

High Renewable Phase 2 Results Summary

Background

In 2019, at the request of NYSRC, the NYISO performed an analysis of potential Installed Reserve Margin (“IRM”) and preliminary Locational Capacity Requirement (“LCR”) impacts from hypothetical high penetration of intermittent renewable resources on the New York Control Area (“NYCA”). The analysis involved adding 4,000 MW of each on-shore wind, off-shore wind, and solar PV to the NYCA. The study and findings were documented in final *The Impacts of High Intermittent Renewable Resources*¹ whitepaper, and was considered as the Phase 1 study.

Subsequent to finalizing the whitepaper, the NYSRC requested further analysis in a Phase 2 study, with varying penetration levels of the intermittent renewable resources and without the limitations of transmission constraints². This report summarizes the results from the Phase 2 study.

Study Inputs

The Phase 2 study shares the same base case used in the Phase 1 study, which is the 2020 IRM Preliminary Base Case (“PBC”). The 2020 IRM PBC captures the constraints of the existing transmission system. It is expected that with the amount of renewable resources increases, these transmission constraints will become binding and that will be reflected in the study results. In order to isolate the impacts of increasing renewable resources, the NYSRC also requested that the Phase 2 study to be conducted with transmission constraints removed from the simulation. Therefore, starting from the Phase 1 base case, transmission constraints are removed, and two scenarios with different levels of renewable resource penetration are modeled:

- Base Case = 2020 IRM PBC with transmission constraints removed
- Scenario A = Base Case + 2,000 MW of each renewable resource type
- Scenario B = Base Case + 6,000 MW of each renewable resource type

The modeling of the added renewable resources, including the renewable production profiles, locations of the renewable resources and modeled outage rates are consistent with Phase 1 study³. The detailed breakdowns of the added renewable resources for both Scenario A and Scenario B are shown in the two tables below. Table 1 includes the zonal ICAP breakdowns and Table 2 shows the associated zonal UCAP breakdowns, with the consideration of EFORds for the added renewable resources. .

¹ Finalized whitepaper: <https://www.nysrc.org/PDF/Reports/HR%20White%20Paper%20-%20Final%204-9-20.pdf>

² Scope of Phase 2 study:

<https://www.nysrc.org/PDF/MeetingMaterial/ICSMaterial/ICS%20Agenda%20234/AI%208%20-%20High%20Renewable%20Supplemental%20Analysis.pdf>

³ Detailed assumptions of Phase 1 study:

<https://www.nysrc.org/pdf/MeetingMaterial/ICSMaterial/ICS%20Agenda%20223/AI%205%20-%20windsolar-v04.pdf>

Table 1: Zonal Breakdown of Added Renewable Resources—ICAP Term

Zone	Scenario A: Base Case + 2,000 MW				Scenario B: Base Case + 6,000 MW			
	Solar	On-Shore	Off-Shore	Total	Solar	On-Shore	Off-Shore	Total
A	437	515		952	1,311	1,545		2,856
B				0				0
C	203	497		700	609	1,491		2,100
D		447		447		1,341		1,341
E		541		541		1,623		1,623
F	941			941	2,823			2,823
G	224			224	672			672
J			1,000	1,000			3,000	3,000
K	144		1,000	1,144	432		3,000	3,432
Total	2,000	2,000	2,000	6,000	6,000	6,000	6,000	18,000

Table 2: Zonal Breakdown of Added Renewable Resources—UCAP Term (with EFORDs)

Zone	Scenario A: Base Case + 2,000 MW				Scenario B: Base Case + 6,000 MW			
	Solar	On-Shore	Off-Shore	Total	Solar	On-Shore	Off-Shore	Total
A	137	79		216	411	238		649
B				0				0
C	64	77		140	191	230		421
D		62		62		185		185
E		93		93		279		279
F	263			263	788			788
G	62			62	185			185
J			294	294			882	882
K	57		337	393	170		1,010	1,179
Total	581	311	631	1,522	1,743	932	1,892	4,566

The breakdown of added renewable resources in each zone is in proportion to the renewable resource additions in the Phase 1 study.

Study Results

The two scenarios were developed based on the High Renewable Sensitivity from the Phase 1 study, which is the Tan45 case with the addition of 4,000 MW for each of the renewable resource types, and capturing transmission constraints. The NYISO then performed a parametric treatment by removing transmission constraints, and subsequently subtracting or adding incremental MW of renewable resources to arrive at Scenario A and Scenario B.

It is important to note that, by removing transmission constraints on the system, there are no long trade-offs between Zone J/K and the rest of the system. In this case, the MW in Zone J or Zone K provide the same LOLE relief as the MW in the rest of the system. As a result, the determination of LCRs, which identify capacity requirements in the constrained Zones J and K, becomes impossible in the unconstrained simulation. Therefore, all the results in Phase 2 study are based on parametric

comparison. Even though same statistics can be calculated for Zone J and K, similarly to the Phase 1 study, those statistics would not provide meaningful information. Hence, the parametric results of the installed reserve margin and the unforced capacity reserve margin (“URM”) for the NYCA are reported and included in the Table 3, and the detailed ICAP and UCAP changes are included in Table 4 below.

Table 3: Results Comparison

Cases and Scenarios	Phase 1 Tan45 Results	Phase 1 Adjusted Results	Phase 2 Scenario A	Phase 2 Scenario B
Each Renewable Resource Added	4,000 MW (12,000 MW total)	4,000 MW (12,000 MW total)	2,000 MW (6,000 MW total)	6,000 MW (18,000 MW total)
Transmission Constraints	Included	Removed	Removed	Removed
Installed Capacity Reserve Margin Comparison				
NYCA	142.9%	140.8%	128.1%	154.4%
Unforced Capacity Reserve Margin (URM) Comparison				
NYCA	107.4%	105.8%	104.3%	108.1%

Table 4: ICAP and UCAP Changes Comparison

NYCA	Phase 1 Tan45 Results	Phase 1 Adjusted Results	Phase 2 Scenario A	Phase 2 Scenario B
NYCA Peak Load (MW)	32,253	32,253	32,253	32,253
ICAP Changes				
As Found ICAP (MW)	54,465	54,465	48,465	60,465
ICAP @ LOLE = 0.1 (MW)	46,088	45,419	41,314	49,804
ICAP Removed (MW)	8,376	9,046	7,151	10,661
ICAP Reserve Margin	142.9%	140.8%	128.1%	154.4%
UCAP Changes				
As Found UCAP (MW)	40,509	40,509	38,986	42,032
UCAP @ LOLE = 0.1 (MW)	34,651	34,135	33,652	34,871
UCAP Removed (MW)	5,857	6,374	5,334	7,161
UCAP Reserve Margin (URM)	107.4%	105.8%	104.3%	108.1%

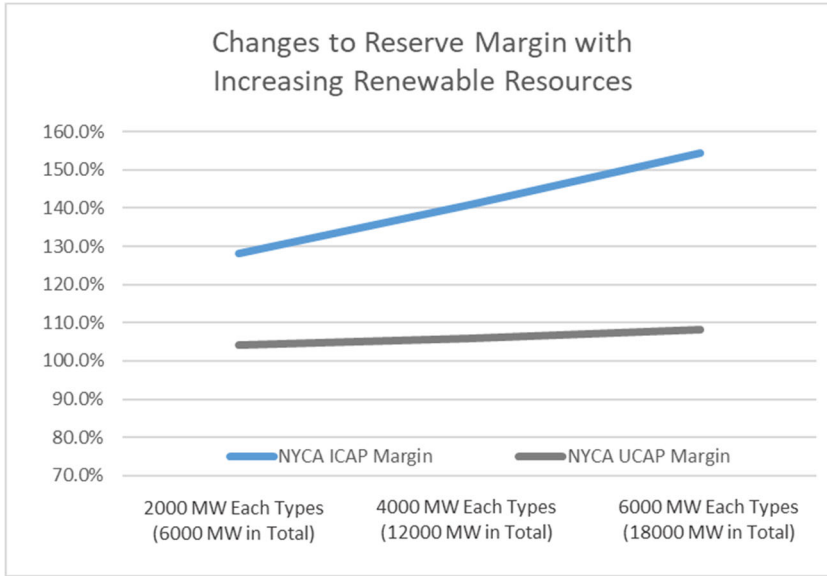
Conclusion

The Phase 1 whitepaper noted that the analysis is conducted with a hypothetical scenario. In reality, when the penetration of renewable resources reaches the similar level, other conditions on the system, including load, topology and other generations, also could have changed. The same caution should also be taken when interpreting the Phase 2 study results.

- In general, results from Phase 2 study are as expected. When removing transmission constraints, system requirement for resources is reduced, in both ICAP and UCAP terms.
- When increasing the penetration of renewable resources, the required ICAP, while maintaining the system LOLE at the 0.1 criterion, increases. This is largely driven by lower availability of intermittent resources comparing to the average resources on the system.
- Similarly, the required UCAP for NYCA also increases with higher penetration of renewable resources. As shown in Figure 1 below, the increases in required UCAP are at a much slower

pace and appear to plateau at Scenario 2. Such result is expected as, with higher penetration, the value of incremental renewable resources is expected to diminish.

Figure 1: Changes to Reserve Margin in ICAP and UCAP Terms



Recommendations

The results from the Phase 2 study support the conclusions and recommendations from the Phase 1 study. Therefore, there are no additional recommendations from the Phase 2 study.