2021-2030 CRP

Kevin DePugh – Sr. Manager, Reliability Planning
Laura Popa – Manager, Resource Planning
Keith Burrell – Manager, Transmission Studies

ESPWG/TPAS

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Agenda

- RNA and CRP Conclusions
- Road to 2040
- Resource Adequacy Metrics/Scenarios
- Transmission Studies Scenarios

RNA and Post-RNA Conclusions

Post-RNA Base Case Key Updates

- **The load forecast update, as presented at the November 19, 2020 ESPWG/TPAS/LFTF meeting [link]**
  - Specifically, Zone J peak load forecast decreased by 392 MW in 2030
- **LTP updates as presented by Con Edison at the January 25, 2021 ESPWG/TPAS [link]:**
  - A new 345/138 kV PAR controlled 138 kV Rainey – Corona feeder
  - A new 345/138 kV PAR controlled 138 kV Gowanus – Greenwood feeder
  - A new 345/138 kV PAR controlled 138 kV Goethals – Fox Hills feeder
- **STRP solution for addressing the 2023 short-term need [link]**
  - Series Reactors status changes, starting summer 2023, through 2030:
    - Placing in service the SR on the following 345 kV cables: 71, 72, M51, M52
    - Bypassing the SR on the following 345 kV cables: 41, 42, Y49

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Post-RNA Conclusions

- All resource adequacy and transmission security Reliability Needs are resolved
- No need to solicit for solutions

Road to 2040

Road to 2040: Load

- **Key takeaways**
  - Climate change will result in a significant increase in summer load
  - CLCPA electrification is expected to cause the NYCA to transition from summer peaking to winter peaking
  - The winter peak load under the CLCPA case is expected to be double compared to the reference case

Road to 2040: Generation

- **Key takeaways**
  - A system with significant amounts of intermittent resources will need significant amounts of dispatchable resources that can run for multiple day periods
  - Due to the characteristics of sun and wind resources, there will be high ramping requirements needed from the dispatchable resources
  - A 100% CO_2 emission-free system by 2040 (100 x 40) system will require those dispatchable resources to be emission free
  - Dispatchable resources that are emissions free and on the scale needed are not yet tested or proposed in the NYISO interconnection queue

Road to 2040: Transmission

- **Key takeaways**
  - More inter- and intra- zonal transmission capacity will be required to deliver a reliable bulk power system with a high renewable penetration
  - Transmission additions would not reduce the amount of dispatchable resource capacity needed, but would decrease the amount of energy output needed from them

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Resource Adequacy Metrics/Scenarios

RNA and CRP Base Cases Resource Adequacy Results

CRP Base Case - NYCA Reliability Metrics			
Study Year	LOLE (dy/yr)	LOLH (hr/yr)	LOEE (MWh/yr)
2021	0.017	0.064	35.3
2022	0.017	0.055	26.6
2023	0.034	0.106	50.8
2024	0.024	0.083	47.2
2025	0.036	0.118	69.3
2026	0.038	0.131	83.7
2027	0.040	0.139	93.2
2028	0.047	0.146	83.4
2029	0.060	0.199	137.2
2030	0.064	0.212	156.2

- Loss of Load Expectation (**LOLE** in **days/year**) - the expected number of days in a given time period (e.g. one study year) when at least one hour from that day the hourly demand is projected to exceed the zonal resources capacity. NYSRC and NPCC's LOLE criterion is to not exceed one day in 10 years, or LOLE < 0.1 days/year.

For information only (there is no criterion defined at this time):

- Loss of load hours (**LOLH** in **hours/year**) - the expected number of hours in a given time period (e.g., one study year) when a system's hourly demand is projected to exceed the zonal resources capacity.
- Expected unserved energy (**EUE** in **MWh/year**), or loss of energy expectation (**LOEE**) - the expected amount of energy (MWh) that will not be served in a given year.

CRP Base Case

Zonal Resource Adequacy Margin (ZRAM)

Study Year	LOLE	Zone A	Zone B	Zone C	Zone D	Zone E	Zone F	Zone G	Zone H	Zone I	Zone J	Zone K
2024	0.02	-950	EZR	-1850	-1800	EZR	-1850	-1850	EZR	EZR	-750	-1350
2025	0.04	-1000	EZR	-1550	-1550	EZR	-1550	-1550	EZR	EZR	-500	-1200
2026	0.04	-950	EZR	-1500	-1500	EZR	-1450	-1500	EZR	EZR	-500	-1250
2027	0.04	-850	EZR	-1400	-1400	EZR	-1400	-1400	EZR	EZR	-400	-1250
2028	0.05	-900	EZR	-1300	-1250	EZR	-1300	-1300	EZR	EZR	-350	-1150
2029	0.06	-750	-750	-950	-950	-950	-950	-950	EZR	EZR	-250	-1000
2030	0.06	-700	-700	-800	-800	-800	-800	-800	EZR	EZR	-200	-850

Notes:

- Negative numbers indicate the amount of MW that can be removed from a zone without causing a violation
- EZR - exceeds zonal resources (all generation can be removed without causing a violation)
- The generation pockets in Zone J and Zone K are not modeled in detail in MARS and the values identified here may be larger as a result

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CRP Base Case

Free Flow Simulations

	2020 RNA Post-RNA Base Case NYCA LOLE *(days/year)*			
Study Year	**With all three updates** *(i.e., Load, ConEd LTP, Series Reactor status)*	**Unlimited I_to_J** (Dunwoodie South)	**Unlimited G_to_H** (UPNY-ConEd)	**Unlimited G_to_H and I_to_J**
2024	**0.024**	0.021	0.024	0.021
2025	**0.036**	0.027	0.035	0.025
2026	**0.038**	0.029	0.038	0.028
2027	**0.040**	0.028	0.039	0.026
2028	**0.047**	0.034	0.046	0.030
2029	**0.060**	0.043	0.059	0.037
2030	**0.064**	0.045	0.063	0.035

- **In order to determine whether or not a specific MARS interface impacts LOLE, free-flow simulations were also performed**
  - Interface limit set to a high MW value
  - LOLE impact is an indication of interface 'binding'
- **The NYCA LOLE results show that:**
  - I_to_J (Dunwoodie South) interface has a significant LOLE impact (i.e., it is 'binding'),
  - G_to_H (UPNY-ConEd) has low LOLE impact due to the fact that most of the LOLE events are in Zone J, and the I-to-J interface 'binds' first

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Resource Adequacy Wind Lull Scenario

MARS: Not a “dispatch” model

- **Not a “dispatch” model**
  - Rather a “bucket of available zonal MW” probabilistically sampled for each hour of the study year, and compared with each of the seven zonal load levels to identify zonal margins or deficiencies (events)
- **The MARS simulations do not take into consideration potential reliability impacts due to:**
  - Unit commitment and dispatch, ramp rate constraints, and other production cost modeling techniques
  - Intra-zonal constraints on the transmission system
  - Development of models for 70% renewable energy by 2030 (“70 x 30”): changes on the transmission system as a result of the resource additions (renewable mix) or subtractions (age-based)

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Renewable Mix by NYCA Zone

Zonal Renewable Mix (Nameplate MW) 70x30 **'Base Load** Case'

Zone/Type	OSW	LBW	UPV	BTM-PV
A		2,286	4,432	995
B		314	505	298
C		2,411	2,765	836
D		1,762		76
E		2,000	1,747	901
F			3,592	1,131
G			2,032	961
H				89
I				130
J	4,320			950
K	1,778		77	1,176
Total	**6,098**	**8,772**	**15,150**	**7,542**

Zonal Renewable Mix (Nameplate MW) 70x30 **'Scenario Load** Case'

Zone/Type	OSW	LBW	UPV	BTM-PV
A		1,640	3,162	995
B		207	361	298
C		1,765	1,972	836
D		1,383		76
E		1,482	1,247	901
F			2,563	1,131
G			1,450	961
H				89
I				130
J	4,320			950
K	1,778		77	1,176
Total	**6,098**	**6,477**	**10,832**	**7,542**

70x30 - Cases At-Criterion and at Low LOLE

70x30 Base Load Case at-Criterion: Age-based Fossil Removal

	Total Thermal Capacity (MW)				Cumulative Capacity Removed (MW)				
Cases (Age >=)	Zone J	Zone K	Other Zones	Total	Zone J	Zone K	Other Zones	Total	NYCA LOLE
Total	8,190	3,962	15,012	27,165	0	0	0	0	0.00
70	6,978	3,564	14,616	25,160	1,212	398	396	2,005	0.02
68	6,601	3,371	14,616	24,590	1,589	591	396	2,575	0.05
67*	6,386	3,360	14,616	24,364	1,804	602	396	2,801	0.11
67	6,236	3,360	14,616	24,214	1,954	602	396	2,951	0.15

70x30 Scenario Load Case at-Criterion: Age-based Fossil Removal

	Total Thermal Capacity (MW)				Cumulative Capacity Removed (MW)				
Cases (Age >=)	Zone J	Zone K	Other Zones	Total	Zone J	Zone K	Other Zones	Total	NYCA LOLE
Total	8,190	3,962	15,012	27,165	0	0	0	0	0
50	4,354	1,541	11,228	17,124	3,836	2421	3784	10,041	0.03
40	4,354	1,393	10,247	15,995	3,836	2569	4765	11,170	0.07
39	4,354	1,349	10,197	15,901	3,836	2613	4815	11,264	0.09
38	3,563	1,325	9,935	14,824	4,627	2637	5077	12,341	0.11

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Scenario Scope: NYCA-Wide Weekly Wind Lull Events

All NYCA zones events: The following types of analysis and events are simulated over each of the 3 MARS models described above.

- **Highest % of NYCA LOLE events:**
  - Identify the top 2 weeks with highest % of NYCA LOLE events
  - For each of the top 2 weeks (one week at the time) having highest % of LOLE events, simulate total loss of NYCA wind (0 MW all NYCA zones) for that entire week and calculate NYCA LOLE, LOLH, and EUE.
  - Compute compensatory MW to bring LOLE close to the initial case
- **Top 2 weeks with highest land-based wind ("LBW") capacity factor:**
  - Identify the top 2 weeks with highest land – based wind capacity factors
  - On each of the top 2 weeks (one week at the time) simulate total loss of NYCA wind (0 MW) for that entire week and calculate NYCA LOLE, LOLH, and EUE.
  - Compute compensatory MW to bring LOLE close to the initial case
- **Top 2 weeks with highest offshore wind ("OSW") capacity factor:**
  - Identify the top 2 weeks with highest offshore wind capacity factors
  - On each of the top 2 weeks (one week at the time) simulate total loss of NYCA wind (0 MW) for that entire week and calculate NYCA LOLE, LOLH, and EUE
  - Compute compensatory MW to bring LOLE close to the initial case

- **Note: the wind lull weeks assume that all land-based or all offshore wind (but not both) have no output to the system for the whole week and then recover to normal output levels for the following week**

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70x30 - LBW Wind Lull Analysis

Loss of LBW during the Week with **Highest LBW Capacity Factor**

No LBW during the 1st Highest LBW Capacity Factor (CF) Week					Compensatory MW		
Model	**LBW CF**	**Initial LOLE**	**Resultant LOLE**	**Delta LOLE**	**Zones A-I**	**Zone J**	**Zone K**
70x30 'Base Load' at-criterion	23%	0.11	0.11	**0.00**	<25	<25	<25
70x30 'Scenario Load' at-criterion	23%	0.11	0.11	**0.00**	<25	<25	<25
70x30 'Scenario Load' at-low-LOLE	23%	0.03	0.03	**0.00**	<25	<25	<25
No LBW during the 2nd Highest LBW Capacity Factor Week					**Compensatory MW**		
Model	**LBW CF**	**Initial LOLE**	**Resultant LOLE**	**Delta LOLE**	**Zones A-I**	**Zone J**	**Zone K**
70x30 'Base Load' at-criterion	20%	0.11	0.11	**0.00**	<25	<25	<25
70x30 'Scenario Load' at-criterion	20%	0.11	0.11	**0.00**	<25	<25	<25
70x30 'Scenario Load' at-low-LOLE	20%	0.03	0.03	**0.00**	<25	<25	<25

Key takeaway: Not much impact as the land-based wind is distributed in A through E Zones, while resource deficiencies are in J and K

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70x30 - LBW Wind Lull Analysis

NYCA LOLE (days/year) for Loss of LBW during the Week with **Highest LOLE Events**

No LBW during the 1st Highest NYCA Event % Week					Compensatory MW		
Model	**Event %**	**Initial LOLE**	**Resultant LOLE**	**Delta LOLE**	**Zones A-I**	**Zone J**	**Zone K**
70x30 'Base Load' at-criterion	34%	0.11	0.11	**0.00**	<25	<25	<25
70x30 'Scenario Load' at-criterion	23%	0.11	0.11	**0.00**	<25	<25	<25
70x30 'Scenario Load' at-low-LOLE	24%	0.03	0.03	**0.00**	<25	<25	<25
No Land-Based Wind during the 2nd Highest NYCA Event % Week					**Compensatory MW**		
Model	**Event %**	**Initial LOLE**	**Resultant LOLE**	**Delta LOLE**	**Zones A-I**	**Zone J**	**Zone K**
70x30 'Base Load' at-criterion	19%	0.11	0.11	**0.00**	<25	<25	<25
70x30 'Scenario Load' at-criterion	18%	0.11	0.11	**0.00**	<25	<25	<25
70x30 'Scenario Load' at-low-LOLE	18%	0.03	0.03	**0.00**	<25	<25	<25

Key takeaway: Not much impact to LOLE as the land-based wind is distributed in Zones A through E, while resource deficiencies are in Zones J and K

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70x30 – OSW Wind Lull Analysis

Loss of OSW during the Week with **Highest OSW Capacity Factor**

No OSW during the 1st Highest OSW Capacity Factor Week					Compensatory MW		
Model	OSW CF	Initial LOLE	Resultant LOLE	Delta LOLE	Zones A-I	Zone J	Zone K
70x30 'Base Load' at-criterion	41%	0.11	0.26	**0.16**	∞	350	∞
70x30 'Scenario Load' at-criterion	41%	0.11	0.22	**0.11**	∞	∞	150
70x30 'Scenario Load' at-low-LOLE	41%	0.03	0.06	**0.03**	∞	∞	150
No OSW during the 2nd Highest OSW Capacity Factor Week					**Compensatory MW**		
Model	**OSW CF**	**Initial LOLE**	**Resultant LOLE**	**Delta LOLE**	**Zones A-I**	**Zone J**	**Zone K**
70x30 'Base Load' at-criterion	32%	0.11	0.14	**0.04**	∞	100	∞
70x30 'Scenario Load' at-criterion	32%	0.11	0.47	**0.36**	∞	∞	400
70x30 'Scenario Load' at-low-LOLE	32%	0.03	0.16	**0.13**	∞	∞	350

∞ - Either a large, or no amount of capacity added in the zone can bring NYCA LOLE below 0.1

- **Outage of all offshore wind generation has a substantial impact on LOLE. This is largely due to the co-location of offshore wind together with the majority of the resource deficiencies in Zones J and K**

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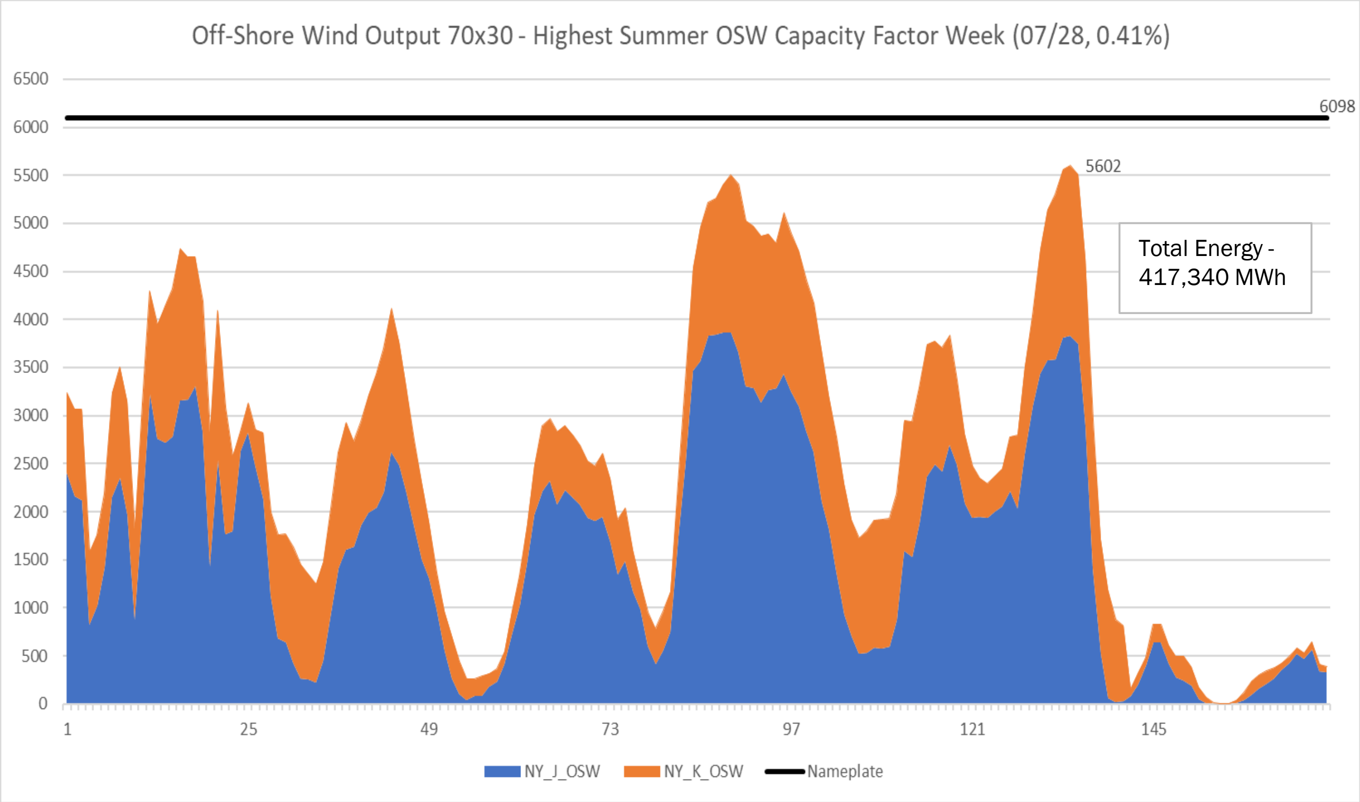
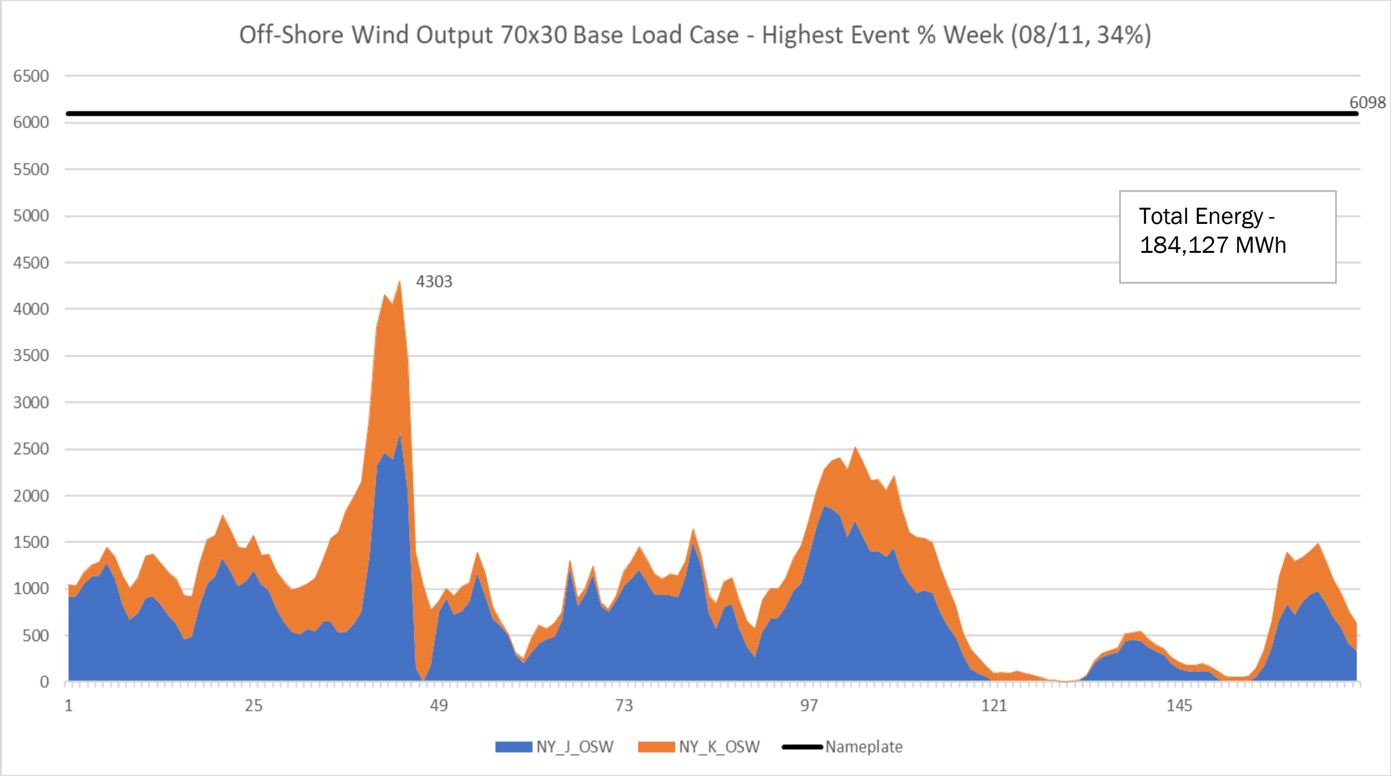
OSW MW Output During the Week with Highest Capacity Factor



OSW MW Output During the Week with Highest % Events – 70x30 'Base Load' Cases



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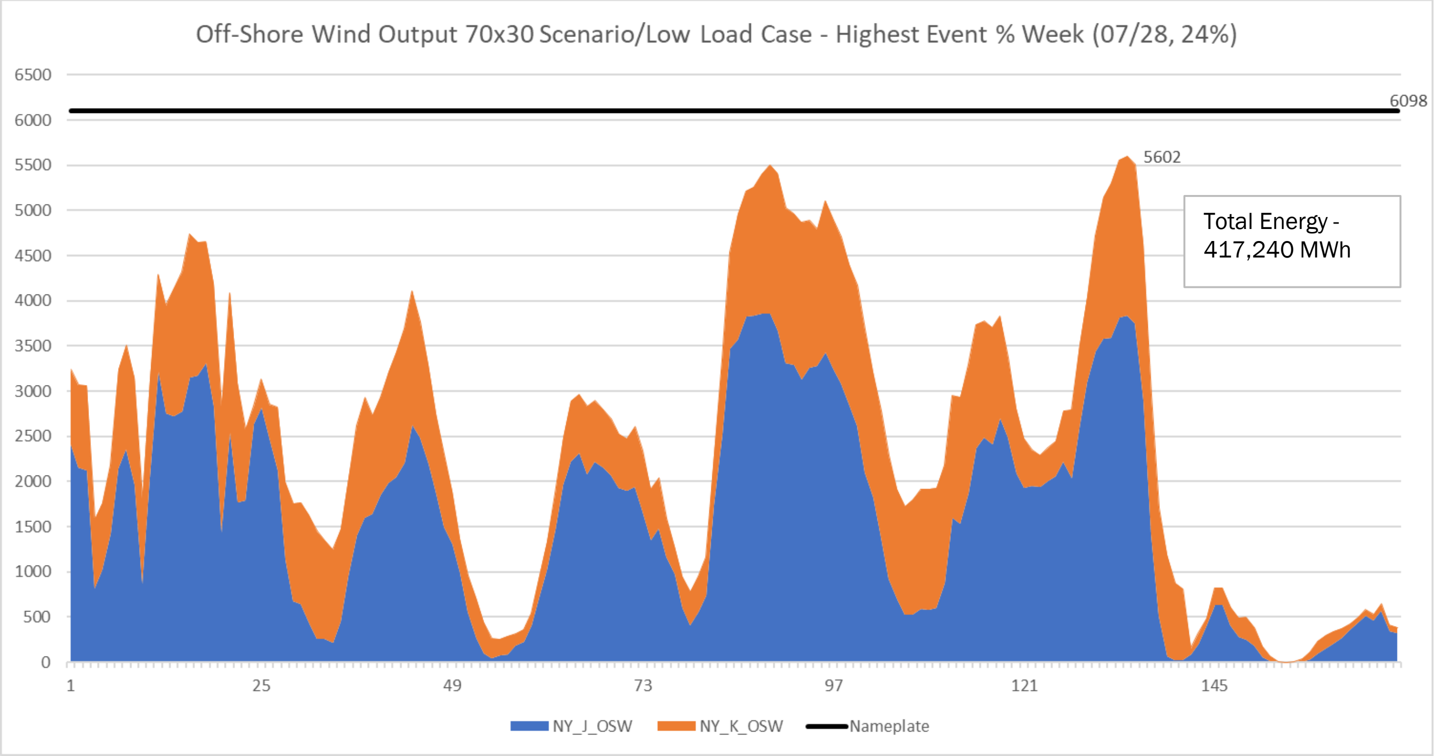
OSW MW Output During the Week with Highest % Events – 70x30 ‘Scenario Load’ and “Low LOLE” Cases



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70x30 – OSW Wind Lull Analysis

Loss of OSW during the Week with **Highest LOLE Events**

No OSW during the 1st Highest NYCA Event % Week				Compensatory MW		
Model	Initial LOLE	Resultant LOLE	Delta LOLE	Zones A-I	Zone J	Zone K
70x30 'Base Load' at-criterion	0.11	0.18	**0.07**	∞	200	∞
70x30 'Scenario Load' at-criterion	0.11	0.22	**0.11**	∞	∞	150
70x30 'Scenario Load' at-low-LOLE	0.03	0.06	**0.03**	∞	∞	150
No OSW during the 2nd Highest NYCA Event % Week				**Compensatory MW**		
Model	**Initial LOLE**	**Resultant LOLE**	**Delta LOLE**	**Zones A-I**	**Zone J**	**Zone K**
70x30 'Base Load' at-criterion	0.11	0.11	**0.01**	∞	150	∞
70x30 'Scenario Load' at-criterion	0.11	0.13	**0.02**	∞	∞	50
70x30 'Scenario Load' at-low-LOLE	0.03	0.03	**0.00**	∞	∞	25

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OSW Lull Scenario Observations

- Outage of all offshore wind generation for the studied week has a substantial impact on NYCA LOLE. This is largely due to the location of the offshore wind in the J and K Zones, where the majority of the NYCA LOLE events occur
- There is a higher impact in the NYCA LOLE for the "Scenario Load" case (i.e., a lower energy case), which had a higher MW of fossil removed (i.e., around 12,340 MW fossil removed, as identified in the 2020 RNA Report) in order to bring it to the 0.1 day/year criterion ("at criterion")
- Using yearly compensatory MW (i.e., 'perfect capacity MW' available every hour of the study year) to bring the NYCA LOLE back to the levels found in the original cases reduces the resultant LOLH, but increases EUE. This is because smaller events are mitigated by the "perfect" compensatory MW, but the large events that are created by the wind lull create a larger energy deficit during that week
    - Note: Annual compensatory MW values are reducing LOLE at other times of the year, not just during the week affected by the wind lull

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Transmission Security

Tipping Points

NYCA Summer Baseline Peak Forecast – Normal

Line	Item	Peak Load Forecast									
		2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
A	NYCA Generation (1)	35,257	34,307	34,297	33,684	33,679	33,679	33,674	33,669	33,664	33,659
B	External Area Interchanges (2)	1,844	1,844	1,844	1,844	1,844	1,844	1,844	1,844	1,844	1,844
C	Temperature Based Generation Derates	0	0	0	0	0	0	0	0	0	0
D	**Total Resources (A+B+C)**	37,101	36,151	36,141	35,528	35,523	35,523	35,518	35,513	35,508	35,503
E	Load Forecast	(32,178)	(31,910)	(31,641)	(31,470)	(31,326)	(31,278)	(31,284)	(31,348)	(31,453)	(31,565)
F	Operating Reserve Requirement	(2,620)	(2,620)	(2,620)	(2,620)	(2,620)	(2,620)	(2,620)	(2,620)	(2,620)	(2,620)
G	**Total Capability Requirement (E+F)**	(34,798)	(34,530)	(34,261)	(34,090)	(33,946)	(33,898)	(33,904)	(33,968)	(34,073)	(34,185)
H	**Transmission Security Margin (D+G)**	2,303	1,621	1,880	1,438	1,577	1,625	1,614	1,545	1,435	1,318
I	SCRs	1,195	1,195	1,195	1,195	1,195	1,195	1,195	1,195	1,195	1,195
J	Forced Outages (3)	(2,164)	(1,952)	(1,952)	(1,867)	(1,867)	(1,867)	(1,867)	(1,867)	(1,867)	(1,867)
K	**Adjusted Transmission Security Margin (H+I+J) (4)**	1,334	864	1,123	766	905	953	942	873	763	646

Notes:

1. Reflects the 2021 Gold Book existing summer capacity plus projected additions, deactivations, and de-rates. For this evaluation wind generation is assumed to have 0 MW output, solar generation is based on the ratio of solar PV nameplate capacity (2021 Gold Book Table I-9a) and solar PV peak reductions (2021 Gold Book Table I-9c). De-rates for run-of-river hydro is included as well as the Oswego Export limit of for all lines in-service.
2. Interchanges are based on ERAG MMWG values.
3. Includes de-rates for thermal resources.
4. Special Case Resources (SCRs) are not applied for transmission security analysis of normal operations.

New York ISO

Tipping Points

NYCA Summer 1-in-10 (90/10) Peak Forecast - Emergency

Line	Item	90th Percentile Forecast									
		2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
A	NYCA Generation (1)	35,257	34,307	34,297	33,684	33,679	33,679	33,674	33,669	33,664	33,659
B	External Area Interchanges (2)	1,844	1,844	1,844	1,844	1,844	1,844	1,844	1,844	1,844	1,844
C	SCRs (4)	1,195	1,195	1,195	1,195	1,195	1,195	1,195	1,195	1,195	1,195
D	Temperature Based Generation Derates	(208)	(195)	(195)	(185)	(185)	(185)	(185)	(185)	(185)	(185)
E	**Total Resources (A+B+C+D)**	38,088	37,151	37,141	36,537	36,532	36,532	36,527	36,522	36,517	36,512
F	Load Forecast	(34,158)	(33,871)	(33,582)	(33,399)	(33,246)	(33,191)	(33,195)	(33,262)	(33,373)	(33,490)
G	Operating Reserve Requirement	(2,620)	(2,620)	(2,620)	(2,620)	(2,620)	(2,620)	(2,620)	(2,620)	(2,620)	(2,620)
H	**Total Capability Requirement (F+G)**	(36,778)	(36,491)	(36,202)	(36,019)	(35,866)	(35,811)	(35,815)	(35,882)	(35,993)	(36,110)
I	**Transmission Security Margin (E+H)**	1,310	660	939	518	666	721	712	640	524	402
J	Forced Outages (3)	(2,164)	(1,952)	(1,952)	(1,867)	(1,867)	(1,867)	(1,867)	(1,867)	(1,867)	(1,867)
K	**Adjusted Transmission Security Margin (I+J)**	(854)	(1,292)	(1,013)	(1,349)	(1,201)	(1,146)	(1,155)	(1,227)	(1,343)	(1,465)

Notes:

1. Reflects the 2021 Gold Book existing summer capacity plus projected additions, deactivations, and de-rates. For this evaluation wind generation is assumed to have 0 MW output, solar generation is based on the ratio of solar PV nameplate capacity (2021 Gold Book Table I-9a) and solar PV peak reductions (2021 Gold Book Table I-9c). De-rates for run-of-river hydro is included as well as the Oswego Export limit of for all lines in-service.
2. Interchanges are based on ERAG MMWG values.
3. Includes de-rates for thermal resources.
4. SCRs are not applied for transmission security analysis of normal operations, but are included for emergency operations.

Tipping Points

NYCA Summer 1-in-100 Peak Forecast - Emergency

Line	Item	1 in 100 Forecast									
		2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
A	NYCA Generation (1)	35,257	34,307	34,297	33,684	33,679	33,679	33,674	33,669	33,664	33,659
B	External Area Interchanges (2)	1,844	1,844	1,844	1,844	1,844	1,844	1,844	1,844	1,844	1,844
C	SCRs (4)	1,195	1,195	1,195	1,195	1,195	1,195	1,195	1,195	1,195	1,195
D	Temperature Based Generation Derates	(437)	(410)	(410)	(390)	(390)	(390)	(390)	(390)	(390)	(390)
E	**Total Resources (A+B+C+D)**	37,859	36,936	36,926	36,332	36,327	36,327	36,322	36,317	36,312	36,307
F	Load Forecast	(35,870)	(35,569)	(35,264)	(35,073)	(34,909)	(34,852)	(34,856)	(34,924)	(35,039)	(35,164)
G	Operating Reserve Requirement	(2,620)	(2,620)	(2,620)	(2,620)	(2,620)	(2,620)	(2,620)	(2,620)	(2,620)	(2,620)
H	**Total Capability Requirement (F+G)**	(38,490)	(38,189)	(37,884)	(37,693)	(37,529)	(37,472)	(37,476)	(37,544)	(37,659)	(37,784)
I	**Transmission Security Margin (E+H)**	(631)	(1,253)	(958)	(1,361)	(1,202)	(1,145)	(1,154)	(1,227)	(1,347)	(1,477)
J	Forced Outages (3)	(2,164)	(1,952)	(1,952)	(1,867)	(1,867)	(1,867)	(1,867)	(1,867)	(1,867)	(1,867)
K	**Adjusted Transmission Security Margin (I+J)**	(2,795)	(3,205)	(2,910)	(3,228)	(3,069)	(3,012)	(3,021)	(3,094)	(3,214)	(3,344)

Notes:

1. Reflects the 2021 Gold Book existing summer capacity plus projected additions, deactivations, and de-rates. For this evaluation wind generation is assumed to have 0 MW output, solar generation is based on the ratio of solar PV nameplate capacity (2021 Gold Book Table I-9a) and solar PV peak reductions (2021 Gold Book Table I-9c). De-rates for run-of-river hydro is included as well as the Oswego Export limit of for all lines in-service.
2. Interchanges are based on ERAG MMWG values.
3. Includes de-rates for thermal resources.
4. SCRs are not applied for transmission security analysis of normal operations, but are included for emergency operations.

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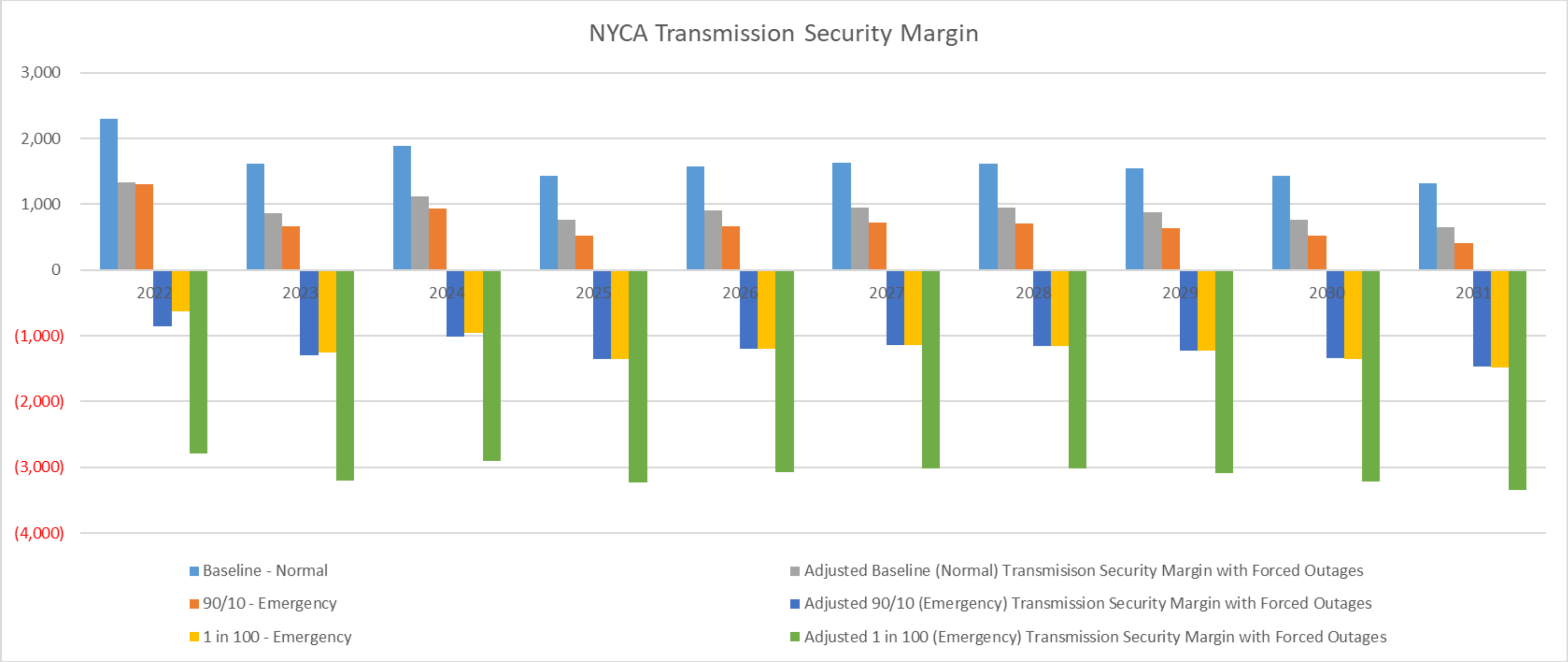
Tipping Points



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Tipping Points

Zone J Summer Baseline Peak Forecast – Normal

Peak Load Forecast (L/O Ravenswood 3 & Mott Haven - Rainey 345 kV (Q12))								
Line	**Item**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**
A	**Zone J Load Forecast**	(11,029)	(11,031)	(11,082)	(11,151)	(11,232)	(11,308)	(11,381)
B	I+K to J	3,904	3,904	3,904	3,904	3,904	3,904	3,904
C	ABC PARs to J	(11)	(11)	(11)	(11)	(11)	(11)	(11)
D	**Total J AC Import (B+C)**	3,893	3,893	3,893	3,893	3,893	3,893	3,893
E	Loss of Source Contingency	(980)	(980)	(980)	(980)	(980)	(980)	(980)
F	**Resource Need (A+D+E)**	(8,116)	(8,118)	(8,169)	(8,238)	(8,319)	(8,395)	(8,468)
G	*Resources needed after N-1-1 (A+D)*	(7,136)	(7,138)	(7,189)	(7,258)	(7,339)	(7,415)	(7,488)
H	J Generation (1)	8,195	8,195	8,195	8,195	8,195	8,195	8,195
I	Temperature Based Generation Derates (2)	0	0	0	0	0	0	0
J	Net ICAP External Imports	315	315	315	315	315	315	315
K	**Total Resources Available (H+I+J)**	8,510	8,510	8,510	8,510	8,510	8,510	8,510
L	*Resources available after N-1-1 (E+L)*	7,530	7,530	7,530	7,530	7,530	7,530	7,530
M	**Transmission Security Margin (F+K)**	394	392	341	272	191	115	42
N	SCRs (3)	428	428	428	428	428	428	428
O	Forced Outages (2)	(515)	(515)	(515)	(515)	(515)	(515)	(515)
P	**Adjusted Transmission Security Margin (M+N+O) (3)**	307	305	254	185	104	28	(45)

Notes:

1. Reflects the 2021 Gold Book existing summer capacity plus projected additions, deactivations, and de-rates. For this evaluation wind generation is assumed to have 0 MW output, solar generation is based on the ratio of solar PV nameplate capacity (2021 Gold Book Table I-9a) and solar PV peak reductions (2021 Gold Book Table I-9c). De-rates for run-of-river hydro is included as well as the Oswego Export limit of for all lines in-service.
2. Inlcudes de-rates for thermal resources.
3. Special Case Resources (SCRs) are not applied for transmission security analysis of normal operations.

New York ISO

Tipping Points

Zone J Summer 1-in-10 (90/10) Peak Forecast - Emergency

90th Percentile Load Forecast (L/O Ravenswood 3 & Mott Haven - Rainey 345 kV (Q12))								
Line	**Item**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**
A	**Zone J Load Forecast**	(11,486)	(11,488)	(11,541)	(11,613)	(11,697)	(11,777)	(11,853)
B	I+K to J	3,904	3,904	3,904	3,904	3,904	3,904	3,904
C	ABC PARs to J	(11)	(11)	(11)	(11)	(11)	(11)	(11)
D	**Total J AC Import (B+C)**	3,893	3,893	3,893	3,893	3,893	3,893	3,893
E	Loss of Source Contingency	(980)	(980)	(980)	(980)	(980)	(980)	(980)
F	**Resource Need (A+D+E)**	(8,573)	(8,575)	(8,628)	(8,700)	(8,784)	(8,864)	(8,940)
G	*Resources needed after N-1-1 (A+D)*	(7,593)	(7,595)	(7,648)	(7,720)	(7,804)	(7,884)	(7,960)
H	J Generation (1)	8,195	8,195	8,195	8,195	8,195	8,195	8,195
I	Temperature Based Generation Derates	(52)	(52)	(52)	(52)	(52)	(52)	(52)
J	Net ICAP External Imports	315	315	315	315	315	315	315
K	SCRs (3)	428	428	428	428	428	428	428
L	**Total Resources Available (H+I+J+K)**	8,886	8,886	8,886	8,886	8,886	8,886	8,886
M	*Resources available after N-1-1 (E+L)*	7,906	7,906	7,906	7,906	7,906	7,906	7,906
N	**Transmission Security Margin (F+L)**	313	311	258	186	102	22	(54)
O	Forced Outages (2)	(515)	(515)	(515)	(515)	(515)	(515)	(515)
P	**Adjusted Transmission Security Margin (N+O)**	(202)	(204)	(257)	(329)	(413)	(493)	(569)

Notes:

1. Reflects the 2021 Gold Book existing summer capacity plus projected additions, deactivations, and de-rates. For this evaluation wind generation is assumed to have 0 MW output, solar generation is based on the ratio of solar PV nameplate capacity (2021 Gold Book Table I-9a) and solar PV peak reductions (2021 Gold Book Table I-9c). De-rates for run-of-river hydro is included as well as the Oswego Export limit of for all lines in-service.
2. Inlcudes de-rates for thermal resources.
3. SCRs are not applied for transmission security analysis of normal operations, but are included for emergency operations.

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Tipping Points

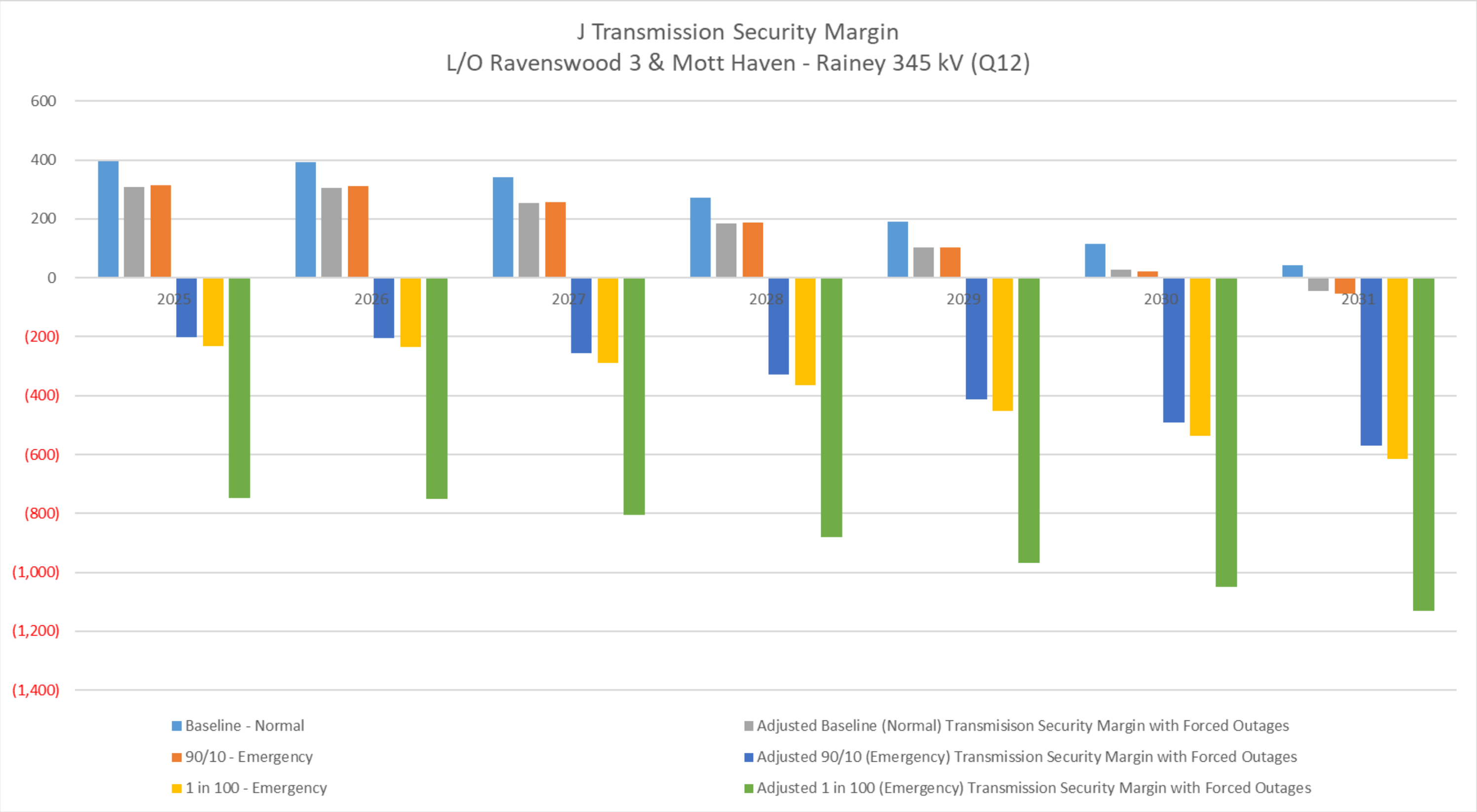
Zone J Summer 1-in-100 Peak Forecast - Emergency

1 in 100 Forecast (L/O Ravenswood 3 & Mott Haven - Rainey 345 kV (Q12))								
Line	**Item**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**
A	**Zone J Load Forecast**	(11,974)	(11,976)	(12,031)	(12,106)	(12,194)	(12,276)	(12,356)
B	I+K to J	3,904	3,904	3,904	3,904	3,904	3,904	3,904
C	ABC PARs to J	(11)	(11)	(11)	(11)	(11)	(11)	(11)
D	**Total J AC Import (B+C)**	3,893	3,893	3,893	3,893	3,893	3,893	3,893
E	Loss of Source Contingency	(980)	(980)	(980)	(980)	(980)	(980)	(980)
F	**Resource Need (A+D+E)**	(9,061)	(9,063)	(9,118)	(9,193)	(9,281)	(9,363)	(9,443)
G	*Resources needed after N-1-1 (A+D)*	(8,081)	(8,083)	(8,138)	(8,213)	(8,301)	(8,383)	(8,463)
H	J Generation (1)	8,195	8,195	8,195	8,195	8,195	8,195	8,195
I	Temperature Based Generation Derates	(110)	(110)	(110)	(110)	(110)	(110)	(110)
J	Net ICAP External Imports	315	315	315	315	315	315	315
K	SCRs (3)	428	428	428	428	428	428	428
L	**Total Resources Available (H+I+J+K)**	8,828	8,828	8,828	8,828	8,828	8,828	8,828
M	*Resources available after N-1-1 (E+L)*	7,848	7,848	7,848	7,848	7,848	7,848	7,848
N	**Transmission Security Margin (F+L)**	(233)	(235)	(290)	(365)	(453)	(535)	(615)
O	Forced Outages (2)	(515)	(515)	(515)	(515)	(515)	(515)	(515)
P	**Adjusted Transmission Security Margin (N+O)**	(748)	(750)	(805)	(880)	(968)	(1,050)	(1,130)

Notes:

1. Reflects the 2021 Gold Book existing summer capacity plus projected additions, deactivations, and de-rates. For this evaluation wind generation is assumed to have 0 MW output, solar generation is based on the ratio of solar PV nameplate capacity (2021 Gold Book Table I-9a) and solar PV peak reductions (2021 Gold Book Table I-9c). De-rates for run-of-river hydro is included as well as the Oswego Export limit of for all lines in-service.
2. Includes de-rates for thermal resources.
3. SCRs are not applied for transmission security analysis of normal operations, but are included for emergency operations.

Tipping Points



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70x30 Dynamic Analysis

- Evaluated under the system conditions shown in the figure below for both N-1 and N-1-1
  - No dynamic stability issues were observed

Case #	Case Load (Net load including BtM solar reductions, MW)	Land Based Wind (% of Pmax)	Off-Shore Wind (% of Pmax)	Solar (% of Pmax)
1	Day Peak Load (30,000)	10	20	45
2	Evening Peak Load (31,100)	0	0	0
3	Light Load (12,500)	15	45	0
4	Light Load (12,500)	0	0	0
5	Shoulder Load (21,500)	0	0	40
6	Shoulder Load (21,500)	15	45	40

- Also performed evaluations for the sudden loss of all OSW at the conditions shown in the figure above as well as with OSW at 100% of its capabilities (details on the following slides)

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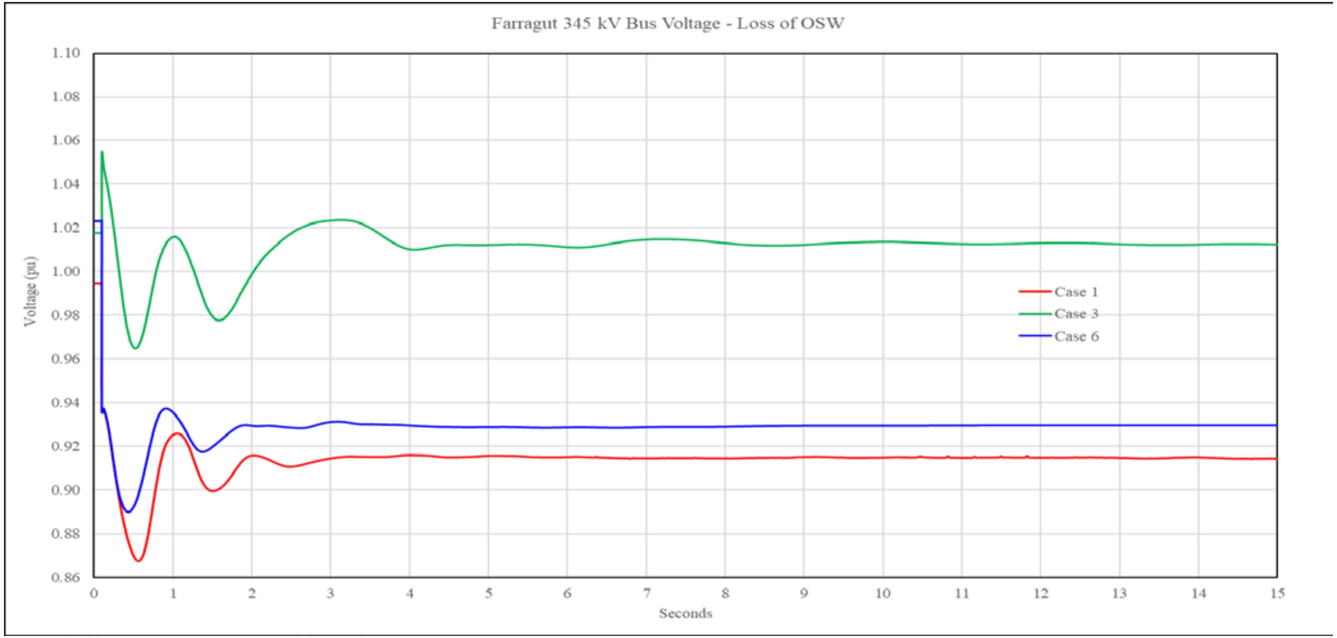
70x30 Analysis: OSW at 100%

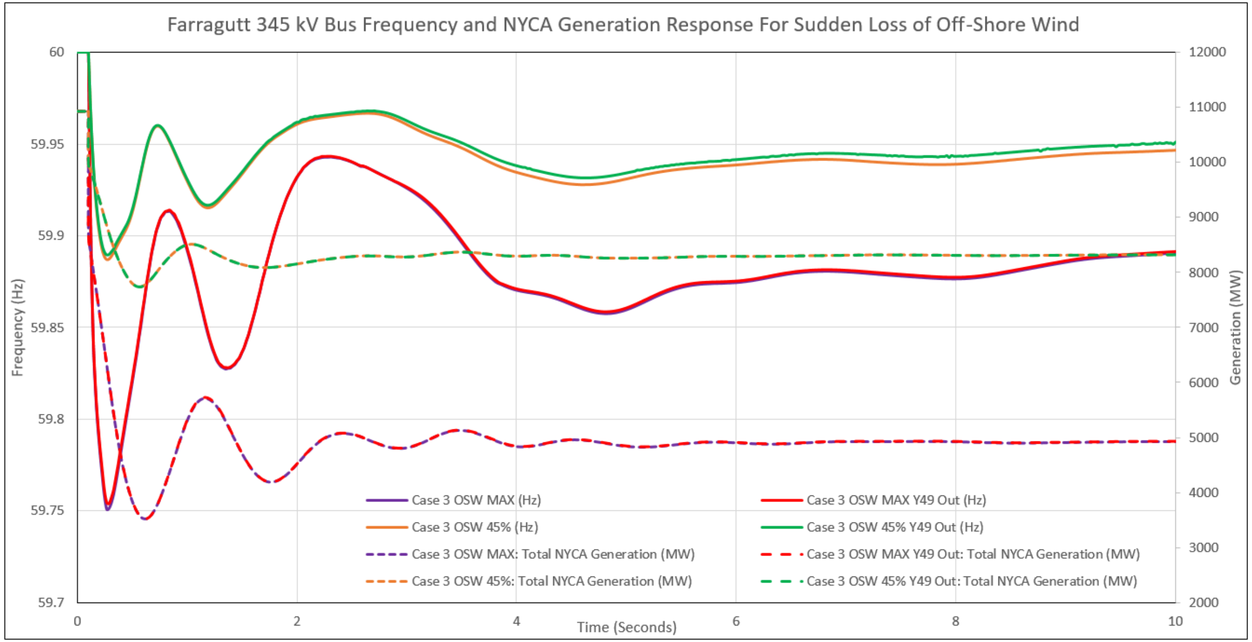
Sudden Loss of OSW – Farragut Voltage

Case 1-Peak, Case 3-Light Load, Case 6-Shoulder



70x30 Analysis: OSW at 100%;

System Frequency Response and NYCA Generation Response for the Loss of Offshore Wind - Case 3 (Light Load)



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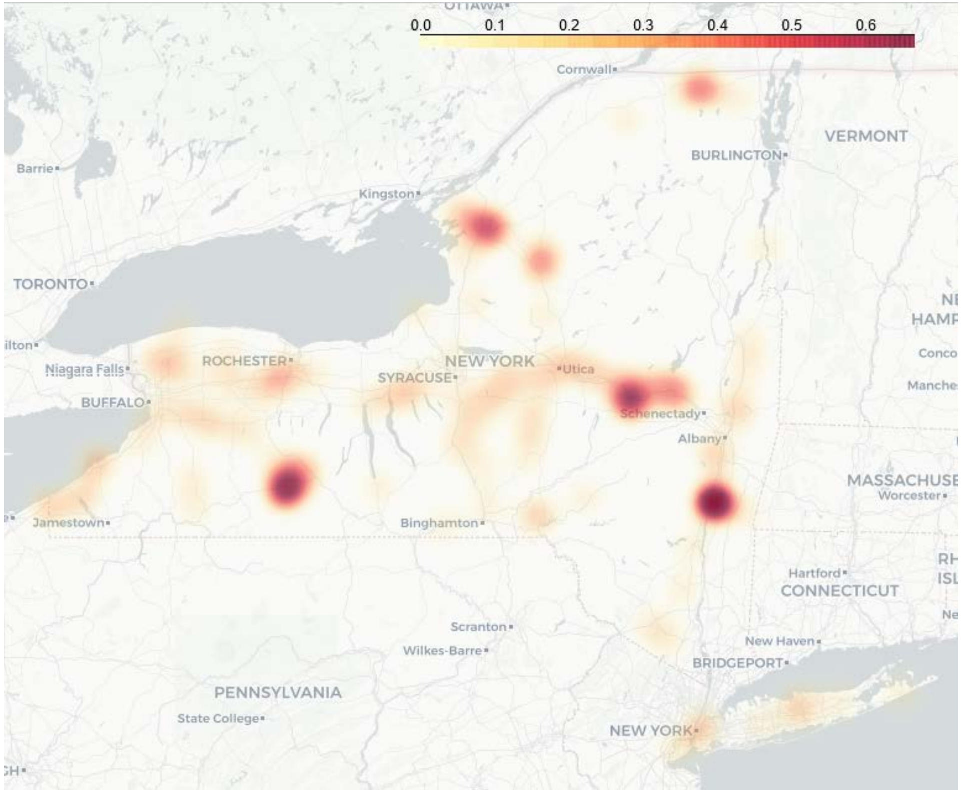
70x30 Analysis: Short-Circuit Ratio

The figure shown here highlights the buses with low short circuit ratio where intensity is inversely proportional to the short-circuit ratio.

Short-circuit ratio is defined as the ratio of short-circuit apparent power (SCMVA) at the point of interconnection (POI) from a 3-phase fault at the POI to the power rating of the resource.

$$SCR_{POI} = \frac{SCMVA_{POI}}{MW}$$



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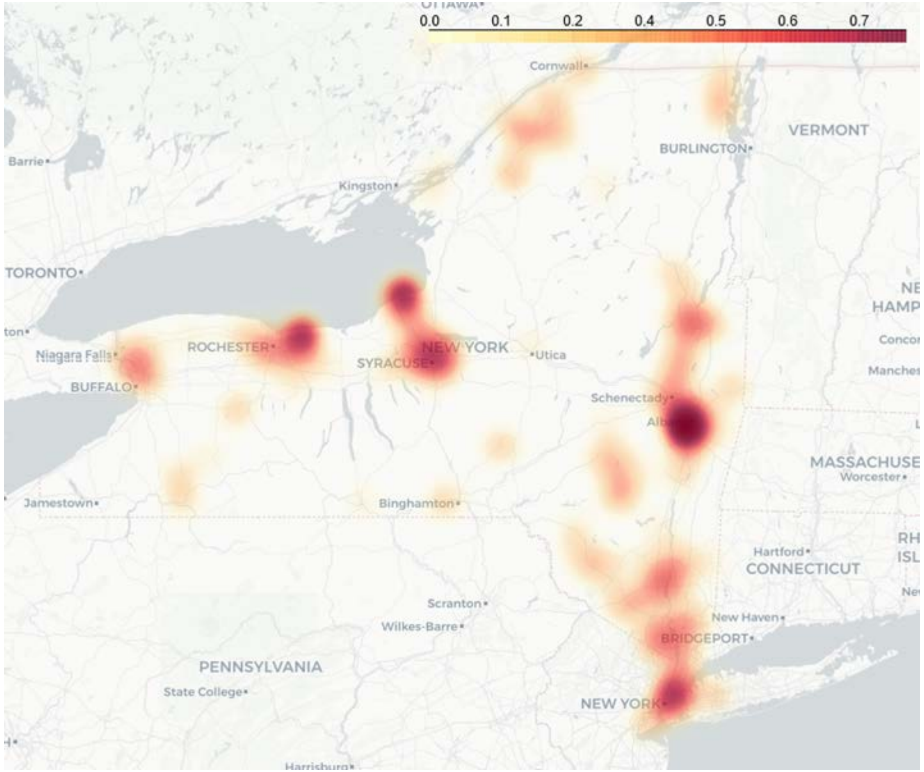
70x30 Analysis: Voltage Flicker

Peak Load Flicker

The figure shown here highlights the buses more susceptible to flicker. In the plot scale, a 0 represents no change in per-unit voltage and a 1 represents at 0.03 per-unit voltage decline



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Schedule

Next Steps: Target Dates

- September/October: ESPWG/TPAS review
- October: OC and MC review and vote
- November: NYISO Board of Directors action

Our mission, in collaboration with our stakeholders, is to serve the public interest and provide benefit 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 policymakers, stakeholders and investors in the power system

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Questions?