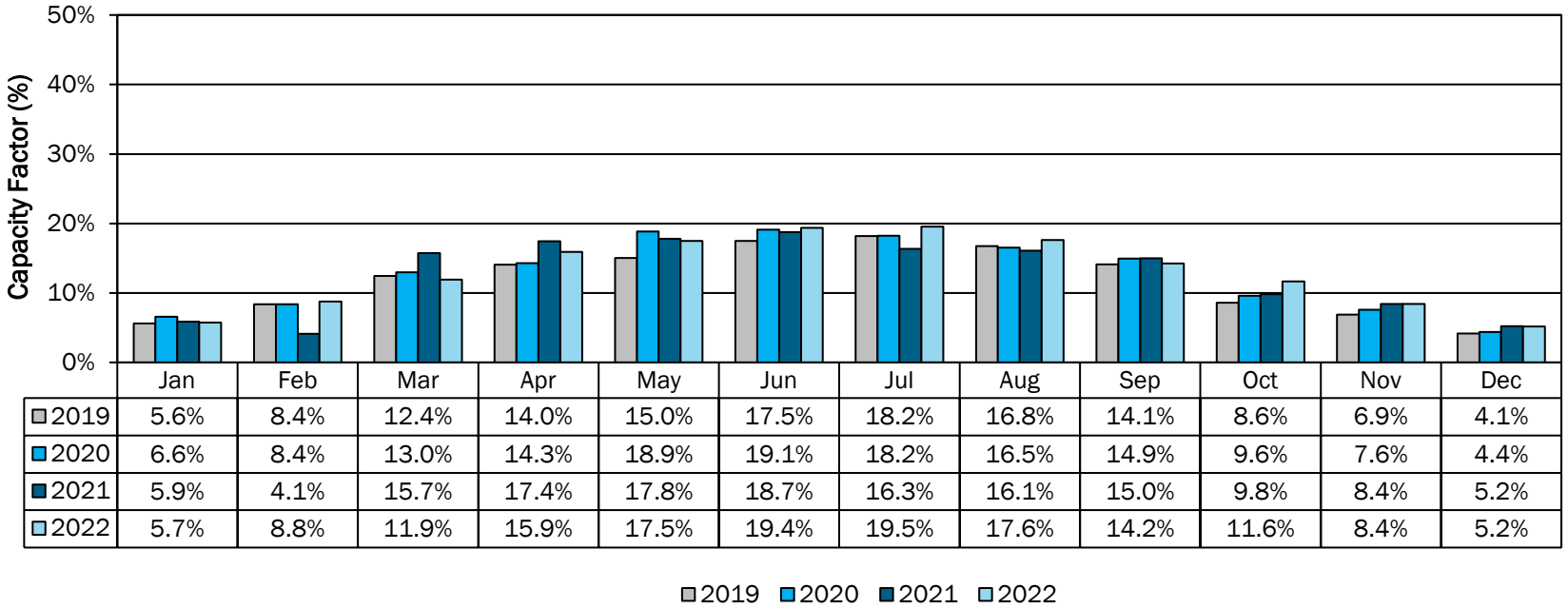
NY BTM Solar Capacity Factors

Annual BTM Solar Capacity Factor			
2019	2020	2021	2022
11.8%	12.6%	12.5%	13.0%

NYCA BTM Solar Generation - Estimated Capacity Factor



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2019	5.6%	8.4%	12.4%	14.0%	15.0%	17.5%	18.2%	16.8%	14.1%	8.6%	6.9%	4.1%
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%

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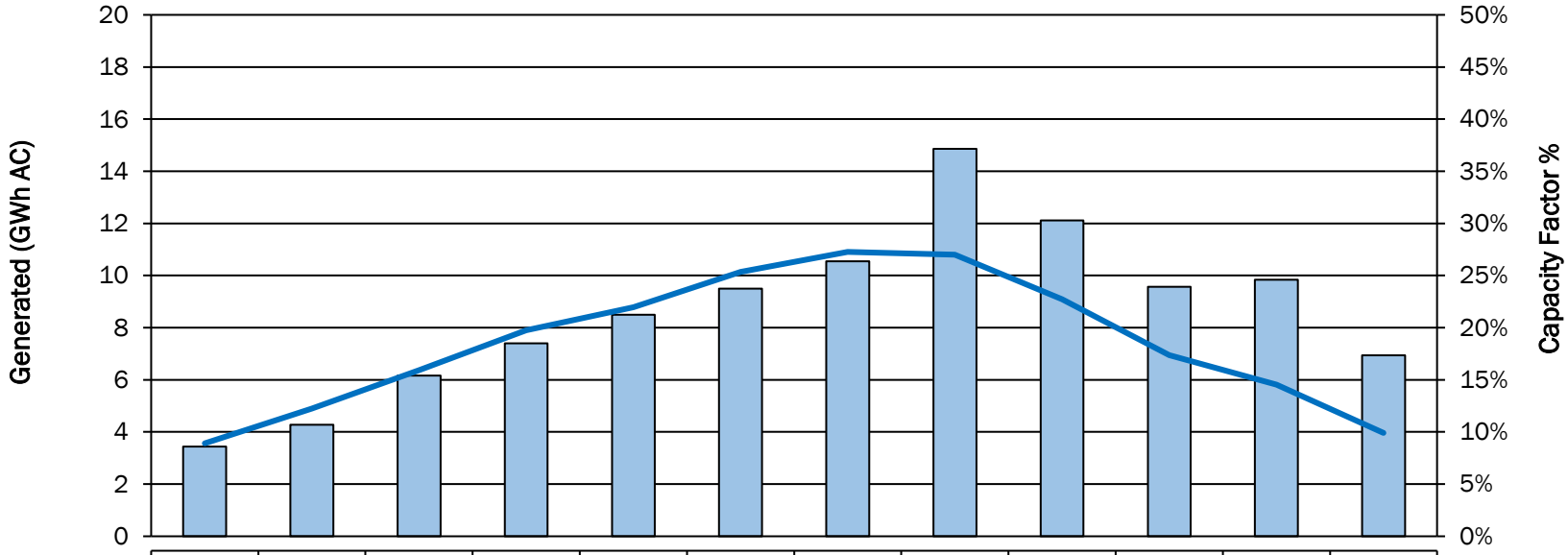
NYCA FTM Solar Performance

Total Annual Production	Annual Capacity Factor
103 GWh	19%



	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22
Generation	3	4	6	7	9	9	11	15	12	10	10	7
Capacity Factor	9%	12%	16%	20%	22%	25%	27%	27%	23%	17%	15%	10%

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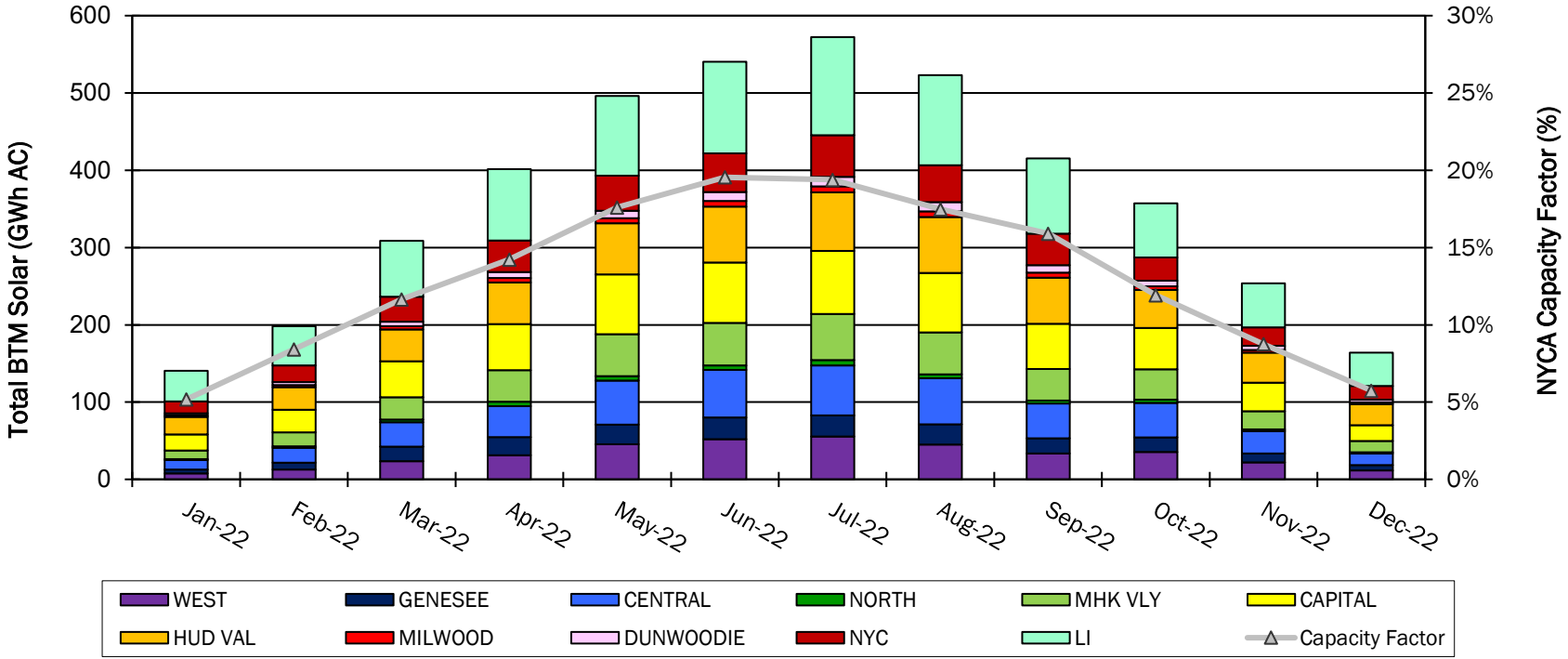
Monthly BTM Solar Production by Zone



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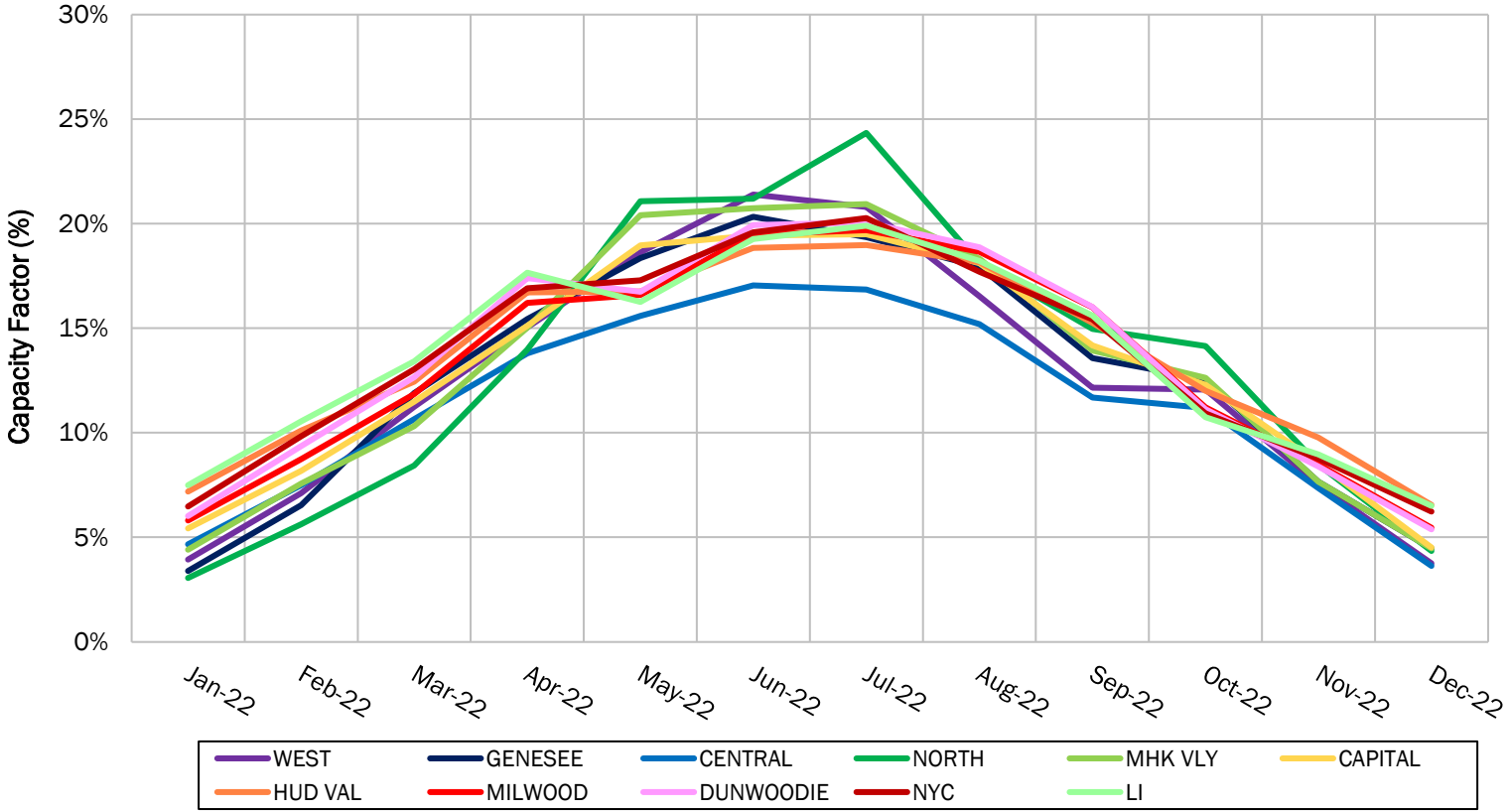
Monthly BTM Solar Capacity Factors by Zone



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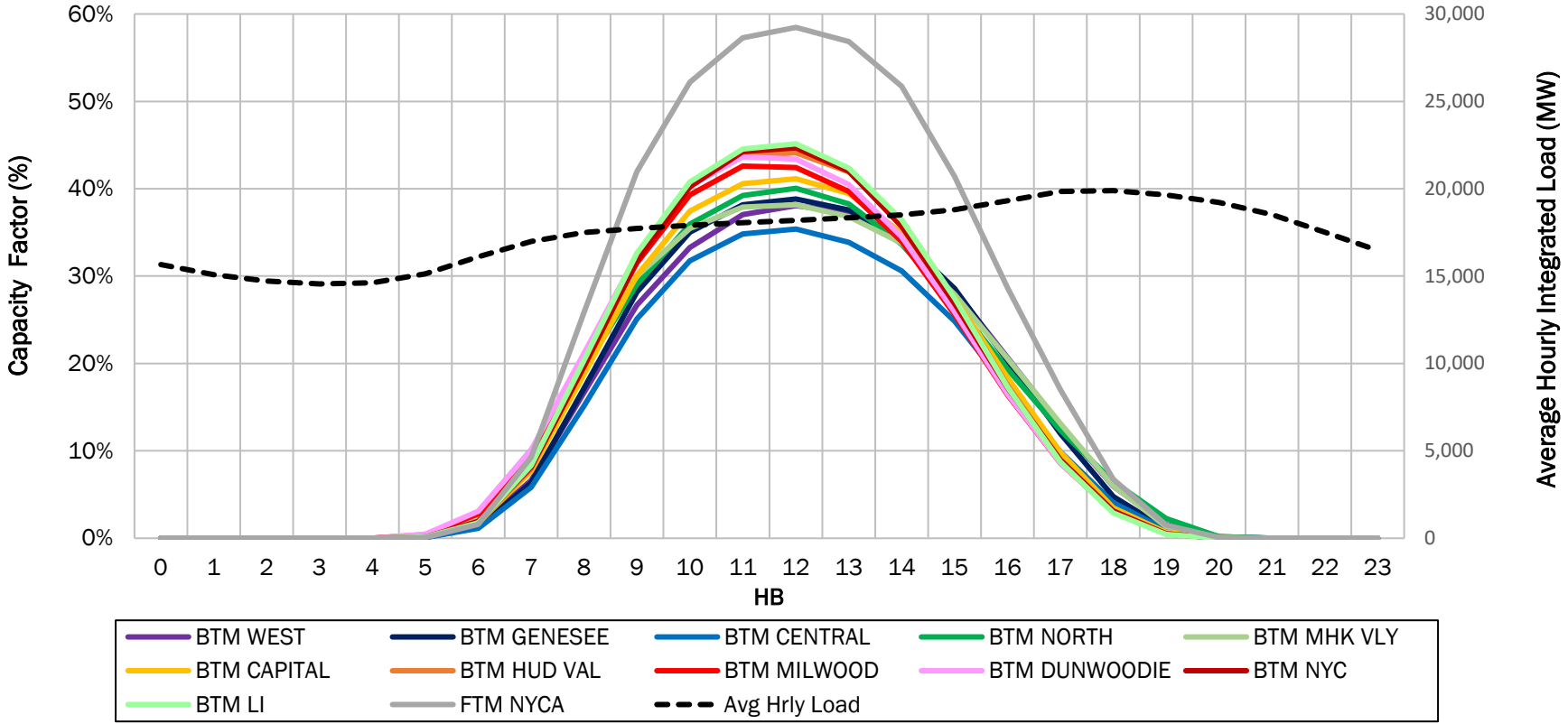
2022 Average Hourly Solar Capacity Factors by Zone



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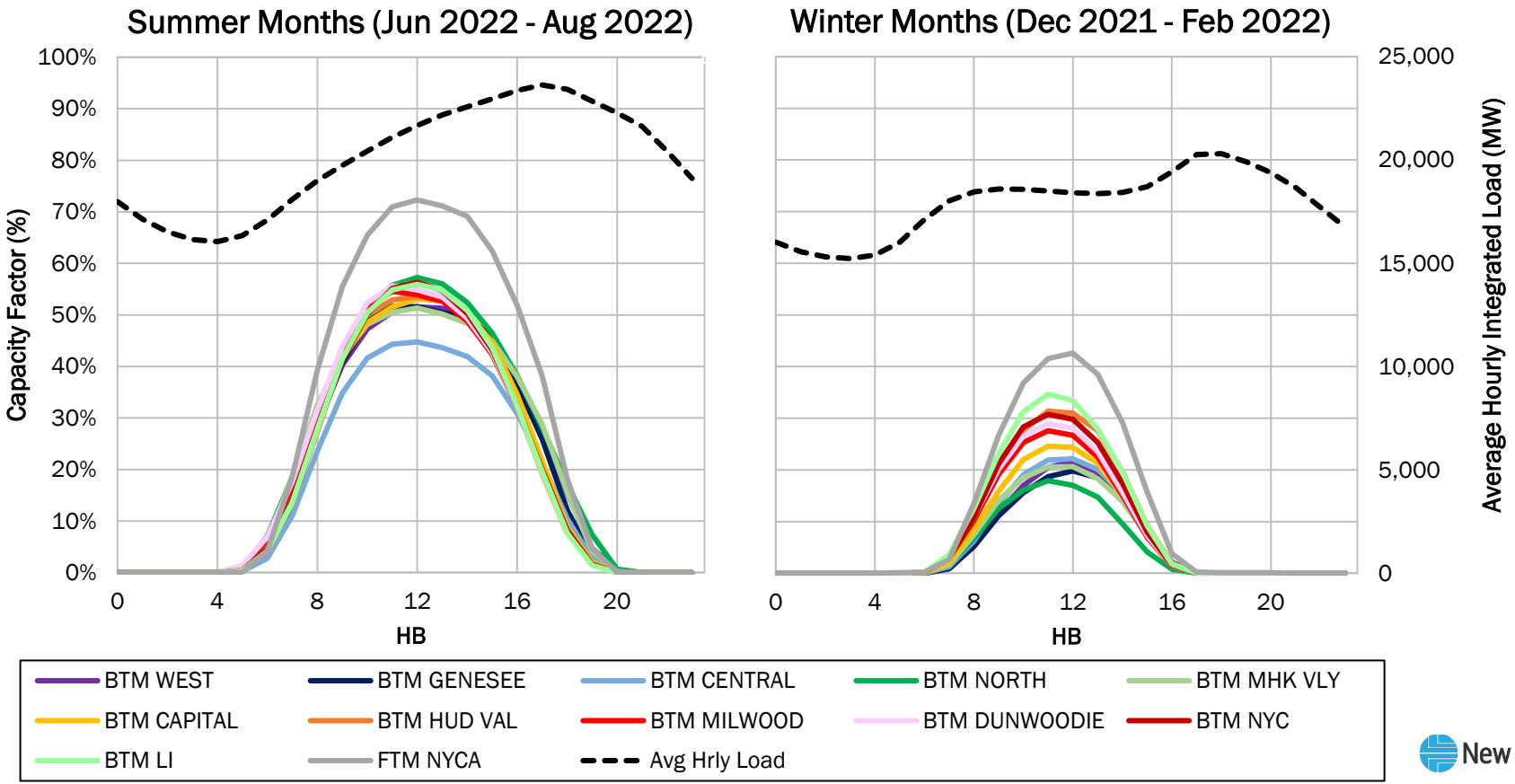
2022 Seasonal Average Hourly Solar Capacity Factors by Zone



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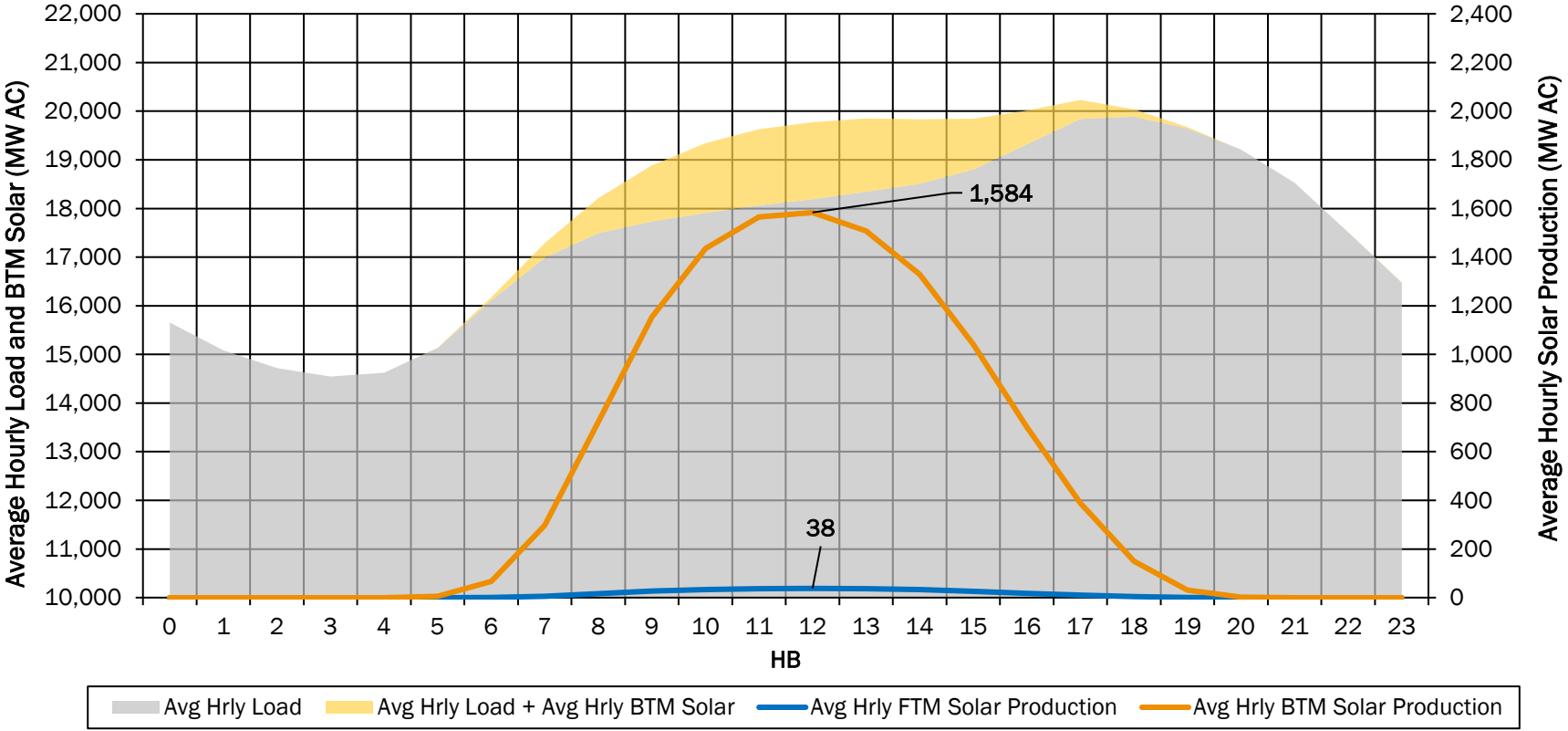
2022 Average Hourly Load and Solar Production



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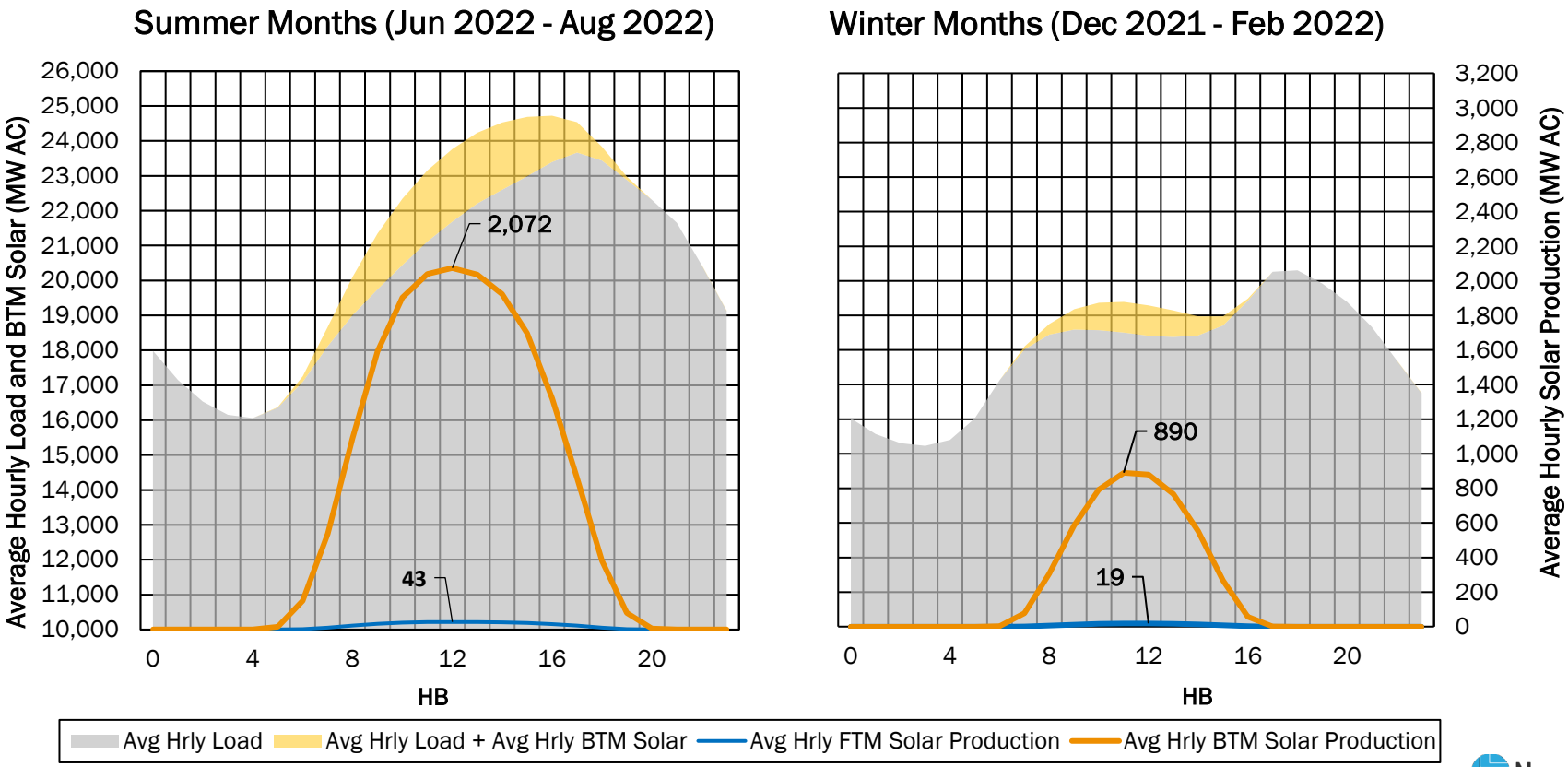
2022 Seasonal Average Hourly Load with Solar Production



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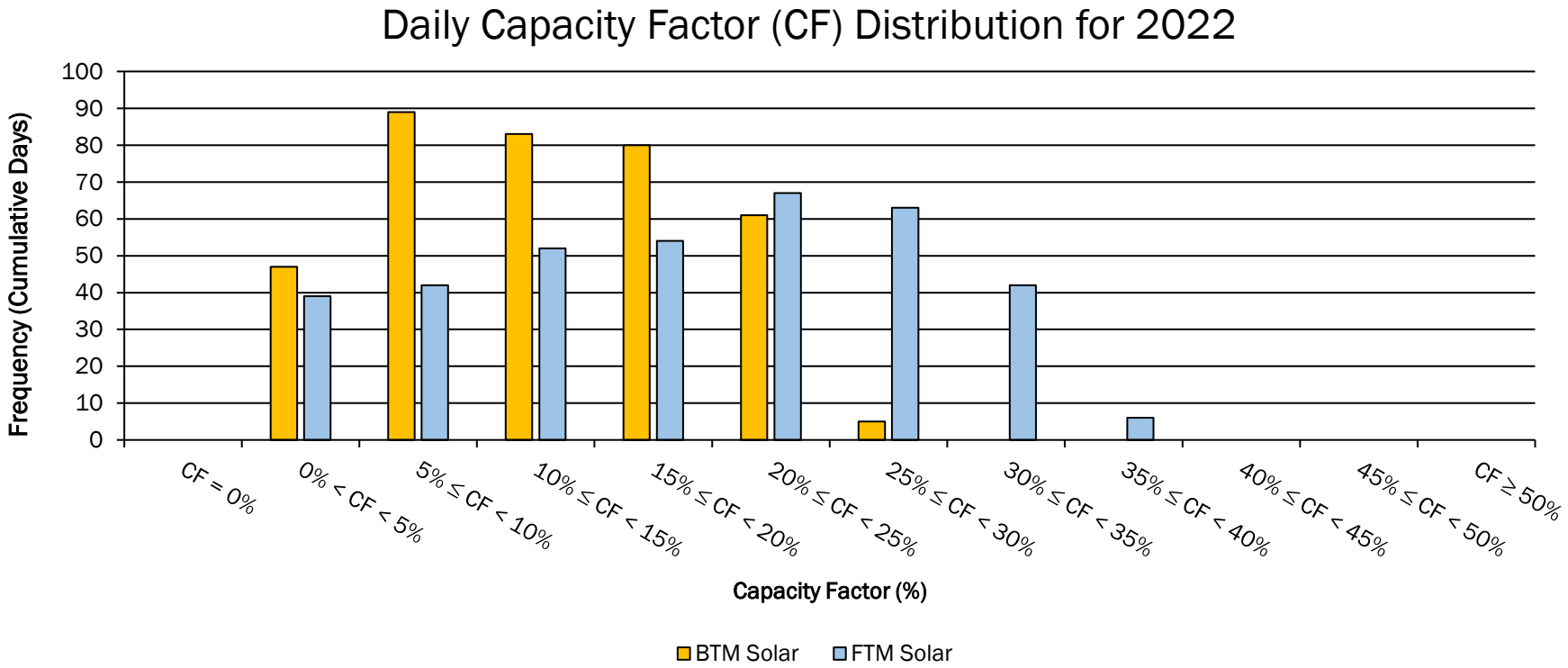
Solar Capacity Factor Distribution



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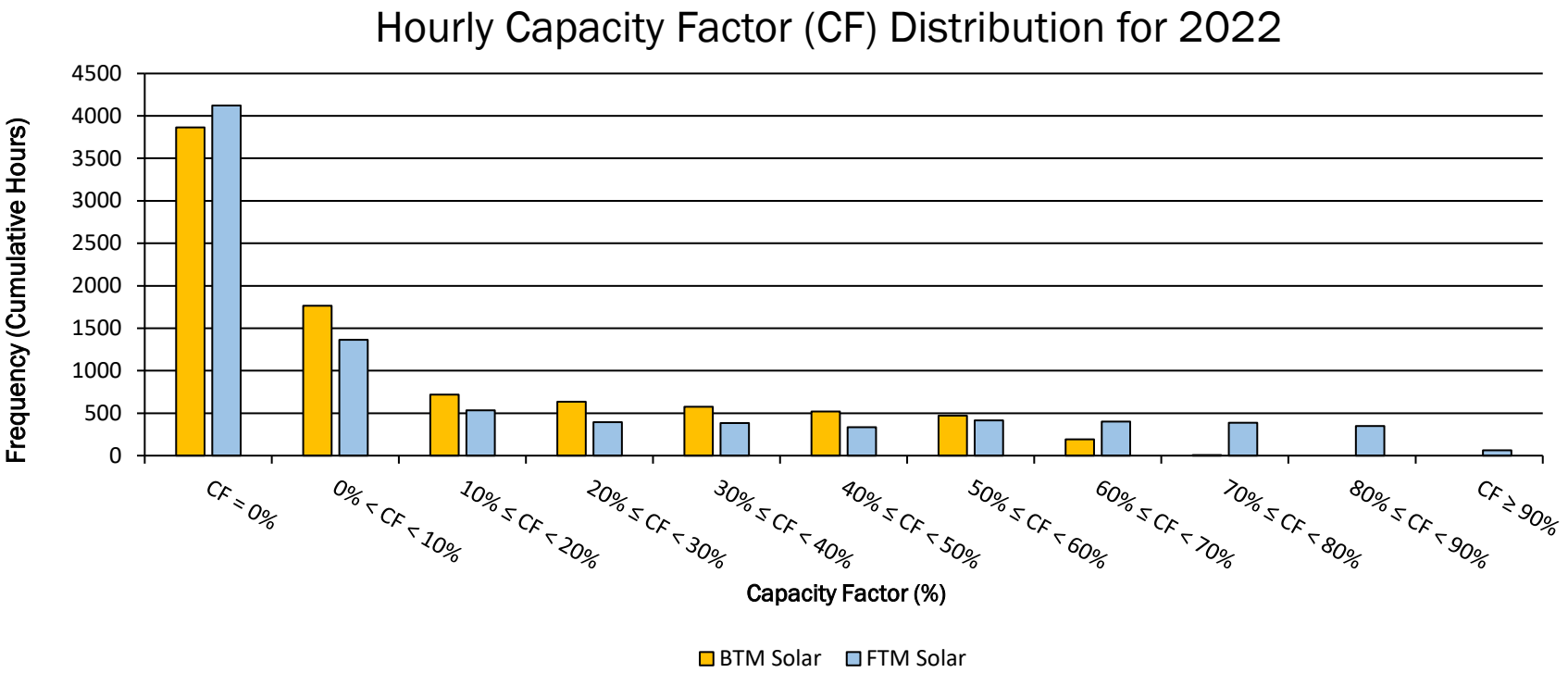
Solar Capacity Factor Distribution



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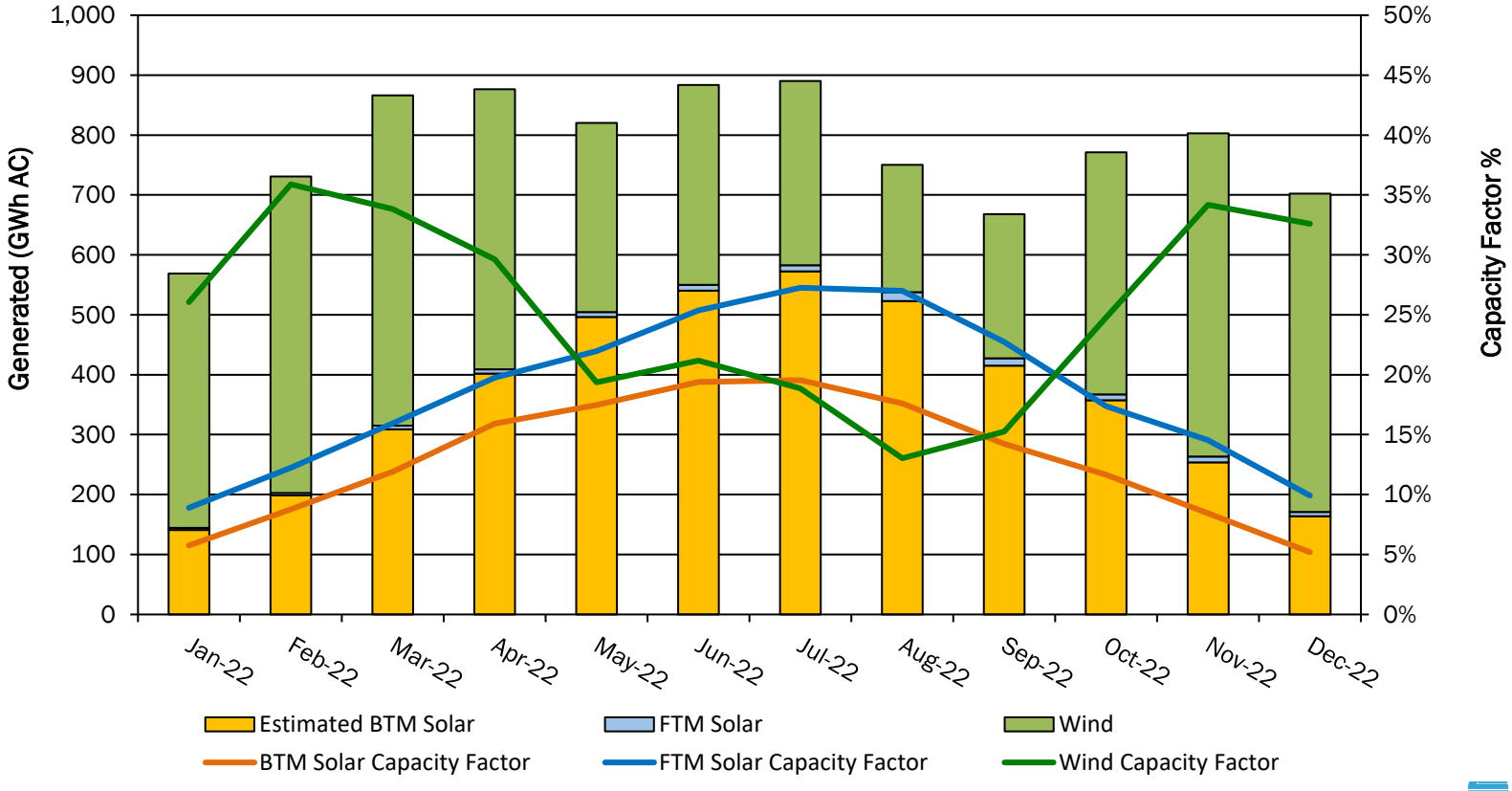
Coincident Wind and Solar

Monthly Wind and BTM Solar Performance (2022)



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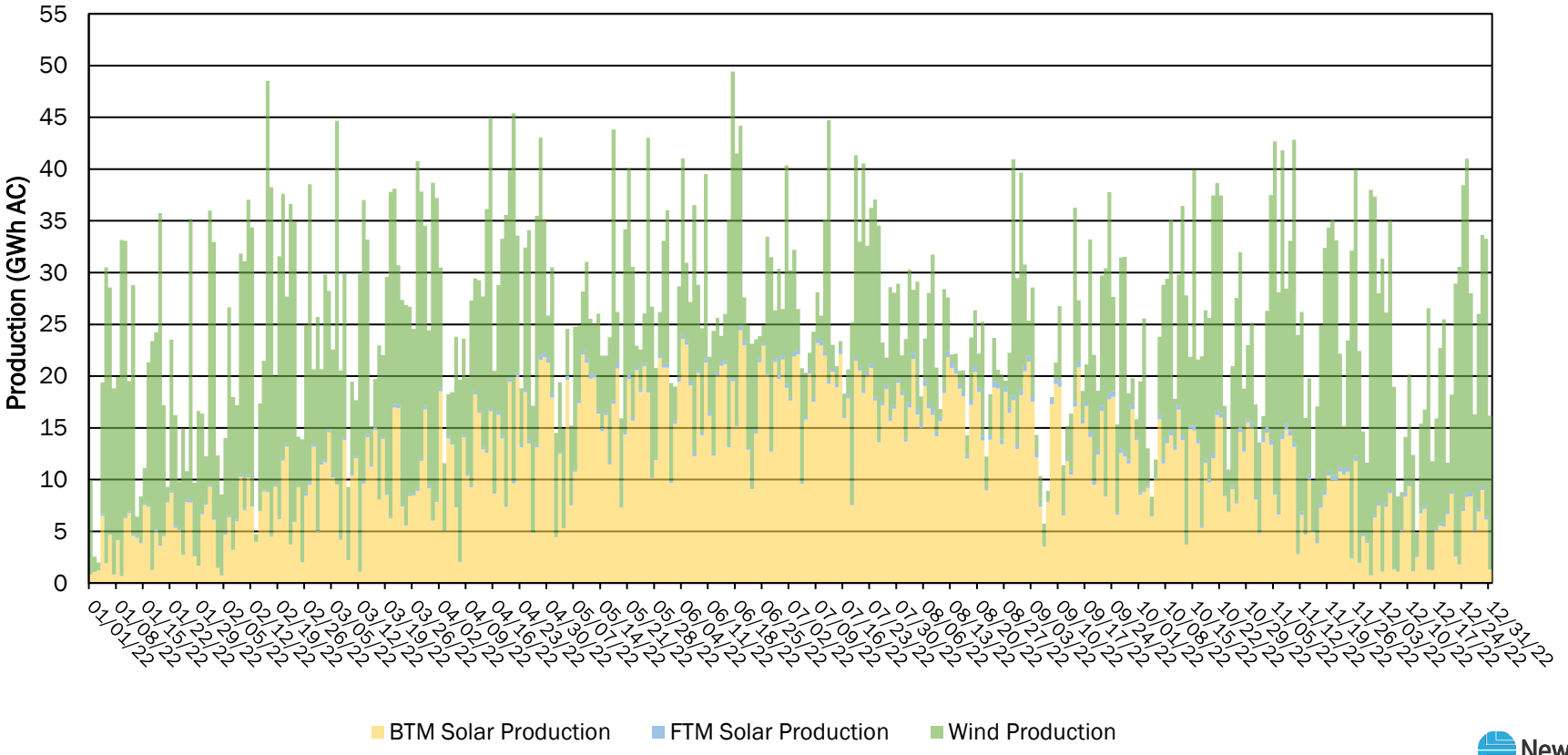
Daily Wind and BTM Solar Performance (2022)



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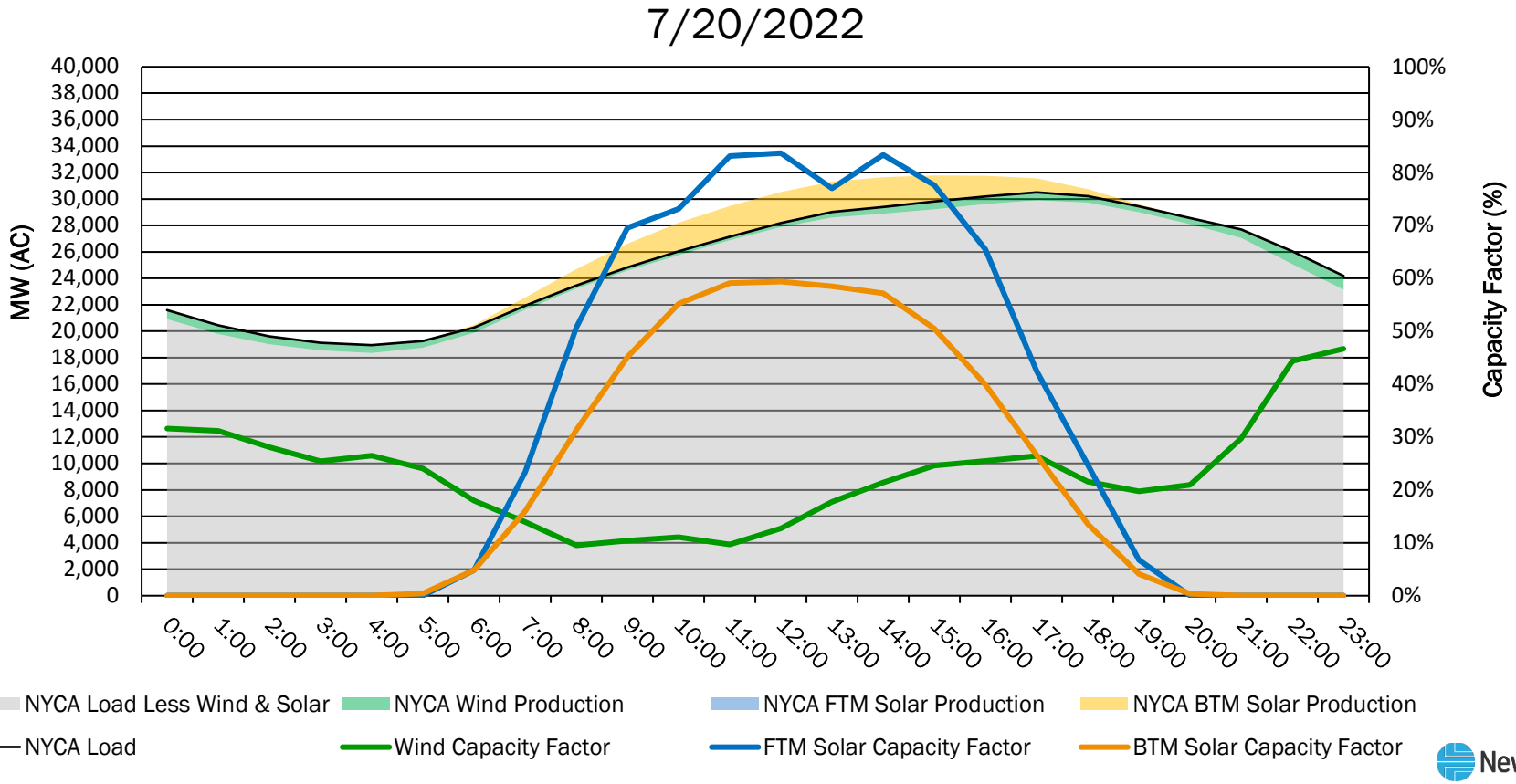
Wind and BTM Solar Performance During Summer Peak Load



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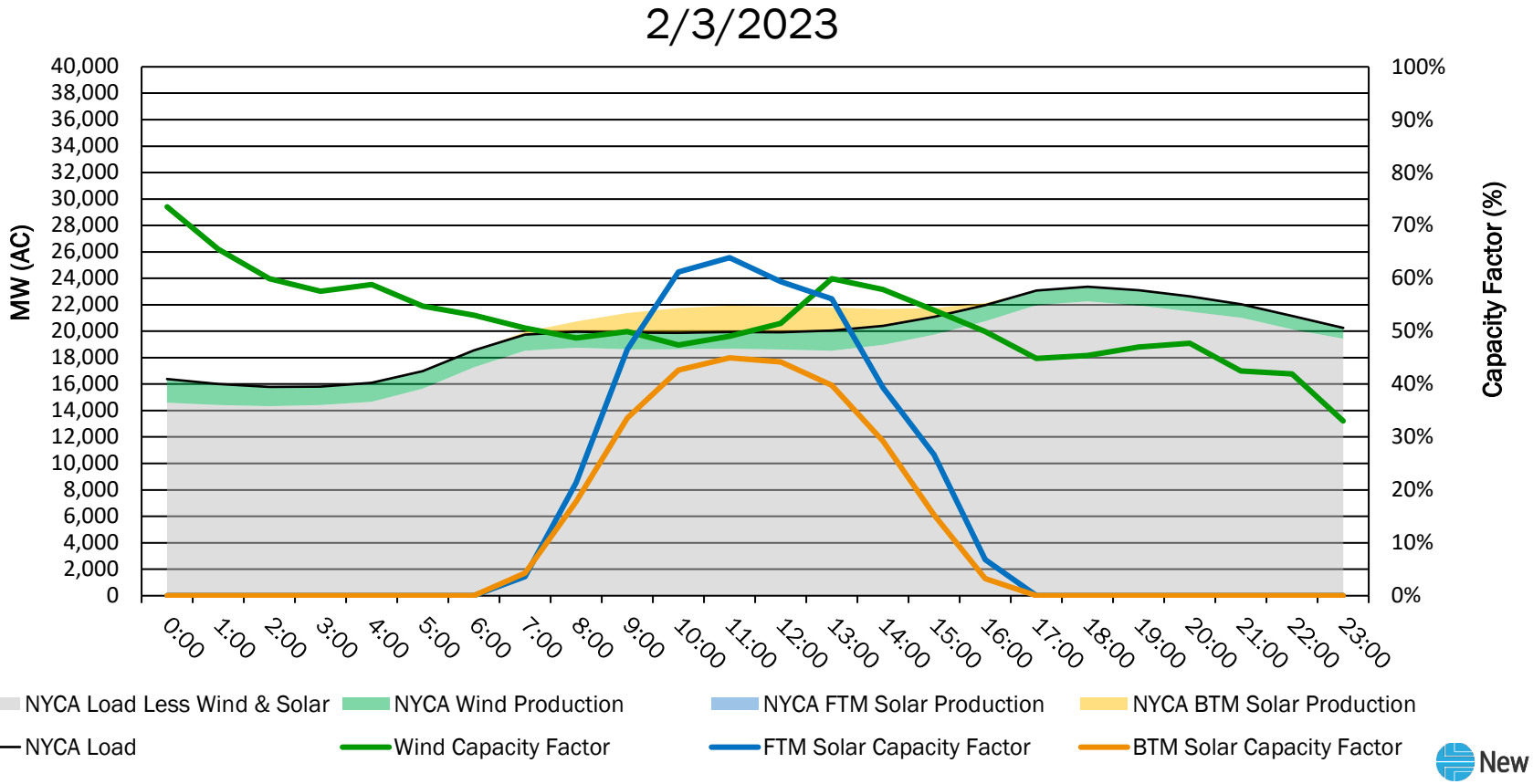
Wind and BTM Solar Performance During Winter Peak Load



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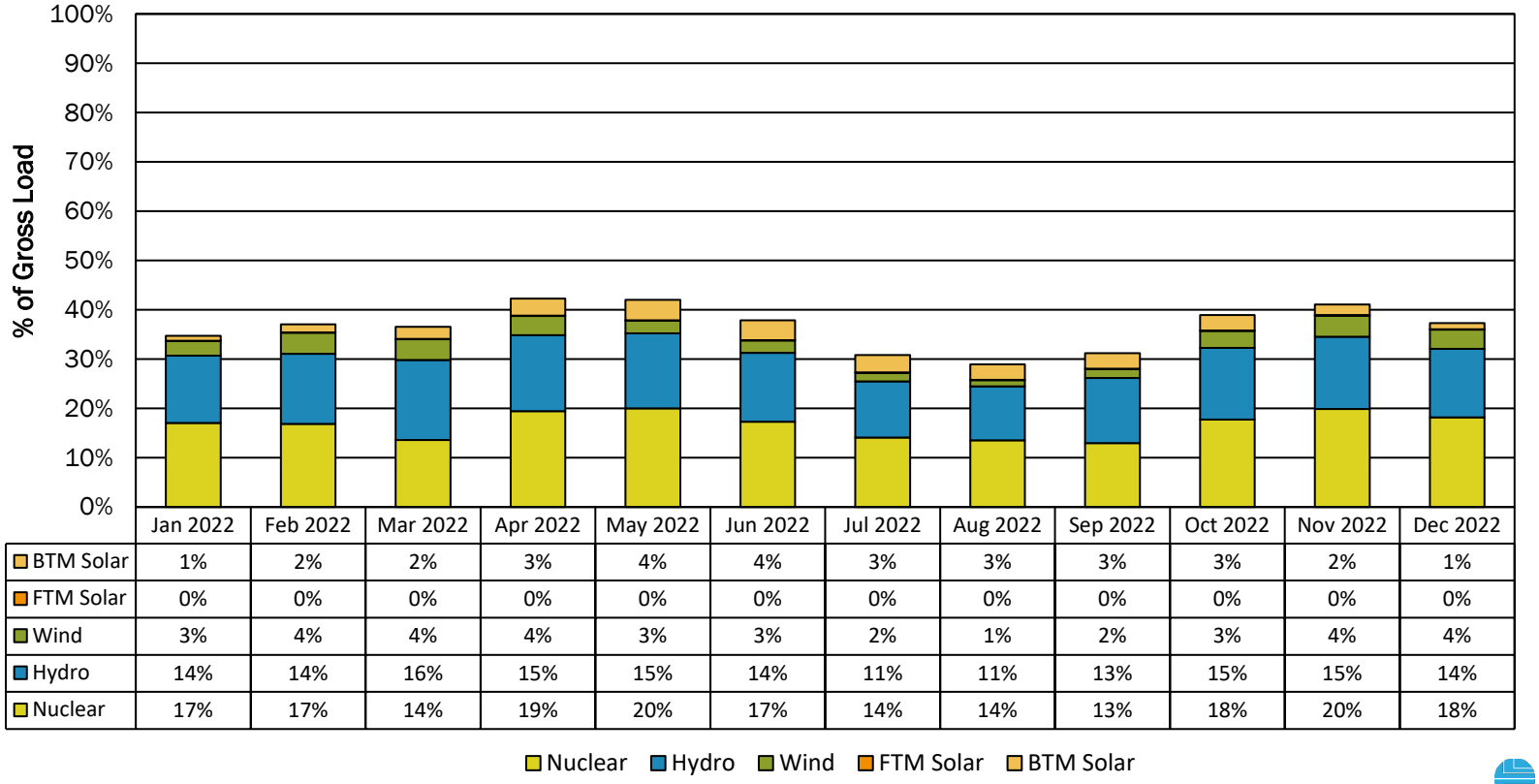
NYCA Emissions-Free Generation

Annual % Gross Load				
Nuclear	Hydro	Wind	FTM Solar	BTM Solar
16.53%	13.78%	3.00%	0.07%	2.75%



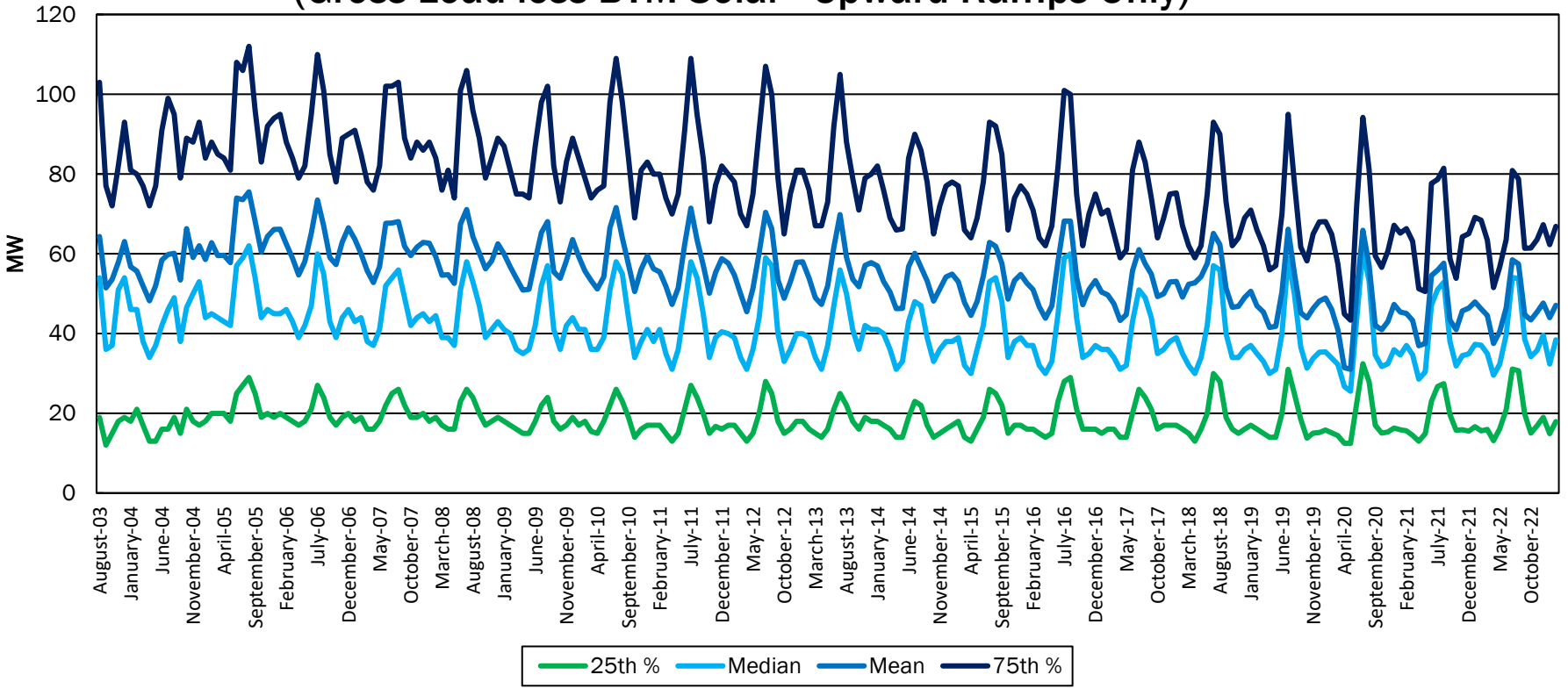
	Jan 2022	Feb 2022	Mar 2022	Apr 2022	May 2022	Jun 2022	Jul 2022	Aug 2022	Sep 2022	Oct 2022	Nov 2022	Dec 2022
BTM Solar	1%	2%	2%	3%	4%	4%	3%	3%	3%	3%	2%	1%
FTM Solar	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Wind	3%	4%	4%	4%	3%	3%	2%	1%	2%	3%	4%	4%
Hydro	14%	14%	16%	15%	15%	14%	11%	11%	13%	15%	15%	14%
Nuclear	17%	17%	14%	19%	20%	17%	14%	14%	13%	18%	20%	18%

New York ISO

Load Ramps

Monthly Distribution of 5-Minute Load Ramps

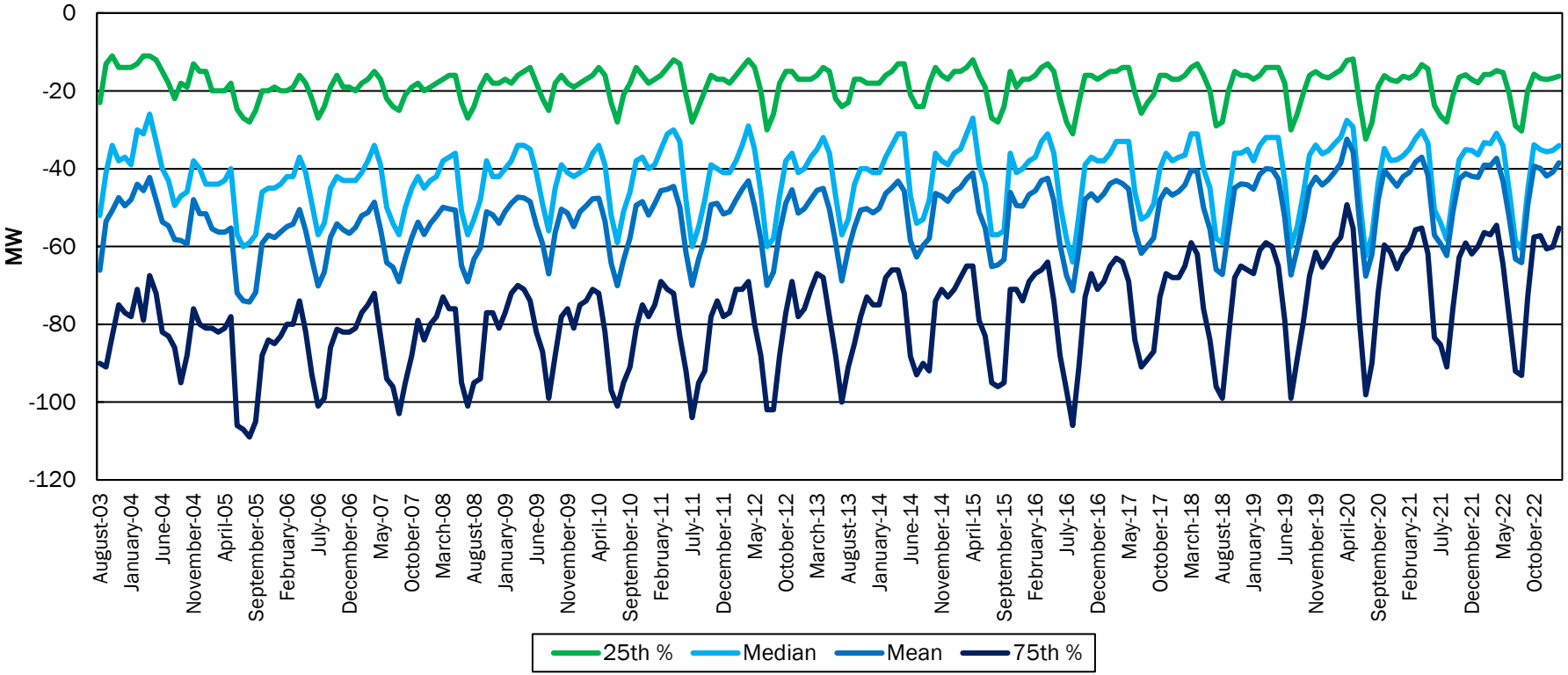
(Gross Load less BTM Solar - Upward Ramps Only)



New York ISO

Monthly Distribution of 5-Minute Load Ramps

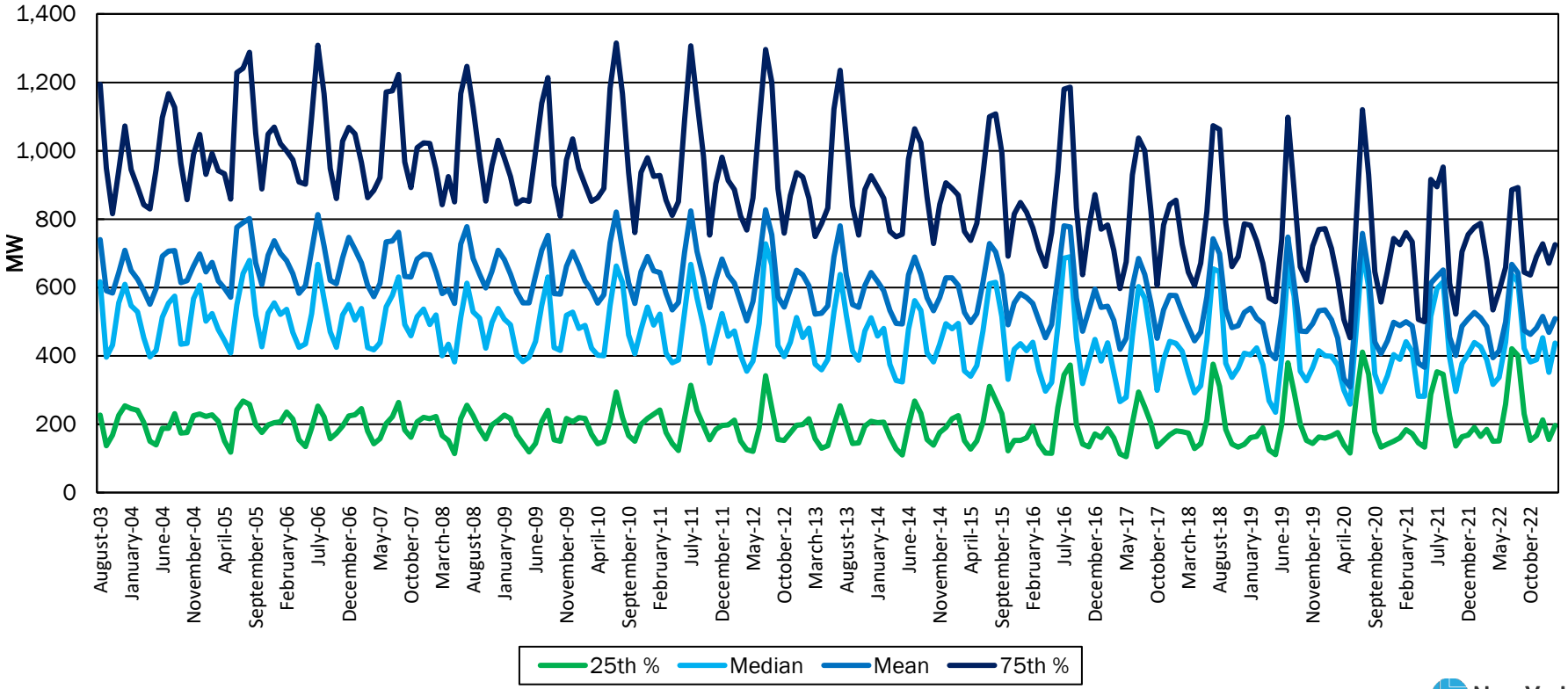
(Gross Load less BTM Solar - Downward Ramps Only)



New York ISO

Monthly Distribution of 60-Minute Load Ramps

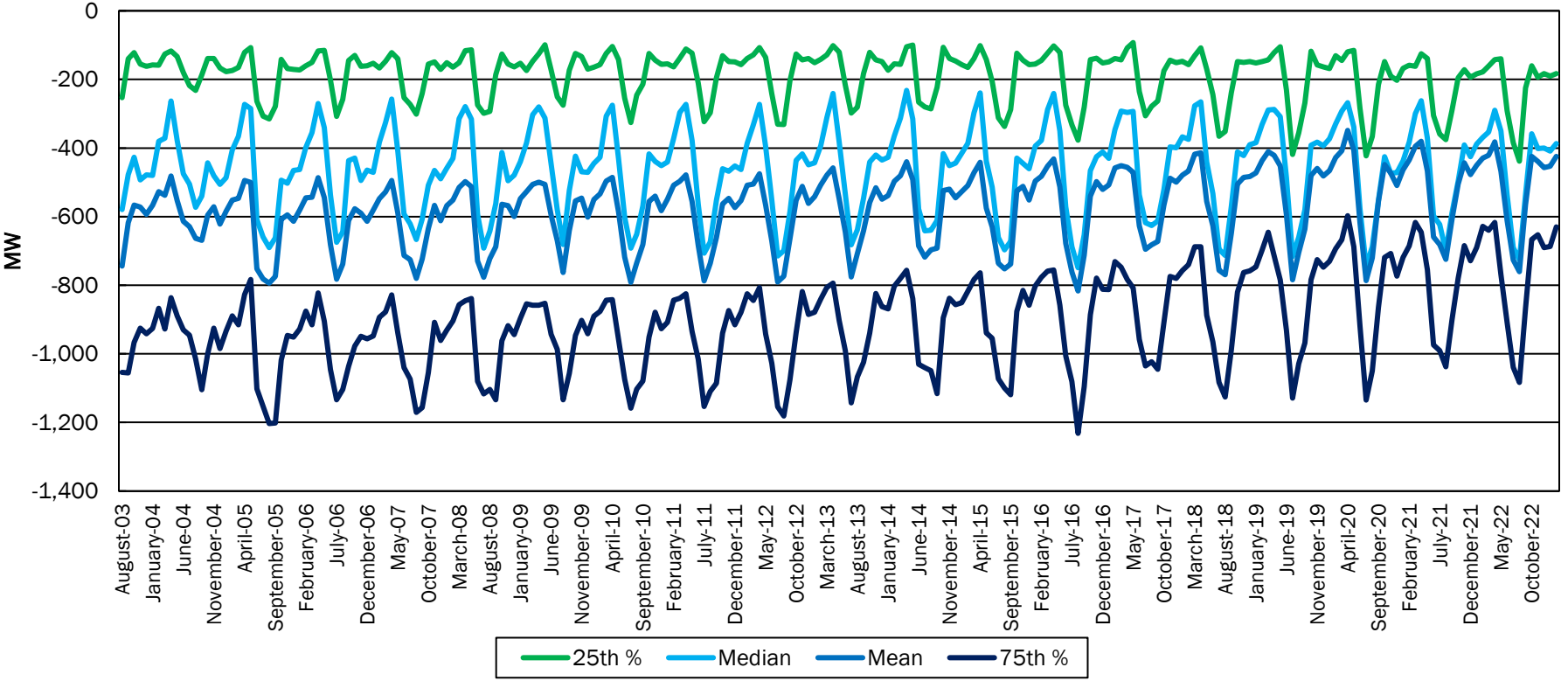
(Gross Load less BTM Solar - Upward Ramps Only)



New York ISO

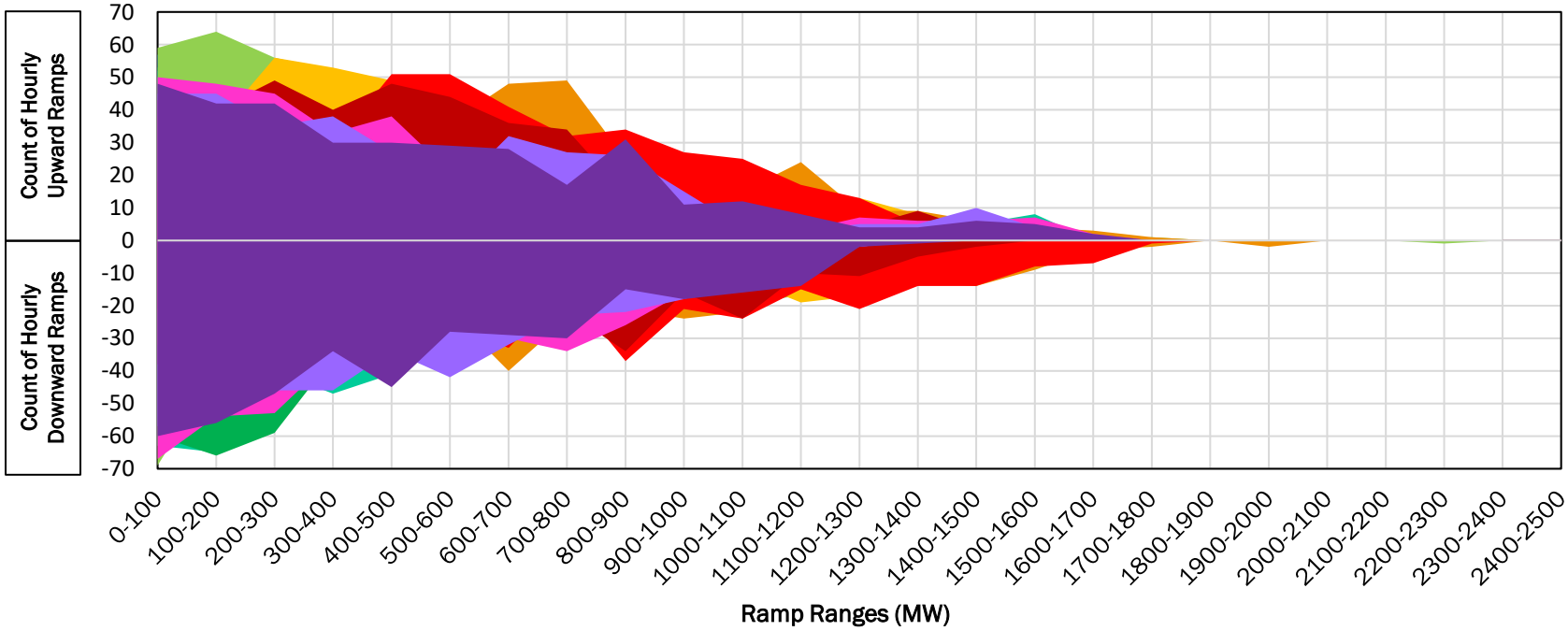
Monthly Distribution of 60-Minute Load Ramps

(Gross Load less BTM Solar - Downward Ramps Only)



NEW YORK ISO

2022 Hourly Ramps of NYCA Load less Wind and Solar



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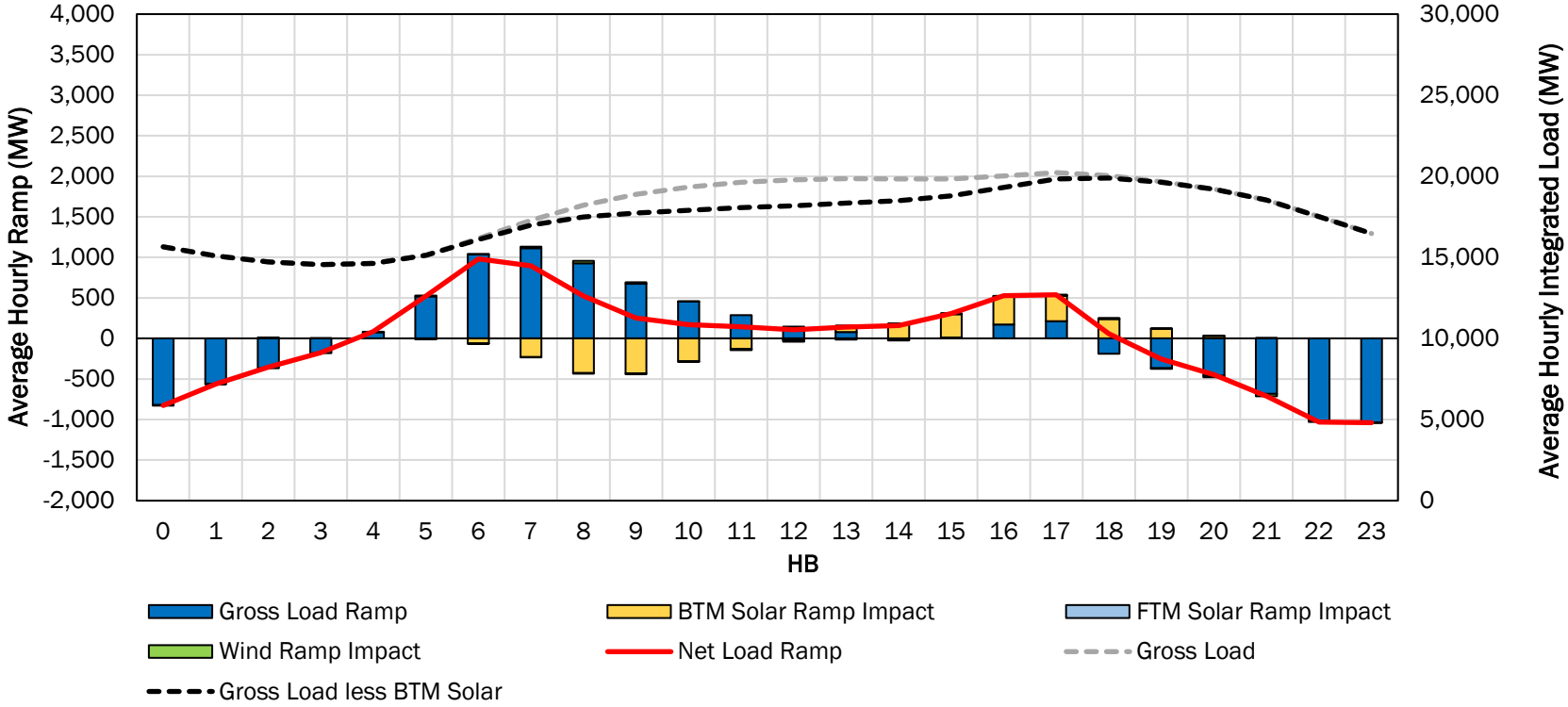
Average Hourly Net Load Ramps (2022)



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

New York ISO

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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