NY Wind – Overview and 2016 Operation

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MIWG

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DRAFT – FOR DISCUSSION PURPOSES ONLY

Agenda

- Overview of NY Wind
- Wind Curtailment Statistics
- Analysis of a month with wind curtailments – Oct 2016
- Analysis of negative LBMP drivers for the year 2016
- Questions

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Introduction

- To address market interest in the grid impact of wind as a renewable source of generation
- To inform the marketplace on wind trends

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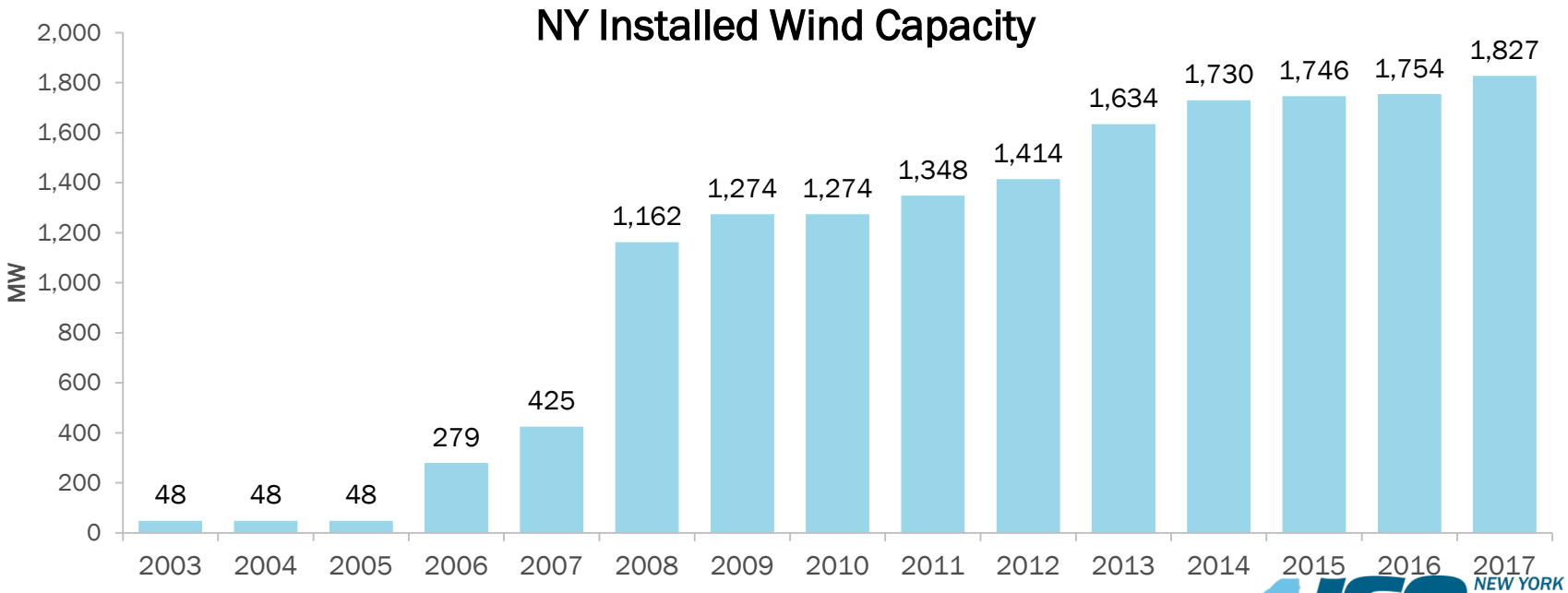
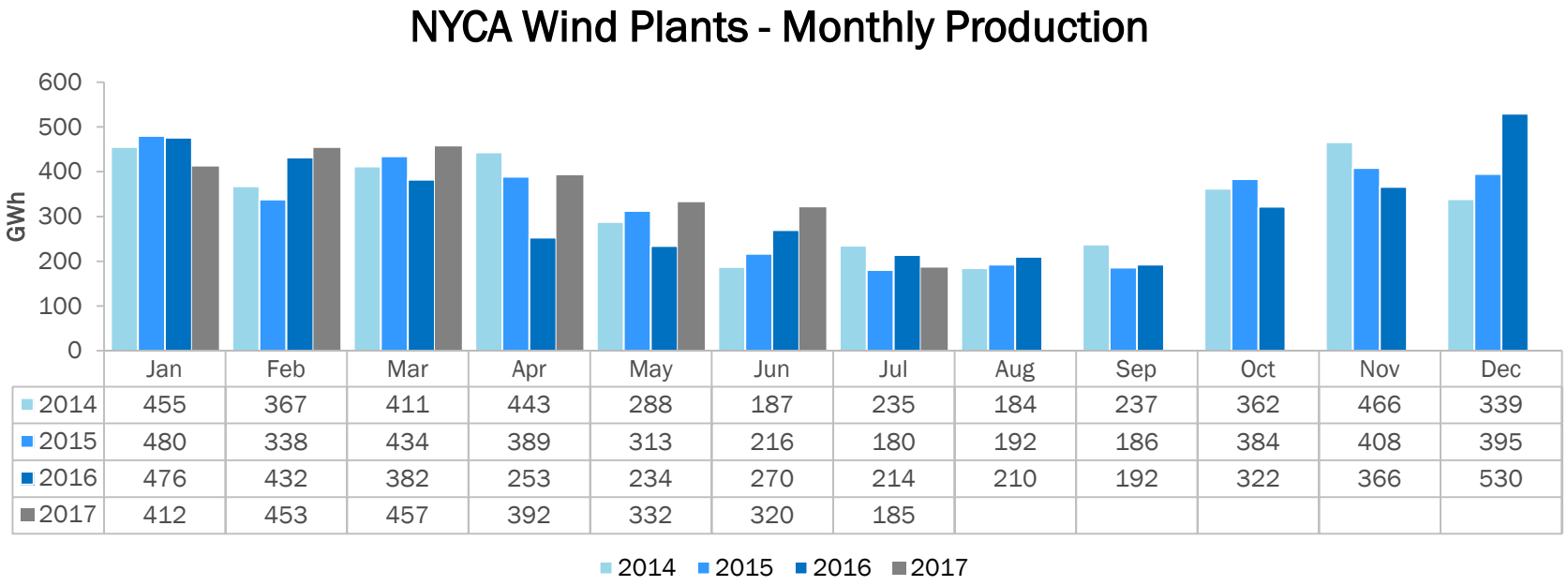
Overview

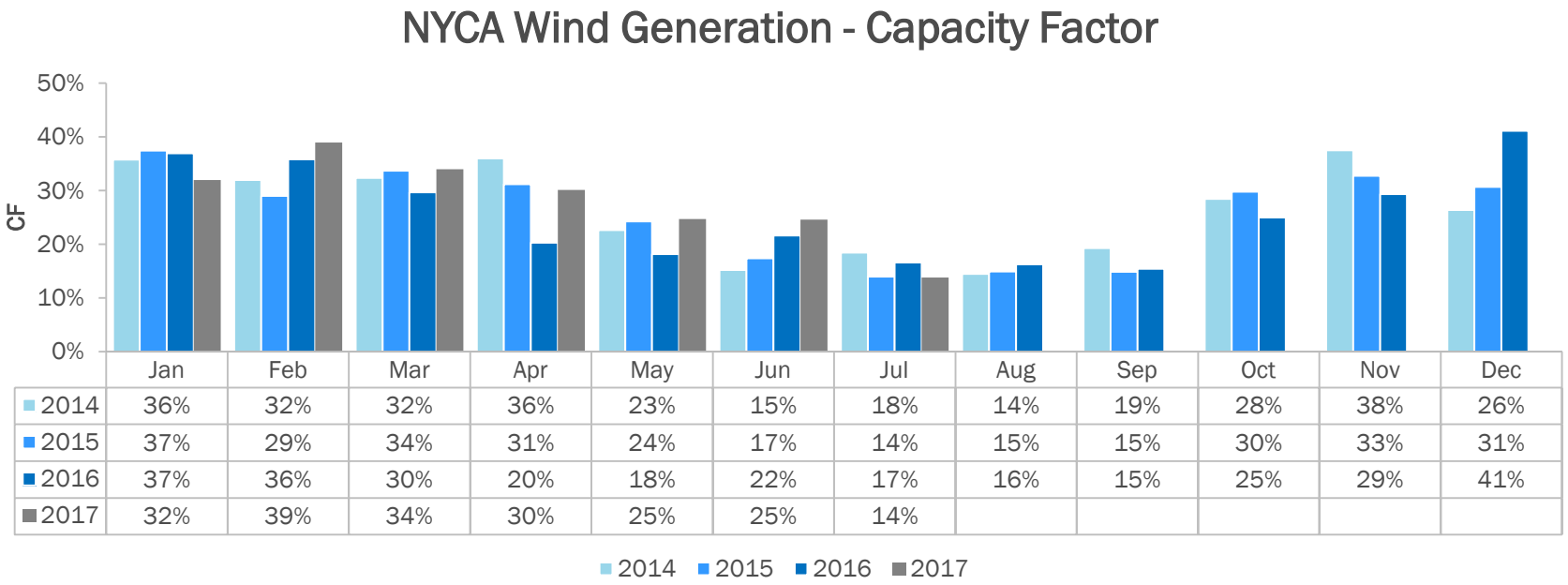


…NY wind generation profile



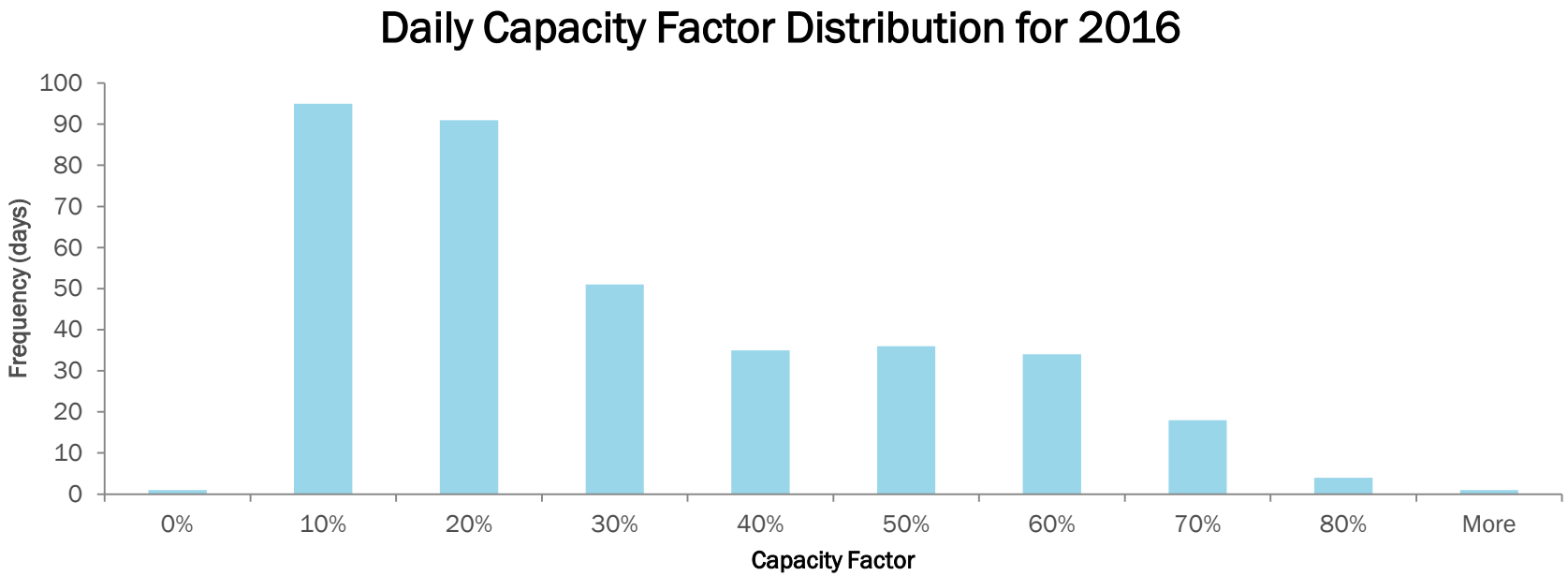
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2014	455	367	411	443	288	187	235	184	237	362	466	339
2015	480	338	434	389	313	216	180	192	186	384	408	395
2016	476	432	382	253	234	270	214	210	192	322	366	530
2017	412	453	457	392	332	320	185					

...NY wind Capacity Factor profile

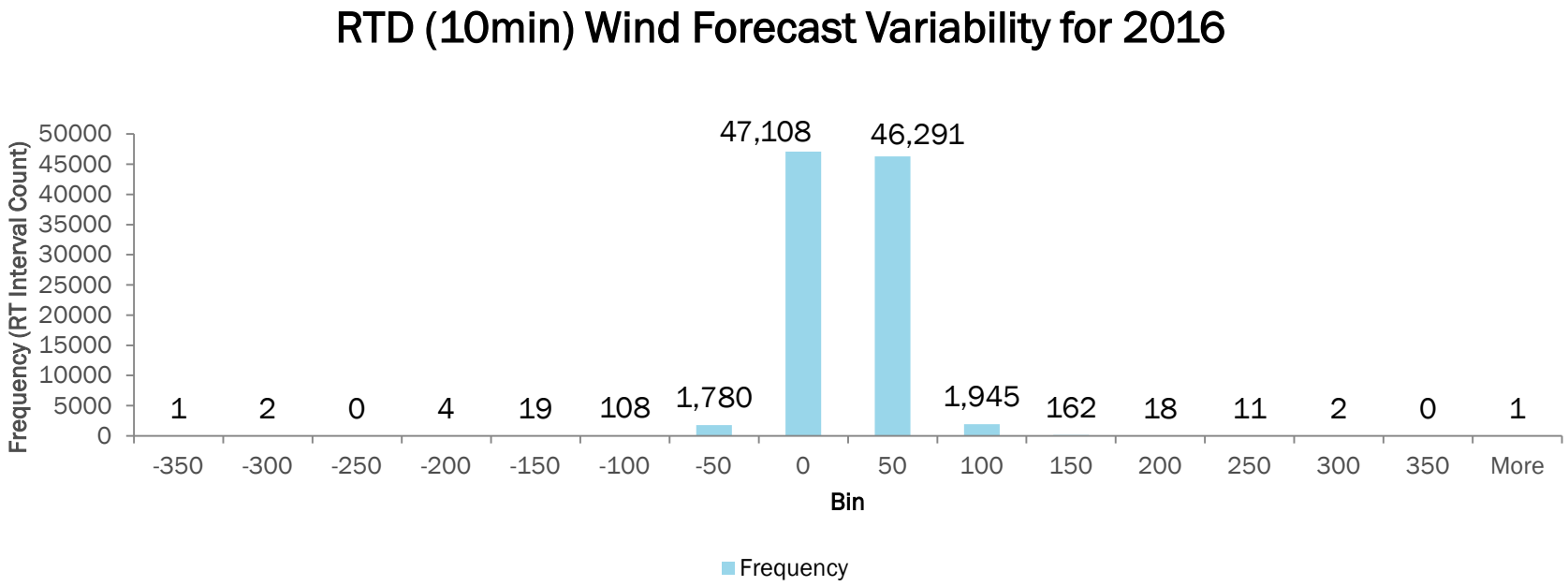


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2014	36%	32%	32%	36%	23%	15%	18%	14%	19%	28%	38%	26%
2015	37%	29%	34%	31%	24%	17%	14%	15%	15%	30%	33%	31%
2016	37%	36%	30%	20%	18%	22%	17%	16%	15%	25%	29%	41%
2017	32%	39%	34%	30%	25%	25%	14%					

…NY wind 2016 Capacity Factor distribution



…NY wind 2016 RTD (10min) Forecast variability



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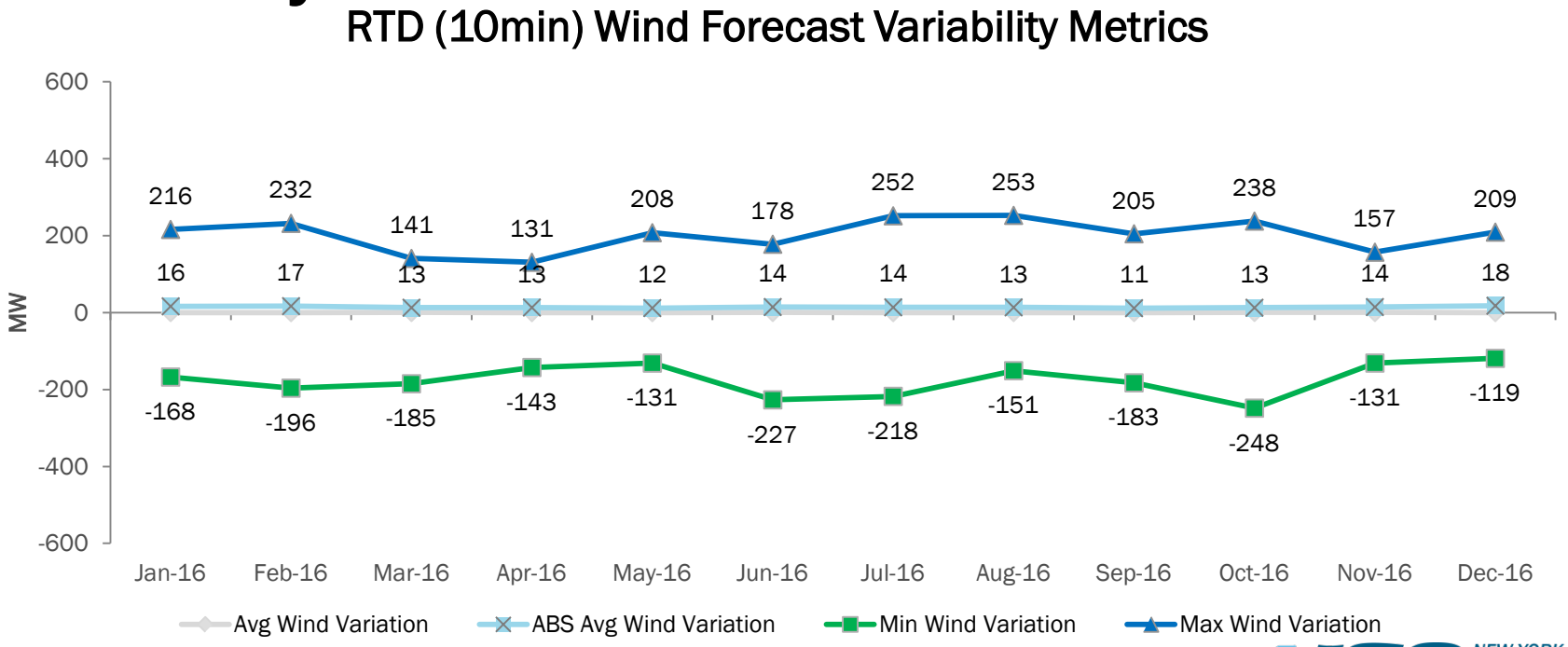
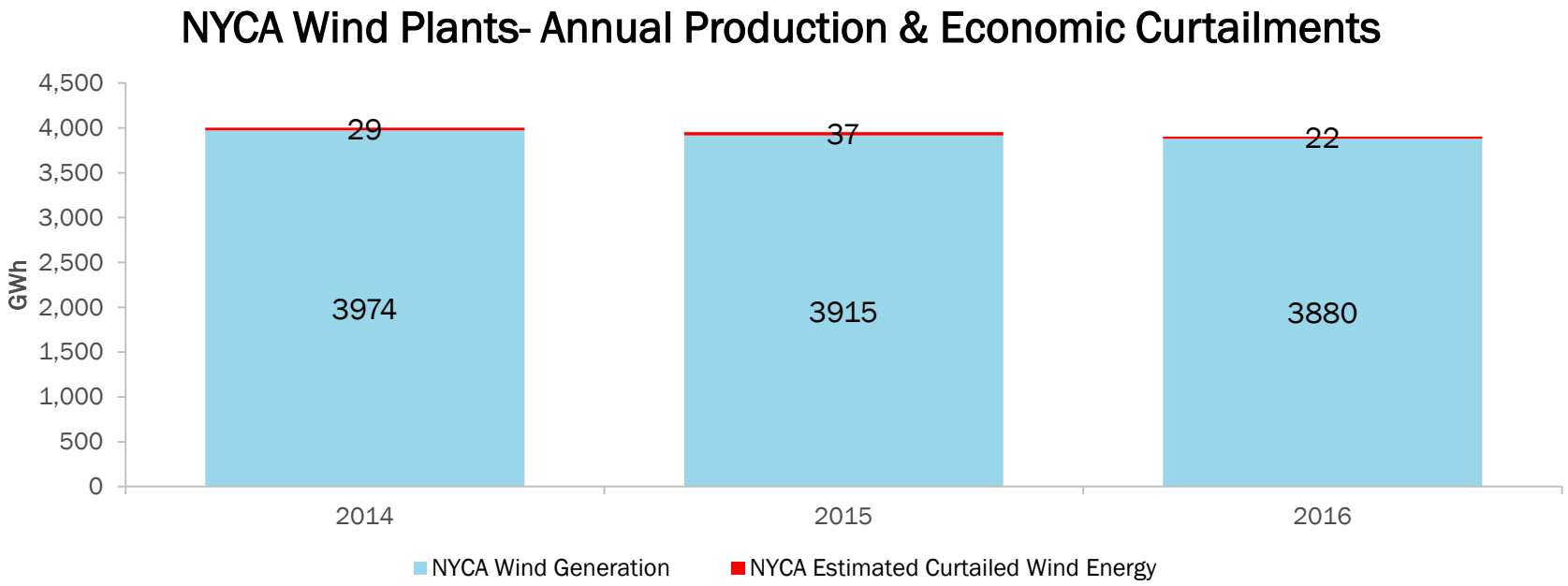
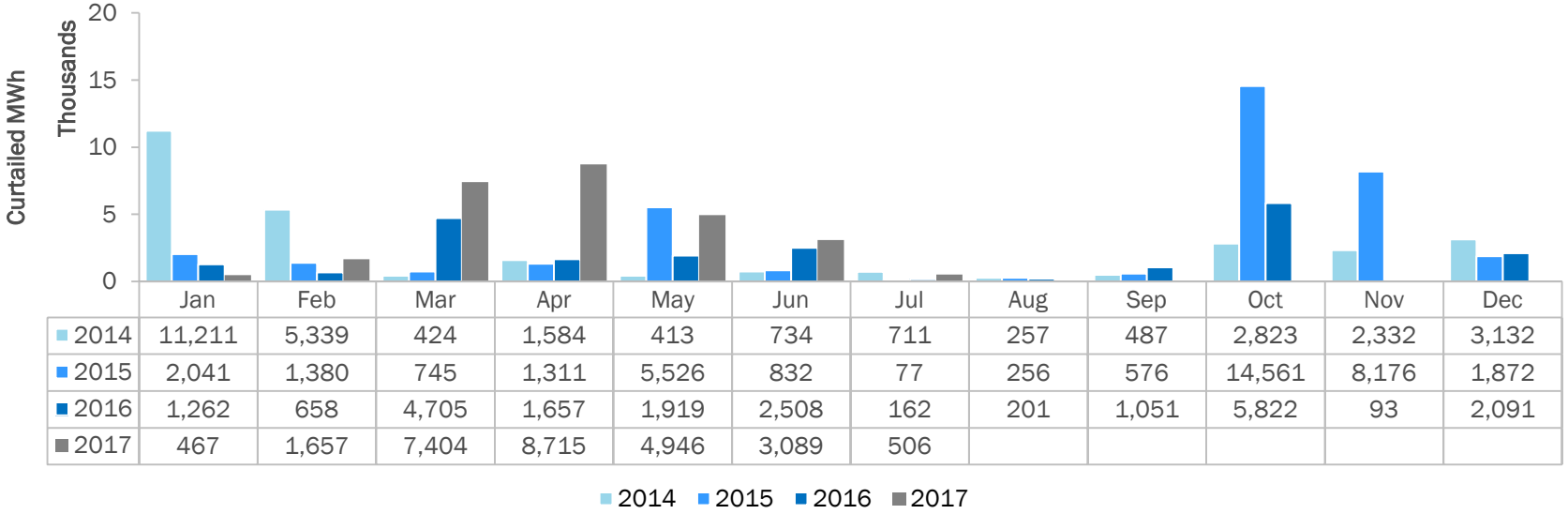


Economic Wind Curtailment



…NY Wind Economic Curtailment profile

NYCA Wind Plants - Monthly Estimated Curtailed Energy



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2014	11,211	5,339	424	1,584	413	734	711	257	487	2,823	2,332	3,132
2015	2,041	1,380	745	1,311	5,526	832	77	256	576	14,561	8,176	1,872
2016	1,262	658	4,705	1,657	1,919	2,508	162	201	1,051	5,822	93	2,091
2017	467	1,657	7,404	8,715	4,946	3,089	506					

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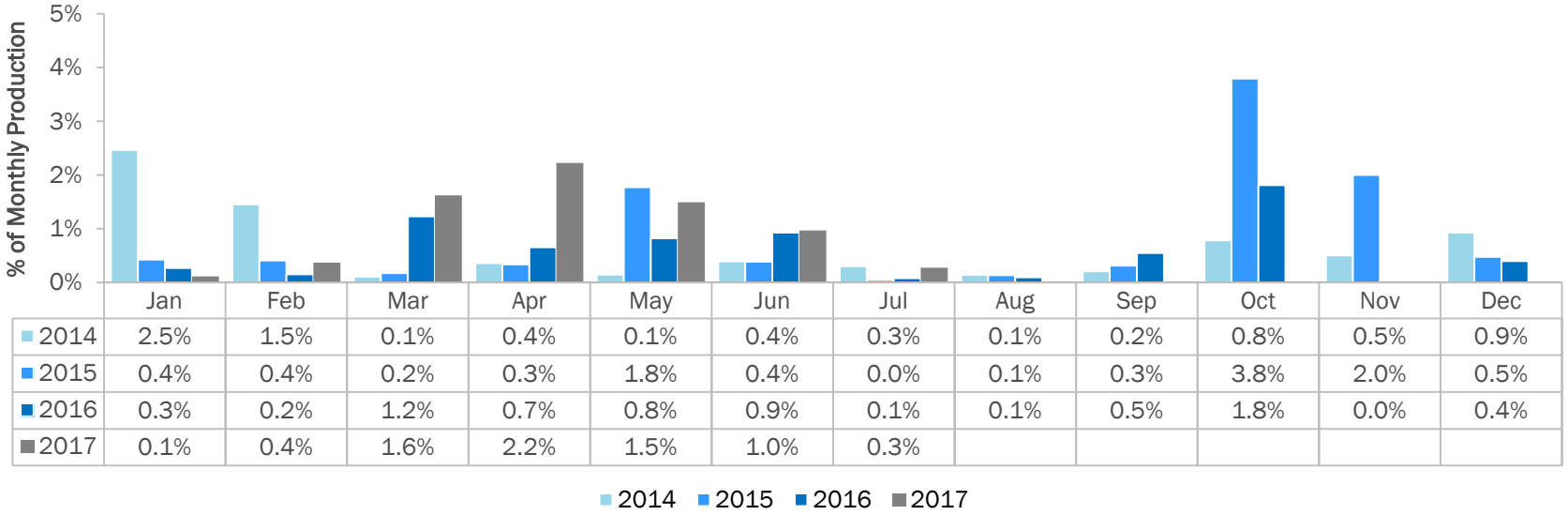
…NY Wind Economic Curtailment profile

NYCA Wind Plants - Monthly Estimated Curtailed Energy %



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2014	2.5%	1.5%	0.1%	0.4%	0.1%	0.4%	0.3%	0.1%	0.2%	0.8%	0.5%	0.9%
2015	0.4%	0.4%	0.2%	0.3%	1.8%	0.4%	0.0%	0.1%	0.3%	3.8%	2.0%	0.5%
2016	0.3%	0.2%	1.2%	0.7%	0.8%	0.9%	0.1%	0.1%	0.5%	1.8%	0.0%	0.4%
2017	0.1%	0.4%	1.6%	2.2%	1.5%	1.0%	0.3%					

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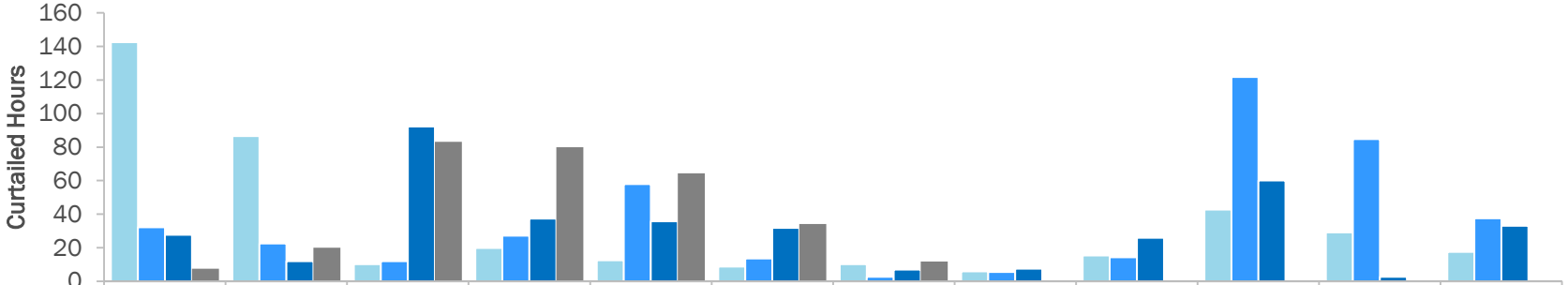
…NY Wind Economic Curtailment duration

NYCA Wind Plants – Monthly Curtailed Energy Duration



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2014	143	87	10	20	12	9	10	6	15	43	29	18
2015	32	23	12	27	58	14	3	6	14	122	85	38
2016	28	12	92	37	36	32	7	7	26	60	3	33
2017	8	20	83	80	64	34	12					

2014 2015 2016 2017

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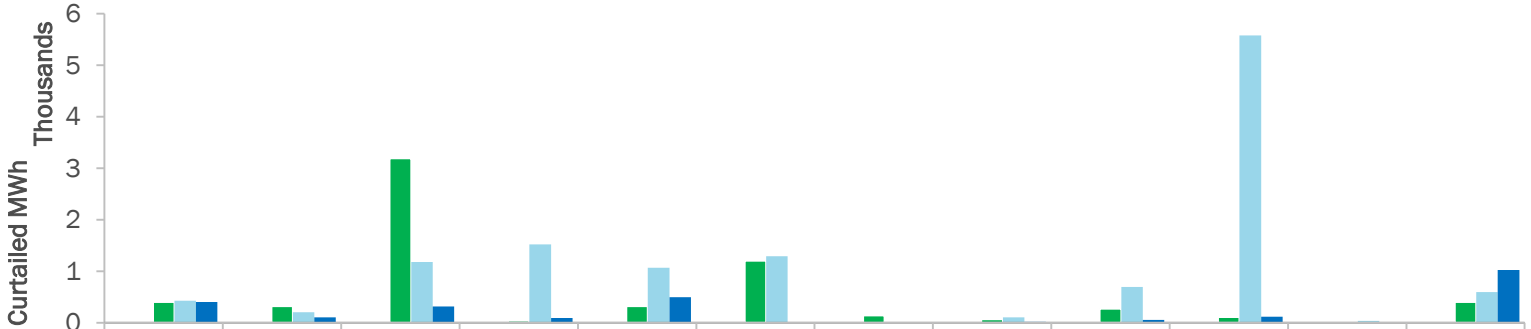
…NY Zonal Economic Wind Curtailments

NYCA Zones- Monthly Estimated Curtailed Energy for 2016



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
WEST	28	31	18	1	24	10	1	12	16	7	2	23
GENESSEE	0	0	0	0	0	0	0	0	0	0	0	0
CENTRAL	406	323	3,191	44	319	1,204	142	66	270	111	34	403
NORTH	427	202	1,178	1,520	1,069	1,293	2	104	696	5,576	37	597
MOHAWK VALLEY	401	102	318	92	497	1	1	18	53	118	7	1,022

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Case Study

October 2016

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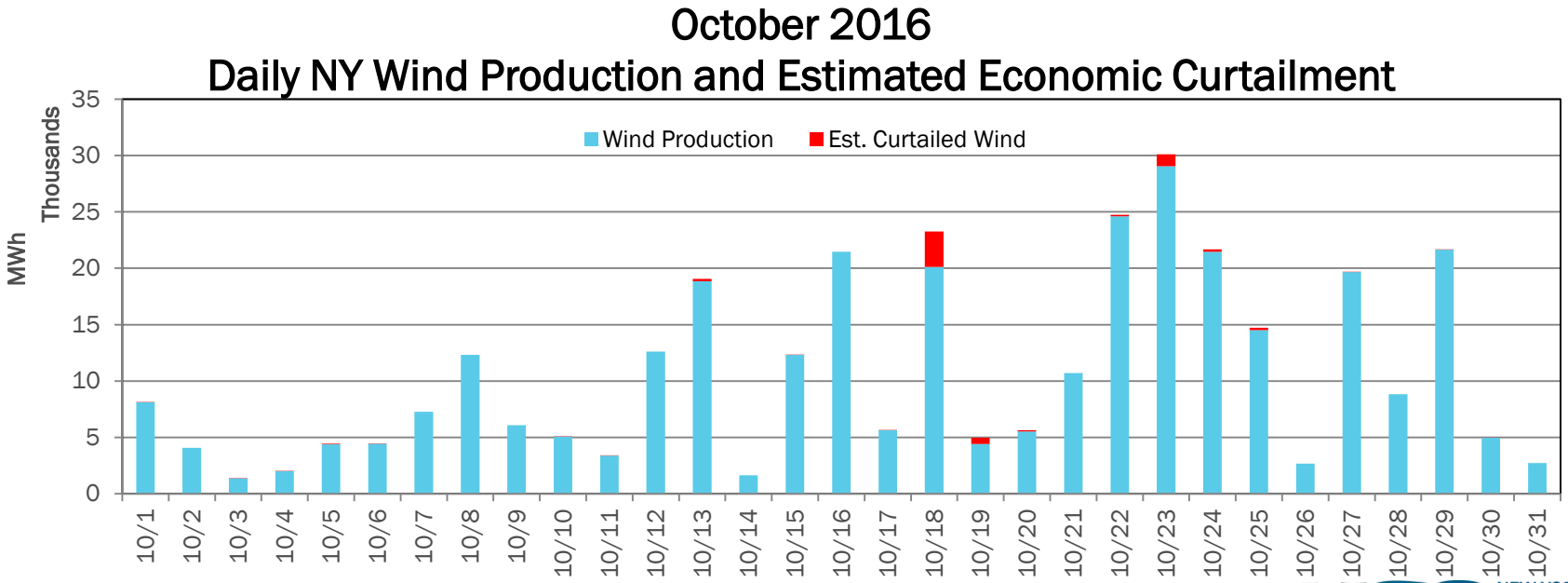
Case Study – October 2016



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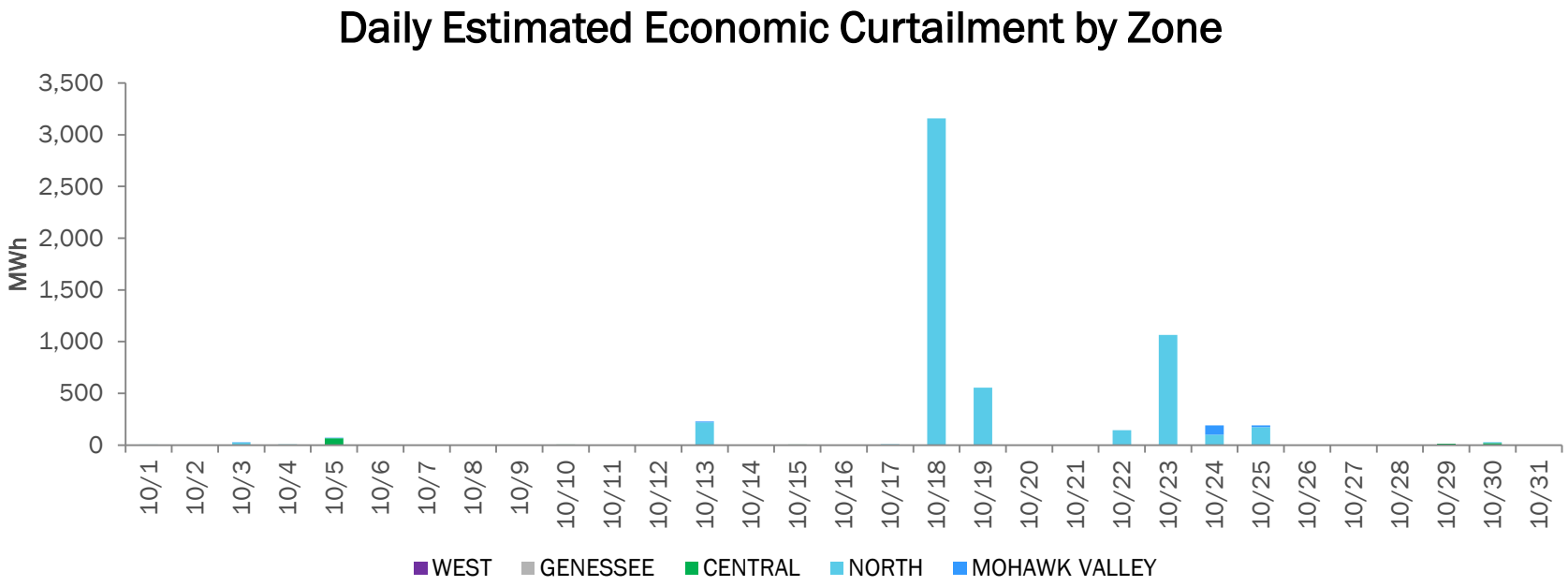
October 2016: Daily Zonal Estimated Curtailment



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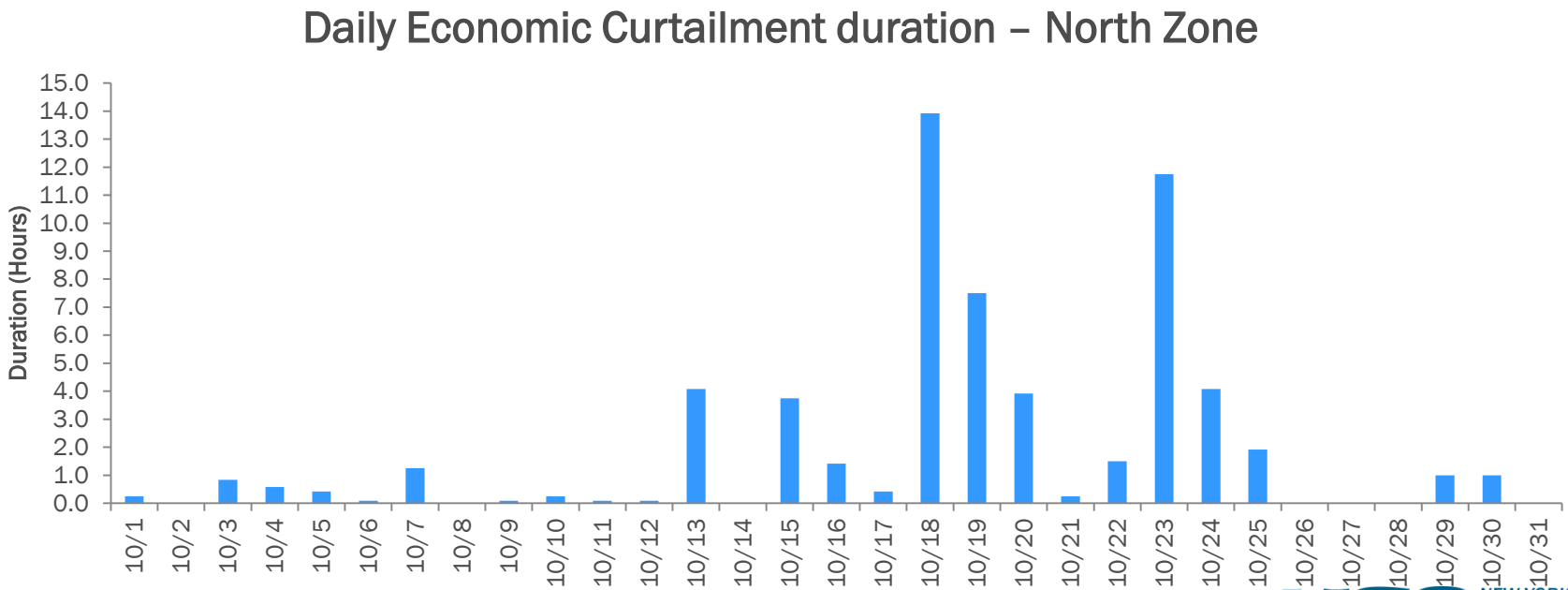
October 2016: Daily Zonal Estimated Curtailment



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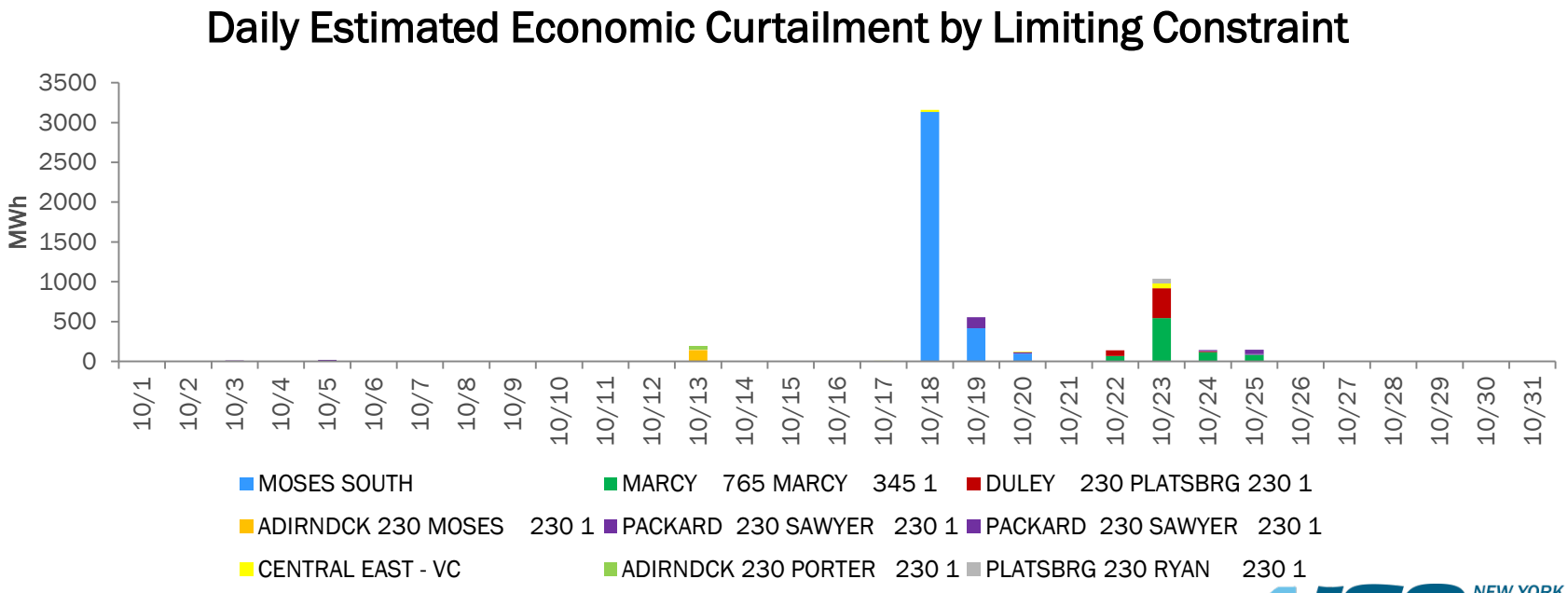
October 2016: Daily Zonal Estimated Curtailment



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October 2016 Transmission Outages

- **Higher levels of wind curtailment in the North were coincident with scheduled outages of the Chateaugay-Massena 756kV (#7040), Massena-Marcy 765kV (#MSU1), and Moses-Massena 230kV (#MMS1/MMS2) transmission lines.**
  - On 10/3-10/6/2016 the limiting constraint resulting in wind curtailments was the Edic-Marcy 345kV. The correlated outage was that of the Marcy-Fraser Annex-Coopers 345kV (#UCC2-41) from 10/3/2016 07:00 to 10/9/2016 15:30 **scheduled** continuously.
  - On 10/13/2016 the limiting constraint resulting in wind curtailments was the Moses-Adirondack 230kV (#MA1). The correlated outage was that of the Moses-Adirondack 230kV (#MA2) from 10/11/2016 07:00-10/14/2016 15:30 **scheduled** continuously.
  - On 10/18 & 10/19/2016 the limiting constraint resulting in wind curtailments was the Moses South interface. The correlated outage was that of the Massena-Marcy 765kV (#MSU1) from 10/17/2016 01:00 to 10/22/2016 19:00 **scheduled** continuously which impacts the Moses South TTC by 2,650MW reducing it from the TTC with all lines in service of 3,150MW to 500MW.
  - On 10/22 -10/25/2016 the limiting constraint resulting in wind curtailments were the Marcy 765/345kV bank AT1 , the Adirondack-Chases Lake-Porter line. The correlated outages were the Marcy 765/345kV bank AT2 from 10/17/2016 01:00 to 10/28/2016 15:30 **scheduled** continuously, the CHAT_DC_GC1 & GC2 from 10/17/2016 01:00 to 10/25/2016 17:30 **scheduled** continuously, and the Adirondack-Porter 230kV (#12) from 10/24/2016 HB23 to 10/25/2016 HB15 **forced** continuously.
- **Similarly, as noted in the October 2016 Operations metrics reports highlights, higher levels of wind curtailments in the North Country that month were coincident with the scheduled outages of the Chateauguay-Massena 765kV (#7040), Massena-Marcy 765kV (#MSU1), and Moses-Massena 230kV (#MMS1/MMS2) transmission lines.**

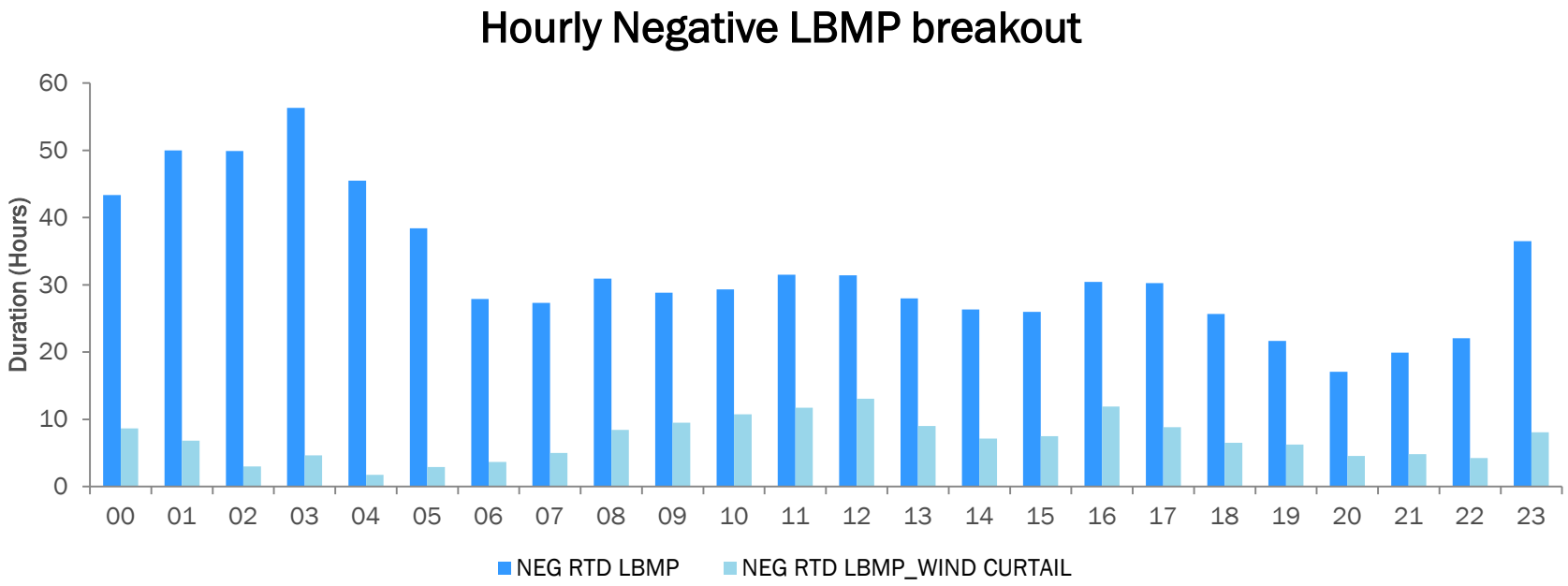
October 2016 Negative LBMP

- We do observe a correlation between wind curtailments and negative zonal LBMP
  - 8% of the North zone RTD intervals in October 2016 had negative LBMPs
    - 77% of those RTD intervals were coincident with wind curtailments
    - 17% of these RTD intervals were coincident with oversupply of energy
- The wind curtailments were driven by scheduled and unscheduled transmission facility outages.
- Oversupply of energy, usually in off-peak hours, is the other primary driver of negative LBMP.

Year 2016 Negative LBMP

- Similar to the October 2016 analysis, there is a correlation between wind curtailments and negative zonal LBMP
  - 9% of the North zone RTD intervals in 2016 had negative LBMPs
    - 30% of those RTD intervals were coincident with wind curtailments
    - 70% of these RTD intervals were coincident with oversupply of energy
- The wind curtailments were driven by scheduled and unscheduled transmission facility outages.
- Oversupply of energy, usually in off-peak hours, is the other primary driver of negative LBMP.

2016: North Zone Negative RTD LBMP



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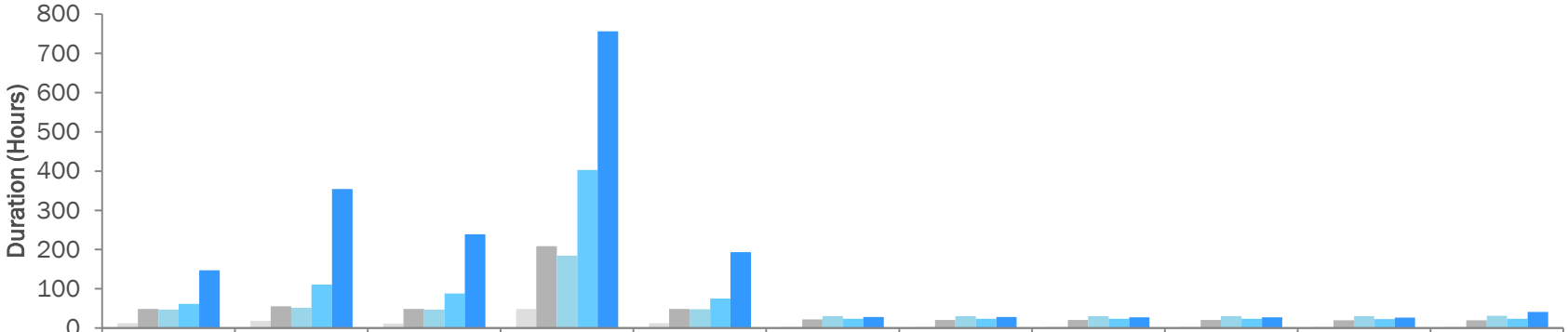
Annual Negative RTD LBMP by Zone



	WEST	GENESE	CENTRL	NORTH	MHK VL	CAPITL	HUD VL	MILLWD	DUNWOD	LONGIL	N.Y.C.
2012	12	18	12	49	13	3	3	3	3	3	3
2013	49	56	49	209	49	22	21	21	20	20	20
2014	47	52	47	185	48	31	31	31	31	31	31
2015	62	111	88	402	76	24	24	23	23	23	24
2016	147	355	239	756	193	28	28	28	28	27	41

Questions?

The Mission of the New York Independent System Operator, in collaboration with its stakeholders, is to serve the public interest and provide benefits to consumers by:

- Maintaining and enhancing regional reliability
- Operating open, fair and competitive wholesale electricity markets
- Planning the power system for the future
- Providing factual information to policy makers, stakeholders and investors in the power system

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Questions?

We are here to help. Let us know if we can add anything.

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