High Intermittent Renewable Resources Analysis – Phase 3

Part 2

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Objective

- Review the High Renewable Phase 3 part 2 study methodology and results
- Observations from the study results
- Conclusions and recommendations

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Notes about Study

- Each part of the phase 3 study was developed without capturing the impacts of transmission constraints
- By removing transmission constraints on the system, there are no longer trade-offs between Zone J/K and the rest of the system
- All the results in Phase 3 study are based on parametric comparisons

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ESR Modeling Methodology

- The energy storage resources ("ESR") are modeled using predetermined charge and discharge shapes as discussed in the NYSRC's Energy Storage Resource Modeling Whitepaper (https://www.nysrc.org/PDF/Reports/IRM%20White%20Papers/Energy%20Storage%20Whitepaper.pdf)
- For Part 2 of the study, the 6,000 MW of ESRs are added after Part 1 in which 27,000 MW of renewable resources were added to the system
  - The duration for the discharging period for the ESRs is 4 hours
- To maximize the benefits of the ESRs, the discharging period is designed to be situated at the 4 hours with the highest probability for Loss of Load (LOL) events, from HB16 to HB19
  - The NYISO reviewed the hourly distribution of LOLE from the Part 1 study and identified that HB16-HB19 had the highest 4-hr LOLE distribution
- To minimize the impact from the charging of the ESRs, the pre-determined shape included hourly charging at 50% capability for eight hours between HB00 and HB08

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Reserve Margin Results

Case and Scenarios	2022 FBC	2022 FBC*	Phase 3 Part 1	Phase 3 Part 2	DELTA (Phase 3 Part 2 – Part 1)
Resource Changes	n/a	No transmission constraints	27,000 MW renewable resources	6,000 MW ESR	
Transmission Constraints	Included	Removed	Removed	Removed	
Installed Capacity Reserve Margin Comparison					
NYCA	119.7%	117.2%	180.5%	198.8%	+18.3%
Unforced Capacity Reserve Margin (URM) Comparison					
NYCA	105.0%	102.7%	112.5%	125.5%	+13.0%

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ICAP and UCAP Changes

NYCA	Part 1	Part 2	Delta
NYCA Peak Load	32,139	32,139	**0**
ICAP Changes			
As Found ICAP (MW)	68,037	74,037	**6,000**
ICAP @ LOLE = 0.1 (MW)	58,000	63,891	**5,857**
ICAP Removed (MW)	10,036	10,146	**143**
ICAP Reserve Margin	180.5%	198.8%	**18.3%**
UCAP Changes			
As Found UCAP (MW)	42,938	47,256	**4,318**
UCAP @ LOLE = 0.1 (MW)	36,147	40,330	**4,183**
UCAP Removed (MW)	6,791	6,926	**135**
UCAP Reserve Margin	112.5%	125.5%	**13.0%**

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Observations

- **When adding significant amount of ESRs to the system, the ICAP and UCAP required to maintain the system LOLE at the 0.1 criterion increases**
- **The sizeable increases in the IRM and URM suggest that a portion of the added ESRs is still needed for system at criterion, indicating that the modeled ESRs have lower-than-expected effectiveness in addressing system LOLE**
  - Discharging of ESRs is scheduled during high risk of LOL events from HB16 to HB19.
  - After adding the ESRs, the LOLEs during H16-HB19 are largely removed; however not all events are completely addressed this four hour window
  - The addition of ESRs improves the reliability of the at-criteria system
    - The Expected Unserved Energy (EUE) as an output from the MARS simulation is reduced from 239 MWh (Part 1 study) to 133 MWh (Part 2 study)

Before Adding the ESRs (Part 1 Study)																	
HB	0-8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	**Total**
Percentage	0.0%	0.0%	0.1%	1.4%	3.7%	4.0%	7.9%	9.9%	13.3%	14.8%	10.0%	12.9%	10.0%	9.5%	2.5%	0.0%	**100.0%**

After Adding the ESRs (Part 2 Study)																	
HB	0-8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	**Total**
Percentage	0.0%	0.1%	0.1%	2.7%	6.7%	7.5%	15.0%	18.8%	0.2%	0.3%	0.2%	0.2%	20.3%	22.8%	5.1%	0.0%	**100.0%**

Observations (cont'd)

- **Upon further review, a few drivers may contribute to the results:**
  - The single four hour output window for all 6,000 MW does not provide full support to the system as reliability events are longer than four hours.
    - Peaker retirements will be included in Part 3 of the study. ESRs are expected to be more beneficial when the penetration of thermal resources is reduced
  - There is likely a saturation effect with the large quantity of ESRs modeled in the study
  - Benefits from additional resources appear to leak to external areas. LOLEs from the external areas are lowered for both the Part 1 and Part 2 studies

NYCA	FBC	FBC*	+27,00 MW Renewables	+6,000 MW ESR
IRM	119.7%	117.1%	180.5%	198.8%
External LOLE				
PJM	0.169	0.178	0.135	0.119
ISONE	0.109	0.122	0.082	0.070
IESO	0.111	0.103	0.076	0.067
HQ	0.109	0.093	0.092	0.092

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Conclusions

- **Predetermined output profiles do not have capabilities to model significant amount of ESRs**
  - Assuming the same operating behavior of all the ESRs is not reasonable, as indicated via a single output profile
  - Breaking the ESRs into multiple smaller units with different output profiles is not an ideal solution as it involves making arbitrary assumptions about different operating behaviors among the ESRs
- **Utilizing the GE ELR functionality to implement dynamic modeling of ESRs should be considered. However further refinements are needed:**
  - Currently, the GE ELR functionality is applied with the output window limitations, which will not be sufficient to model large amount of ESRs
  - The charging of the ESRs should be sufficient to provide full energy storage and not introduce new reliability issues
- **The interplay between NYCA and external systems also requires further investigation**
  - The High Renewable Phase 3 study considers high renewable and intermittent penetration for NYCA but with the current supply mix in external areas

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Recommendations

- **Continue the evolution of the GE ELR functionality to develop a modeling approach and tools for high penetration of ESRs, considering:**
  - The output characteristics of ESRs, such as staggering output of the ESR fleet to address a system shortage with a longer duration
  - The charging requirements and impacts of the ESRs
- **Investigate the impact of the additional renewable and intermittent resources on NYCA compared with external systems.**

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Questions?

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Working together with stakeholders to build the cleanest, most reliable electric system in the nation

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