



NYSERDA

Attachment #5.3.1
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The Potential for Energy Storage to Repower or Replace Peaking Units in New York State

**NYSRC-EC
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Scope

- December 13, 2018 PSC Storage Order called for Staff to consult with NYSERDA, NYISO, DEC, Con Edison, and LIPA to perform a study on peaker operation
- Order required a unit-by-unit analysis to determine potential opportunities for replacement or hybridization (compliance) with energy storage with or without PV

Key Inputs and Assumptions

Input	Source & Method
Peaker Operations/Emissions	CEMS 2013 Data for hourly output and emissions, cross-checked with EIA 923 facility data
Replacement	4, 6 and 8-hour storage (plus solar scenario) sized to 100, 125 and 150% of maximum 2013 output must replace all annual operations, charge and discharge determined by E3 storage dispatch tool
Hybridization	4, 6 and 8-hour storage (plus solar scenario) sized to 25, 50, 75, 100% of maximum 2013 output must average with peaker emissions to fall below 3 lb of NOx per MWh daily (to reflect 2023 limit) and 1.5 lb/MWh for gaseous fuels or 2.0 lb/MWh for liquid fuels (to reflect 2025 limit)
Solar Scenarios	Solar is added with energy storage to replace or hybridize peaker. For downstate peakers, 20% of the full technical rooftop potential within a half mile radius of each plant is assumed to be developable. A flat 10 MW of solar is added for peakers not located in Lower Hudson Valley, New York City, and Long Island. The overlapping area of adjacent plants is allocated equally between the plants. Storage is assumed to be able to charge from grid and/or solar.
Charging Constraints	Screening for high congestion at generator node is used to limit the ability of storage to charge
Energy Pricing	Historical 2013 NYISO pricing data (generator and zonal hourly LBMPs)
Energy Storage Assumptions	Optimized dispatch under perfect foresight with 85% roundtrip efficiency

Methodology

- Study analyzed all units subject to DEC's draft NOx rule, which include all SCCTs
- Replacement
 - Storage (and PV) used to offset all actual peaker operation from 2013
- Hybridization
 - Storage (and PV) used to bring unit into compliance with proposed 2025 NOx limit through daily averaging

Results - Replacement

Energy Storage sized to max 2013 output		Energy Storage Unit Hours of Operation		
	NYISO Zone	4	6	8
Stand-alone Energy Storage	Zone K	16	122	227
	Zone J	20	107	236
	Rest of State	47	47	47
	Total	83	275	509
Energy Storage Paired with Solar	Zone K	32	122	227
	Zone J	73	132	288
	Rest of State	47	47	47
	Total	152	300	562

Results - Hybridization

Energy Storage sized to max 2013 output		Energy Storage Unit Hours of Operation		
	NYISO Zone	4	6	8
Stand-alone Energy Storage	Zone K	743	883	883
	Zone J	74	195	477
	Rest of State	47	47	47
	Total	864	1,125	1,407
Energy Storage Paired with Solar	Zone K	876	1,015	1,129
	Zone J	627	742	1,135
	Rest of State	47	47	88
	Total	1,550	1,804	2,352

Discussion

- Sizing storage up to full summer CRIS, winter CRIS, or nameplate significantly increases the number of units that can be replaced or brought into compliance
- 817 MW in Zones J and K can potentially be hybridized by 4-hour standalone storage
 - Increases to 1,550 MW when solar is considered

QUESTIONS

Appendix – Full Results

Complete Results – Replacement with standalone storage

Capacity (% of maximum output)	Duration (Hours)	Number of units that are candidates for replacement	Aggregate nameplate capacity (MW)	Percent of total nameplate capacity analyzed	Average longest start (hours)	Total avoided MWh of peaker generation	Total avoided NOx emissions (lb)	Average avoided NOx non-compliance days in 2023	Average avoided NOx non-compliance days in 2025
100	4	3	83	2%	4	332	6,108	3	2
	6	12	275	6%	6	3,676	45,547	5	5
	8	18	509	11%	7	18,154	156,086	9	9
125	4	9	224	5%	5	2,244	28,385	5	4
	6	17	467	10%	7	14,306	129,386	8	8
	8	46	1,607	36%	10	158,582	1,394,843	20	20
150	4	12	275	6%	6	3,676	45,547	5	5
	6	29	822	18%	8	49,042	366,121	13	13
	8	65	2,369	53%	11	350,781	2,008,815	22	23

Complete Results – Replacement with storage and PV

Capacity (% of maximum output)	Duration (Hours)	Number of units that are candidates for replacement	Aggregate nameplate capacity (MW)	Percent of total nameplate capacity analyzed	Average longest start (hours)	Total avoided MWh of peaker generation	Total avoided NOx emissions (lb)	Average avoided NOx non-compliance days in 2023	Average avoided NOx non-compliance days in 2025
100	4	7	152	3%	5	1,016	15,495	3	3
	6	13	300	7%	6	4,630	49,034	6	6
	8	21	562	13%	7	19,611	164,497	10	9
125	4	11	256	6%	5	2,789	33,460	5	5
	6	19	502	11%	7	15,013	134,778	8	8
	8	52	1,764	39%	10	196,424	1,659,622	23	24
150	4	13	300	7%	6	4,630	49,034	6	6
	6	35	1,033	23%	9	79,442	556,192	15	16
	8	69	2,453	55%	12	385,326	2,262,488	24	25

Complete Results – Hybridization with standalone storage

Capacity (% of maximum output)	Hours	Number of units	Aggregate nameplate capacity (MW)	Percent of total nameplate capacity analyzed	Average longest start (hours)	Total avoided MWh of peaker generation	Total avoided NOx emissions (lb)	Average avoided NOx non-compliance days in 2023	Average avoided NOx non-compliance days in 2025
25	4	9	461	10%	318	64,621	9,596	2	2
	6	9	461	10%	318	89,383	12,677	2	2
	8	9	461	10%	318	108,642	14,887	2	2
50	4	9	461	10%	318	127,889	18,657	2	2
	6	10	522	12%	288	199,130	28,254	2	2
	8	11	601	13%	263	250,891	53,863	2	5
75	4	10	522	12%	288	214,346	31,408	2	2
	6	17	785	18%	173	309,999	99,718	5	6
	8	23	968	22%	131	383,488	183,052	6	8
100	4	20	864	19%	147	292,118	98,386	3	5
	6	30	1,124	25%	101	407,390	205,245	5	7
	8	40	1,407	31%	78	510,472	387,163	8	9

Complete Results – Hybridization with storage plus PV

Capacity (% of peak output)	Hours	Number of units	Aggregate nameplate capacity (MW)	Percent of total nameplate capacity	Average longest start (hours)	Total avoided MWh of peaker generation	Total avoided NOx emissions (lb)	Average avoided NOx non-compliance days in 2023	Average avoided NOx non-compliance days in 2025
25	4	21	1,064	24%	169	164,347	27,853	3	4
	6	21	1,064	24%	169	212,643	35,025	3	4
	8	21	1,064	24%	169	249,164	40,314	3	4
50	4	21	1,064	24%	169	301,598	50,038	3	4
	6	23	1,140	25%	155	419,834	70,327	4	4
	8	26	1,270	28%	139	507,729	107,874	4	6
75	4	27	1,214	27%	133	461,670	83,114	4	4
	6	36	1,518	34%	102	627,681	173,428	4	6
	8	43	1,737	39%	87	753,849	284,525	6	7
100	4	36	1,549	35%	102	603,798	165,884	4	6
	6	45	1,803	40%	83	803,142	306,741	6	7
	8	60	2,352	53%	65	1,004,687	825,796	10	11