High Intermittent Renewable Resource Analysis – Phase 3 Scope Problem Statement

The NYSRC Executive Committee ("EC") is committed to understanding the impacts on electric system reliability of the addition of high levels of renewable resources to the New York grid. As such, the EC has requested that the Installed Capacity Subcommittee ("ICS"), with the support of the New York Independent System Operator ("NYISO"), prepare a Phase 3 High Intermittent Renewable Resource analysis based on Climate Leadership and Community Protection Act ("CLCPA") 2030 requirements to evaluate impacts on the IRM of a future New York Control Area ("NYCA") system. The electricity-sector related 2030 requirements of the CLCPA[1] include:

- 70% Renewable Energy by 2030
- 6 GW of Energy Storage Resources[2]
- Approaching 9 GW of offshore wind (2035 target)
- 10 GW of photovoltaic solar ("PV")[3]

The Phase 1[4] and Phase 2[5] studies also recommended that the NYSRC conduct periodic studies to consider future developments regarding intermittent resources. Additionally, future studies were recommended to evaluate substantial Energy Storage Resources ("ESR") that were not evaluated previously. Accordingly, this analysis is intended to provide understanding of these potential impacts on the Installed Capacity Requirement Margin ("IRM") and Minimum Locational Installed Capacity Requirements ("LCRs").[6] This memo aims to outline assumptions that can be utilized for such a further study.

The EC is also interested in understanding the impacts of the New York State Department of Environmental Conservation's regulation to limit nitrogen oxides emissions, also known as the "Peaker Rule[7]". This regulation will affect the availability of generation capability in the lower Hudson Valley, New York City, and Long Island. As such, the EC directed ICS to include an evaluation of the impacts that the unavailability of the units subject to this rule will have on the IRM and LCRs for the Zones G-J, Zone J and Zone K .

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[1] https://climate.ny.gov/

[2] https://www.governor.ny.gov/sites/default/files/2022-01/2022StateoftheStateBook.pdf

[3] https://www.governor.ny.gov/news/governor-hochul-announces-expanded-ny-sun-program-achieve-least-10gigawatts-solar-energy-2030

[4] https://www.nysrc.org/PDF/Reports/HR%20White%20Paper%20-%20Final%204-9-20.pdf

[5] https://www.nysrc.org/PDF/Reports/IRM%20White%20Papers/High%20Renewable%20Phase%202%20Summary%20FINAL_5_21.pdf

[6] The term 'locational capacity factors' used here is identified in the IRM Study Report as the 'preliminary LCRs' and is based on the Tan45 methodology. The NYISO establishes final LCRs using other methods.

[7] https://www.dec.ny.gov/regulations/116131.html

Study Overview

The NYISO recommends that the Phase 3 study have three segments (all completed as part of this Phase).

The first segment will take the New York electric system as assumed in the NYSRC 2022 IRM Study Final Base Case ("FBC") and increase renewable capacity by a hypothetical 27,000 MW (9,000 each of front-of-meter (FTM, or utility scale solar PV), onshore wind, and offshore wind). This set of assumptions meets the 2030 ESR requirements, the 2035 offshore wind requirements, and approaches the 2030 PV solar goal.

The second segment will take the case described above (the 2022 FBC + 27,000 MW renewable capacity) and increase energy storage resources ("ESR") by a hypothetical 6,000 MW.

The third segment is to take the case above (the 2022 FBC + 27,000 MW renewable capacity + 6,000 MW ESR capacity) and retire the units that will be unavailable starting in the summers of 2023 and 2025 due to the Peaker Rule (approximately 1,600 MW ICAP).

The NYISO supports the NYSRC conducting this Phase 3 whitepaper because it will provide important and actionable information to the NYSRC. First, it will be the first high renewable resource penetration study that incorporates storage. Second, while the case adds 12,000 MW of resources relative to previous high renewable scenarios, it represents incremental resource growth and thus the incremental impact of renewable resources will be calculable. Third, scenarios with greater quantities of renewable resources may "bottle" up renewable generation, revealing transmission congestion. Thus, IRM calculations under these circumstances will need to assume no transmission congestion in order to evaluate the impact of the resources themselves and not any potential transmission congestion. Lastly, the study will provide insight into the impacts of retiring dispatchable resources from a system with a high intermittent resource penetration.

Methodology

The NYISO would begin the evaluation using the 2022 IRM Study FBC assumptions, which satisfy the LOLE criterion that the probability of an unplanned disconnection of firm load due to resource deficiencies is, on average, no more than 0.1 days per year. For the purpose of this sensitivity analysis, 9,000 MW each of onshore wind, offshore wind and FTM PV resources, and 6,000 MW of ESR will be added to the base case. A total of 1,609.8 MW of thermal generation affected by the DEC Peaker Rule will be subtracted from this case. The hypothetical renewable resources will be added in a manner consistent with the previous high renewable studies. The

ESR capacity will be modeled with a 4-hour duration, and otherwise consistent with the ICS's "Energy Storage Resource Modeling Whitepaper." [8]

Location

The locations of Installed Capacity ("ICAP") placement for both FTM PV and onshore wind units will be based on the projections of wind and solar installation represented in the 70x30 renewable mix assumptions for the NYISO 2021-2030 Comprehensive Reliability Plan Appendices.[9] These projections will be scaled on a zonal basis to the requisite 9,000 MW for each resource type. The placements of offshore wind capacity will be split between Zones J and K, with two-thirds of capacity in Zone J and one-third in Zone K. ESR Capacity is distributed proportionally with respect to renewable ICAP by zone. The Zonal ICAP values by resources represented in this sensitivity analysis are provided in Table 1.

Table 1–ICAP added to FBC Assumptions by Resource Type (MW)

Zone	Solar PV	On-Shore	Off-Shore	Renewable Total	ESR	Total Additions
A	2632.9	2345.1		*4978.0*	1106.2	6084.222
B	300.0	322.1		*622.1*	138.2	760.3444
C	1642.6	2473.4		*4116.0*	914.7	5030.667
D		1807.6		*1807.6*	401.7	2209.289
E	1037.8	2051.8		*3089.6*	686.6	3776.178
F	2133.9			*2133.9*	474.2	2608.1
G	1207.1			*1207.1*	268.2	1475.344
H				*0.0*		
I				*0.0*		
J			6000.0	*6000.0*	1333.3	7333.333
K	45.7		3000.0	*3045.7*	676.8	3722.522
Total	**9000.0**	**9000.0**	**9000.0**	***27000.0***	**6000.0**	**33000.0**

These additions will be modeled as incremental renewable and ESR ICAP resources to those represented in the FBC, provided in Table 2. The current system contains 214 MW of utility scale solar PV resources and no offshore wind resources.

[8] https://www.nysrc.org/PDF/Reports/IRM%20White%20Papers/Energy%20Storage%20Whitepaper.pdf

[9] https://www.nyiso.com/documents/20142/26735166/2021-2030-Comprehensive-Reliability-Plan-Appendices.pdf/3cac252d-7eee-87e7-441c-f039c7730fcf

Table 2 – Existing Renewable ICAP in FBC by Resource Type (MW)

Zone	Solar PV	On-Shore	Off-Shore	Renewable Total	ESR	Total ICAP
A		304.9		*304.9*		304.9
B		0.0		*0.0*		0.0
C		512.8		*512.8*		512.8
D		678.4		*678.4*		678.4
E		521.4		*521.4*		521.4
F	160.0			*160.0*		160.0
G				*0.0*		0.0
H				*0.0*		0.0
I				*0.0*		0.0
J				*0.0*		0.0
K	54.4			*54.4*		54.4
Total	**214.4**	**2017.5**	**0.0**	*2231.9*	**0.0**	**2231.9**

The retirement of the peaker units is based on the DEC Peaker Rules assumptions as represented in the NYISO 2021 Q4 Short-Term Assessment of Reliability[10]. The ICAP retired by zone is represented in Table 3.

Table 3 – Peaker Rule Retirement Capacity by Zone (MW)

Zone	Total[11] ICAP
G	37.7
J	1,409.3
K	116.6
Total	**1,580.8**

[10]https://www.nyiso.com/documents/20142/25620932/03%202021%20Q4%20STAR%20Key%20Study%20Assumptions.pdf

[11] The total ICAP in Table 3 is not identical to that in the Q4 STAR assumptions because two of the units in those assumptions were already excluded from the 2020 FBC

Figures 1 and 2 provides a comparison of the installed capacity mixes by fuel type for both the 2022 IRM study FBC and high renewable resources scenarios.

Figure 1– High Renewable Study ICAP Mix Comparison by Fuel

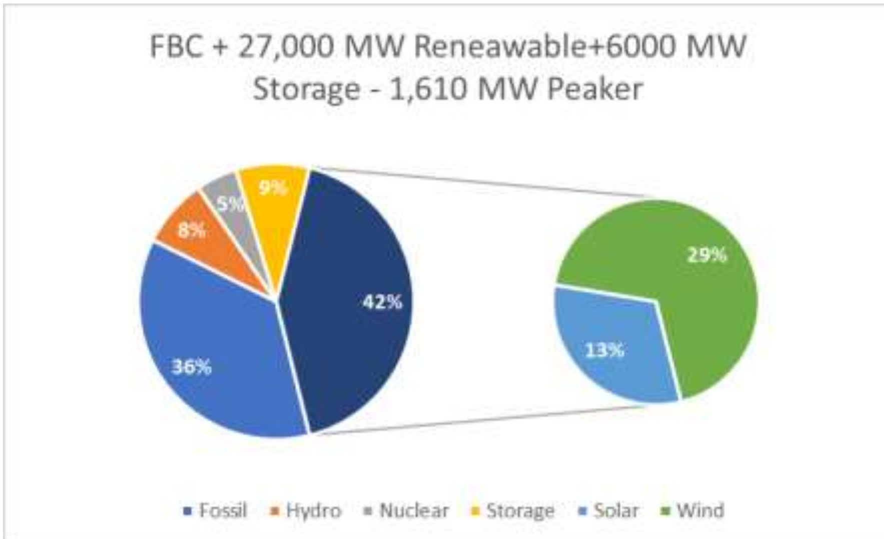
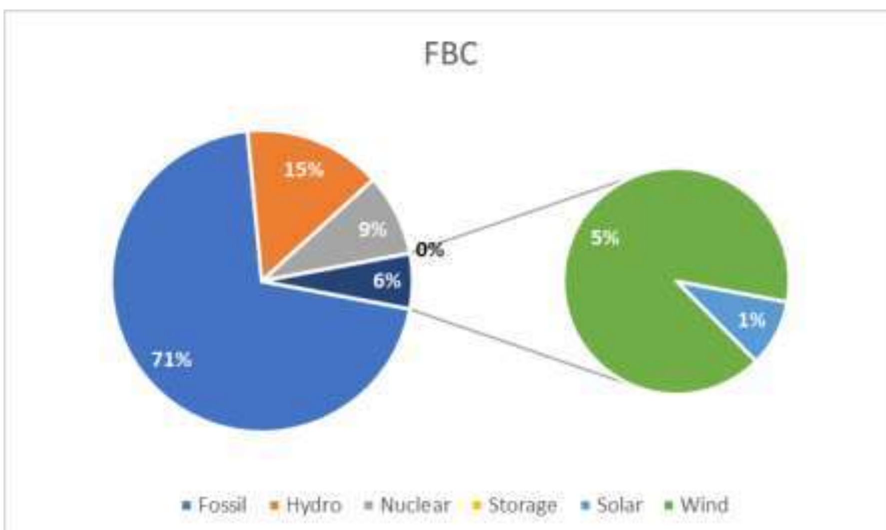


Figure 2– FBC ICAP Mix Comparison by Fuel



Considerations beyond the scope of this study

1. **Load shapes, load growth, and load forecast uncertainty**: The CLCPA encourages electrification, behind the meter solar PV, and other behaviors that are likely to shift electricity

consumption patterns. These will likely result in changing electricity demand patterns. The compressed timeline of the Phase 3 study does not allow for these changes to be captured in the study, however, further information on potential changes in electricity demand patterns are discussed in the NYISO's Climate Change Impact Phase II study[12].

2. **Topology:** Significant transmission upgrades are likely necessary to optimize the utility of significant renewable resource capacity additions. It seems unlikely that substantial quantities of renewables would be constructed without the transmission to deliver their output to load. Thus, NYISO recommends modeling the system without transmission constraints for the Phase 3 study. A detailed assessment of potential future transmission needs given a renewable buildout scenario would likely provide a more accurate representation of potential future grid configurations; however, this analysis is beyond the scope of the Phase 3 study.

12 https://www.nyiso.com/documents/20142/15125528/02%20Climate%20Change%20Impact%20and%20Resilience%20Study%20Phase%202.pdf/89647ae3-6005-70f5-03c0-d4ed33623ce4