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Independent System Operator

Long Island Offshore Wind Export PPTN: Power Flow Results

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ESPWG/TPAS

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Agenda

- Metrics Overview
- Study Assumptions
- Transfer Analysis Results
- Electrical Expandability Results
- Operability Results
- Next Steps

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Evaluation Metrics Overview

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Long Island Offshore Wind Export PPTN

- **PSC Order for Public Policy Transmission Need (PPTN):**
  - CLCPA constitutes a Public Policy Requirement driving the need for transmission to increase the export capability from Long Island to the rest of New York State to ensure full output of at least 3,000 MW of offshore wind interconnected to Long Island
  - Add at least one bulk transmission intertie cable connecting between Long Island and the rest of the New York Control Area and additional transmission expansion or upgrades, as necessary
- **To pass the Viability & Sufficiency Assessment, each project provided full output of at least 3,000 MW of offshore wind connected to Long Island under line outage conditions**
  - Also assuming 6,000 MW of offshore wind connected to New York City to achieve the CLCPA goal of 9,000 MW by 2035

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Evaluation Metrics

- Transfer Analysis & Cost per MW
- Expandability – Electrical & Physical
- Operability
- Production Cost
- Performance
- Capacity Benefits
- Capital Cost Estimate
- Voluntary Cost Cap
- Property Rights & Routing
- Potential Construction Delays
- Other Considerations: Metrics prescribed in PSC Order, Interconnection Studies, Consequences for Other Regions, Impact on Wholesale Electricity Markets, Integration with Local Transmission Owner Plans

*Results for metrics in red will be discussed today

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Power Flow Assumptions

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Power Flow Cases

- Base Case assumptions, based on the Viability & Sufficiency Assessment (VSA) Baseline and Alternate Cases
  - CY21 ATBA base cases with consistent assumptions to VSA are used for analyses that cross over with System Impact Studies
- Electrical Expandability analysis utilized VSA Alternate Case with 6,000 MW Long Island OSW
- Transfer Capability and Flexibility for Outages analyses utilized CY21 ATBA transfer case with 6,000 MW Long Island OSW modeled
- Grid Strength analysis utilized CY21 ATBA case with 3,000 MW Long Island OSW modeled

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Power Flow Cases: Offshore Wind Assumptions

- **~3,000 MW in Zone K at full output in Baseline Case:**
  - LIPA/NYSERDA Awarded: 139 MW @ East Hampton 69 kV, 880 MW @ Holbrook 138 kV, 1,260 MW @ Barrett 138 kV
  - Non-Awarded: 800 MW @ Ruland Rd. 138 kV
- **~6,000 MW in Zone K at full output in Alternate Case:**
  - LIPA/NYSERDA Awarded: 139 MW @ East Hampton 69 kV, 1,050 MW @ Holbrook 138 kV, 1,350 MW @ Barrett 138 kV
  - Non-Awarded: 1,150 MW each @ Ruland Rd. 138 kV, East Garden City 345 kV, Northport 138 kV
- **~6,000 MW in Zone J at full output:**
  - NYSERDA Awarded: 816 MW @ Gowanus 345 kV, 1,230 MW @ Astoria 138 kV
  - Non-Awarded: 1,310 MW each @ Farragut East 345 kV, Farragut West 345 kV, and West 49th St. 345 kV

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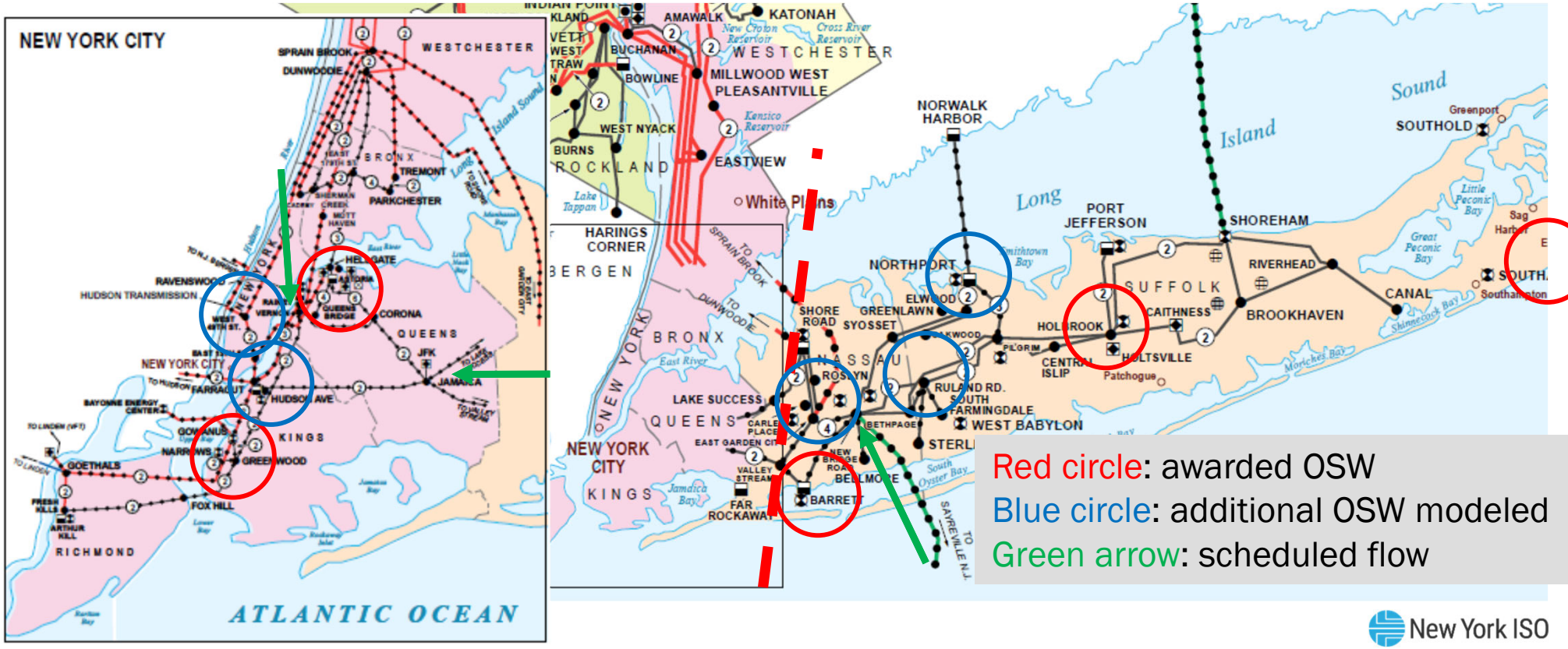
Power Flow Cases: Offshore Wind Assumptions



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Power Flow Cases: Generation & Load

	Expandability		Transfer & Operability	Grid Strength
	Summer Peak	Light Load	Summer Peak	Light Load
Zone K OSW (MW)	6,000	6,000	6,000	3,000
Zone J OSW (MW)	6,000	6,000	0	0
Zone K Load (MW net)	4,423 (including 499 MW BTM solar)	1,107 (including 1,108 MW BTM solar)	4740	1,055 (including 1182 MW BTM Solar)
Zone K Conventional Generation Dispatch (Pgen MW)	~350	~350	~3100	~500
Zone K Conventional Reserve (Pmax - Pgen MW of committed units)	~1200	~1050	~1100	~400
LIPA Imports (MW into Long Island)	NNC = 0 CSC = 0 Neptune = 660 901/903 = -300	NNC = 0 CSC = 0 Neptune = 0 901/903 = -300	NNC = 0 CSC = 0 Neptune = 660 901/903 = -300	NNC = 0 CSC = 0 Neptune = 0 901/903 = -300

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Transfer Analysis

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Transfer Limit

- **Incremental transfer limit analysis is performed to determine a project's impact on Long Island import and export capability**
  - Consistent with planning methodology for proportional N-1 normal transfer criteria
  - For the purpose of understanding system behavior in this analysis, flows on project tie lines are included in the transfer limit calculation. These results do not indicate how the future interface will be defined
  - Controllable lines are adjusted for increased transfers
- **Additional interfaces are studied in the System Impact Studies, and internal LIPA transfer may be considered for top tier sensitivity**

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Long Island Export Capability

Project	Monitored Facility	Cont Name	Flowgate MW	Delta MW
Base Case	Y49 - East Garden City - Sprain Brook 345kV	Shore Road 138kV P5 contingency	1,075	--
T035 - LS Power	Y49 - East Garden City - Sprain Brook 345kV	East Garden City 138kV P5 contingency	3,900	+2,825
T036 - NextEra Core1	Ruland Road - Sprain Brook 345 kV	Base Case	2,775	+1,700
T037 - NextEra Core 2	Newbridge Rd - East Garden City 345 kV	East Garden City 345 kV stuck breaker	3,475	+2,400
T038 - NextEra Core 3	Northport - Dunwoodie 345kV	Base Case	3,300	+2,225
T039 - NextEra Core4	Northport 138kV - Northport 345kV	Ruland Road - Sprain Brook 345kV	3,225	+2,150
T040 - NextEra Core5	Northport 138kV - Northport 345kV	Ruland Road - Sprain Brook 345kV	3,225	+2,150
T041 - NextEra Core 6	Ruland Road - Sprain Brook 345 kV	Northport - Sprain Brook HVDC	3,575	+2,500
T042 - NextEra Core 7	Ruland Road - Sprain Brook 345 kV	Northport - Sprain Brook HVDC	3,575	+2,500
T043 - NextEra Enh 1	East Garden City - Dunwoodie 345kV	Buchanan 345kV stuck breaker	3,325	+2,250
T044 - NextEra Enh 2	East Garden City - Dunwoodie 345kV	Base Case	3,350	+2,275
T047 - Propel Base 1	Y50 - Shore Road - Dunwoodie 345kV	Base Case	2,575	+1,500
T048 - Propel Base 2	Y50 - Shore Road - Dunwoodie 345kV	Base Case	2,600	+1,525
T049 - Propel Base 3	Y49 - East Garden City - Sprain Brook 345kV	East Garden City 345kV stuck breaker	2,575	+1,500
T051 - Propel Alt 5	Y50 - Shore Road - Dunwoodie 345kV	Base Case	3,300	+2,225
T052 - Propel Alt 6	Y49 - East Garden City - Sprain Brook 345kV	Base Case	3,675	+2,600
T053 - Propel Alt 7	Y49 - East Garden City - Sprain Brook 345kV	Eastern Queens 345/138kV stuck breaker	3,625	+2,550

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Long Island Import Capability

Project	Monitored Facility	Cont Name	Flowgate MW	Delta MW
Base Case	Y50 - Dunwoodie - Shore Road 345kV	Sprain Brook 345 kV stuck breaker	1,625	--
T035 - LS Power	Y50 - Dunwoodie - Shore Road 345kV	North Gate - South Gate HVDC #1	3,500	+1,875
T036 - NextEra Core1	Sprain Brook - Ruland Road 345kV	Base Case	3,500	+1,875
T037 - NextEra Core 2	Newbridge Rd 345kV - Newbridge Rd 138kV	Sprain Brook 345 kV stuck breaker	3,200	+1,575
T038 - NextEra Core 3	Dunwoodie - Northport 345kV	Base Case	3,975	+2,350
T039 - NextEra Core4	Y50 - Dunwoodie - Shore Road 345kV	Base Case	4,150	+2,525
T040 - NextEra Core5	Northport 345kV - Northport 138 kV	Sprain Brook 345 kV stuck breaker	4,325	+2,700
T041 - NextEra Core 6	Y50 - Dunwoodie - Shore Road 345kV	Base Case	4,025	+2,400
T042 - NextEra Core 7	Y50 - Dunwoodie - Shore Road 345kV	Base Case	4,025	+2,400
T043 - NextEra Enh 1	Newbridge Rd 345kV - Newbridge Rd 138kV	Newbridge Rd 345/138kV #1	3,675	+2,050
T044 - NextEra Enh 2	Dunwoodie - East Garden City 345kV	Base Case	3,750	+2,125
T047 - Propel Base 1	Y50 - Dunwoodie - Shore Road 345kV	Base Case	2,500	+875
T048 - Propel Base 2	Y50 - Dunwoodie - Shore Road 345kV	Base Case	2,475	+850
T049 - Propel Base 3	Y50 - Dunwoodie - Shore Road 345kV	Base Case	2,475	+850
T051 - Propel Alt 5	Y50 - Dunwoodie - Shore Road 345kV	Base Case	2,825	+1,200
T052 - Propel Alt 6	Y50 - Dunwoodie - Shore Road 345kV	Shore Road 345kV stuck breaker	3,150	+1,525
T053 - Propel Alt 7	Y50 - Dunwoodie - Shore Road 345kV	Y53 - Ruland Road - Sprain Brook 345 kV	3,150	+1,525

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Electrical Expandability

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Expandability Metric

- **Purpose: considers the impact of the proposed project on subsequent system expansion**
- **Evaluation: substation layout review, power flow analysis**
- **Look For:**
  - Electrical expandability - greater future generation accommodation
  - Physical expandability - more new Point of Interconnection (POI) additions

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Electrical Expandability

- **Identifies maximum amount of Long Island OSW (up to 6,000 MW) that can be securely injected**
- **N-0, N-1, and N-1-1 contingency analyses**
  - VSA Alternate Summer Peak and Spring Light Load cases
  - Consideration is given for OSW distribution different than the Alternate Case
- **Long Island internal and tie lines secured by adjusting controllable lines and redispatching OSW output**

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OSW Capability

Project	Summer Peak			Spring Light Load		
	N-0	N-1	N-1-1	N-0	N-1	N-1-1
Base Case	4,550	4,575	4,150	2,300	2,300	2,050
T035 - LSPower*	6,000	5,575	5,100	6,000	5,150	4,350
T036 - NextEra Core1*	6,000	5,825	5,200	4,525	5,125	4,450
T037 - NextEra Core 2	6,000	5,825	4,975	5,450	4,925	4,150
T038 - NextEra Core 3	6,000	6,000	4,850	5,725	5,325	4,600
T039 - NextEra Core4	6,000	6,000	4,900	4,925	5,175	4,400
T040 - NextEra Core5	6,000	6,000	4,900	4,925	5,175	4,375
T041 - NextEra Core 6	6,000	6,000	4,900	5,175	5,500	4,475
T042 - NextEra Core 7	6,000	6,000	4,900	5,175	5,500	4,500
T043 - NextEra Enh 1	6,000	6,000	6,000	6,000	6,000	5,400
T044 - NextEra Enh 2	6,000	6,000	6,000	6,000	5,175	4,900
T047 - Propel Base 1*	6,000	5,825	5,050	4,275	4,525	3,750
T048 - Propel Base 2*	6,000	5,825	4,900	4,575	4,525	3,725
T049 - Propel Base 3*	6,000	5,825	5,075	4,225	4,550	3,750
T051 - Propel Alt 5*	6,000	5,325	4,900	5,175	5,125	4,300
T052 - Propel Alt 6*	6,000	5,825	5,025	5,700	5,650	5,075
T053 - Propel Alt 7*	6,000	6,000	5,375	5,550	5,300	4,350

*OSW MW was distributed among the Long Island POIs to obtain higher total injection amounts w/o curtailment

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Operability

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Operability Metric

- Purpose: considers how the proposed project may affect additional flexibility in operating the system
- Evaluation: power flow analysis, short circuit analysis
- Look For: wider range to operate the system under outage conditions, higher grid strength

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Flexibility for Outages Methodology

- **Mimics Business Management System (BMS) Dispatch in Control Center**
  - Does not include Bid information: Assumes Identical Bids and All Generators Available
- **Optimal Transfer Analysis for Long Island import and export capability**
  - Starting point of CY21 ATBA Transfer Summer Peak case
  - All lines 69 kV and above in Zone K, 115 kV and above in Zones F-I, all NYISO BPTF lines secured to Normal Ratings
  - Generators are dispatch independently (not proportionally) between their PMin and PMax to facilitate transfers
  - PARs and HVDC may change schedule to facilitate transfers
- **Maintenance Conditions Considered**
  - Single Outage results take one single element out of service and find maximum transfers (N-1-1 Transfers)
  - Double Outage results take two single elements out of service and find maximum transfers (N-2-1 Transfers)

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Flexibility for Outages - LI Export

	Long Island Export Limit (MW)		Transfer Derate (MW)	
Project	Single Outage	Double Outage	Single Outage	Double Outage
Base Case	-415	-650	790	1025
T035 - LSPower	2565	1355	985	2195
T036 - NextEra Core1	2440	1540	825	1725
T037 - NextEra Core 2	2540	1725	1145	1960
T038 - NextEra Core 3	2775	2385	1150	1540
T039 - NextEra Core4	2395	1510	990	1875
T040 - NextEra Core5	2425	1530	980	1875
T041 - NextEra Core 6	2510	1530	1160	2140
T042 - NextEra Core 7	2500	1535	1160	2125
T043 - NextEra Enh 1	3160	2510	1145	1795
T044 - NextEra Enh 2	3130	2465	1145	1810
T047 - Propel Base 1	1300	625	830	1505
T048 - Propel Base 2	1270	510	770	1530
T049 - Propel Base 3	1310	660	835	1485
T051 - Propel Alt 5	1930	1190	710	1450
T052 - Propel Alt 6	3135	2400	725	1460
T053 - Propel Alt 7	1725	905	1190	2010

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Flexibility for Outages – LI Import

	Long Island Import Limit (MW)		Transfer Derate (MW)	
Project	Single Outage	Double Outage	Single Outage	Double Outage
Base Case	1005	390	660	1275
T035 - LSPower	2740	2540	480	680
T036 - NextEra Core1	3055	2400	350	1005
T037 - NextEra Core 2	3035	2535	375	875
T038 - NextEra Core 3	3330	3035	110	405
T039 - NextEra Core4	3155	3060	260	355
T040 - NextEra Core5	3105	3035	315	385
T041 - NextEra Core 6	3355	3000	105	460
T042 - NextEra Core 7	3350	3005	110	455
T043 - NextEra Enh 1	3450	3280	305	475
T044 - NextEra Enh 2	3430	3275	305	460
T047 - Propel Base 1	2310	1635	830	1505
T048 - Propel Base 2	2455	1660	720	1515
T049 - Propel Base 3	2325	1610	815	1530
T051 - Propel Alt 5	3145	2320	330	1155
T052 - Propel Alt 6	3255	2815	205	645
T053 - Propel Alt 7	3340	3150	85	275

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Flexibility for Outages - Range

Project	Import - Export Ranges (MW)	
	Single Outage	Double Outage
T035 - LSPower	5305	3895
T036 - NextEra Core1	5495	3940
T037 - NextEra Core 2	5575	4260
T038 - NextEra Core 3	6105	5420
T039 - NextEra Core4	5550	4570
T040 - NextEra Core5	5530	4565
T041 - NextEra Core 6	5865	4530
T042 - NextEra Core 7	5850	4540
T043 - NextEra Enh 1	6610	5790
T044 - NextEra Enh 2	6560	5740
T047 - Propel Base 1	3610	2260
T048 - Propel Base 2	3725	2170
T049 - Propel Base 3	3635	2270
T051 - Propel Alt 5	5075	3510
T052 - Propel Alt 6	6390	5215
T053 - Propel Alt 7	5065	4055

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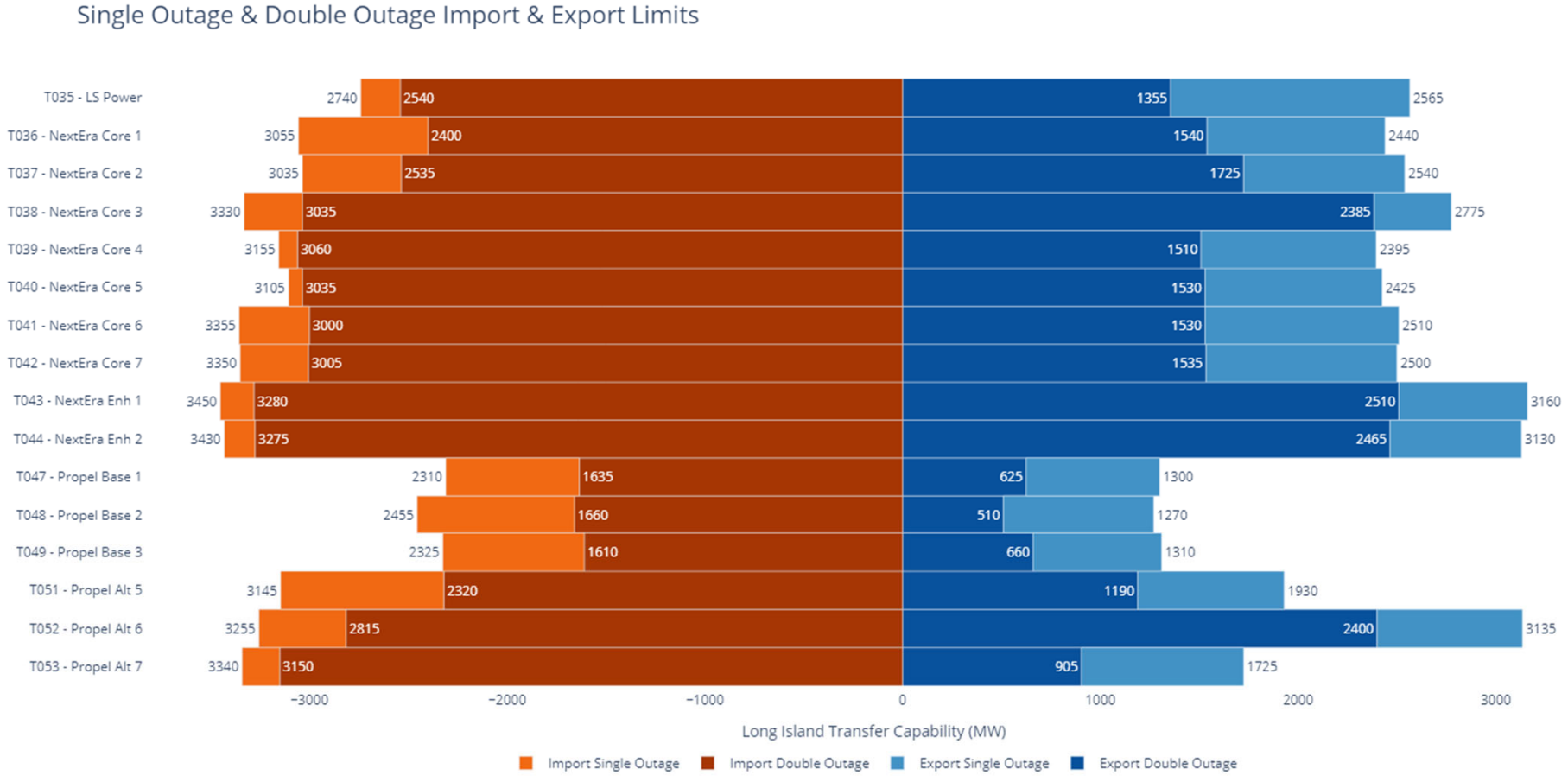
Flexibility for Outages



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Grid Strength

- Short circuit ratio is a common screening method to obtain a high-level understanding of the the voltage stiffness of the grid and indirectly assess ability of inverter-based resources (IBR) to respond “as expected” to system perturbations
- Weighted short circuit ratio (WSCR) is the recommended approach for systems with multiple IBRs in close proximity
- WSCR calculated for each project under operating conditions with reduced synchronous generation (CY21 ATBA light load case) in addition to system outages (N-1, N-2, N-3 345 kV Long Island tie lines)
- NERC does not have a WSCR reliability criteria

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System Strength Results

Project	WSCR w/1 Outage	WSCR w/2 Outages	WSCR w/3 Outages
Pre-Project	1.83	1.61	N/A
T035 - LS Power	0.78	0.70	N/A
T036 -NextEra Core 1	2.46	2.39	2.11
T037 -NextEra Core 2	2.63	2.59	2.47
T038 -NextEra Core 3	2.45	2.38	2.26
T039 -NextEra Core 4	2.49	2.40	2.17
T040 -NextEra Core 5	2.48	2.40	2.16
T041 -NextEra Core 6	1.75	1.68	1.45
T042 -NextEra Core 7	1.75	1.68	1.45
T043 -NextEra Enh 1	1.47	1.44	1.39
T044 -NextEra Enh 2	1.90	1.87	1.78
T047 - Propel Base 1	2.22	2.11	1.95
T048 - Propel Base 2	2.15	2.02	1.78
T049 - Propel Base 3	2.19	2.06	1.87
T051 - Propel Alt 5	2.26	2.17	2.09
T052 - Propel Alt 6	2.50	2.42	2.31
T053 - Propel Alt 7	1.30	1.21	1.07

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Summary of Power Flow Results

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Power Flow Results

- Transfer Limit: Normal Proportional Transfer Limits across the Long Island to ROS interface
- Electrical Expandability: OSW injection amount without curtailment
- Flexibility for Outages: BMS operating import and export range under outage conditions

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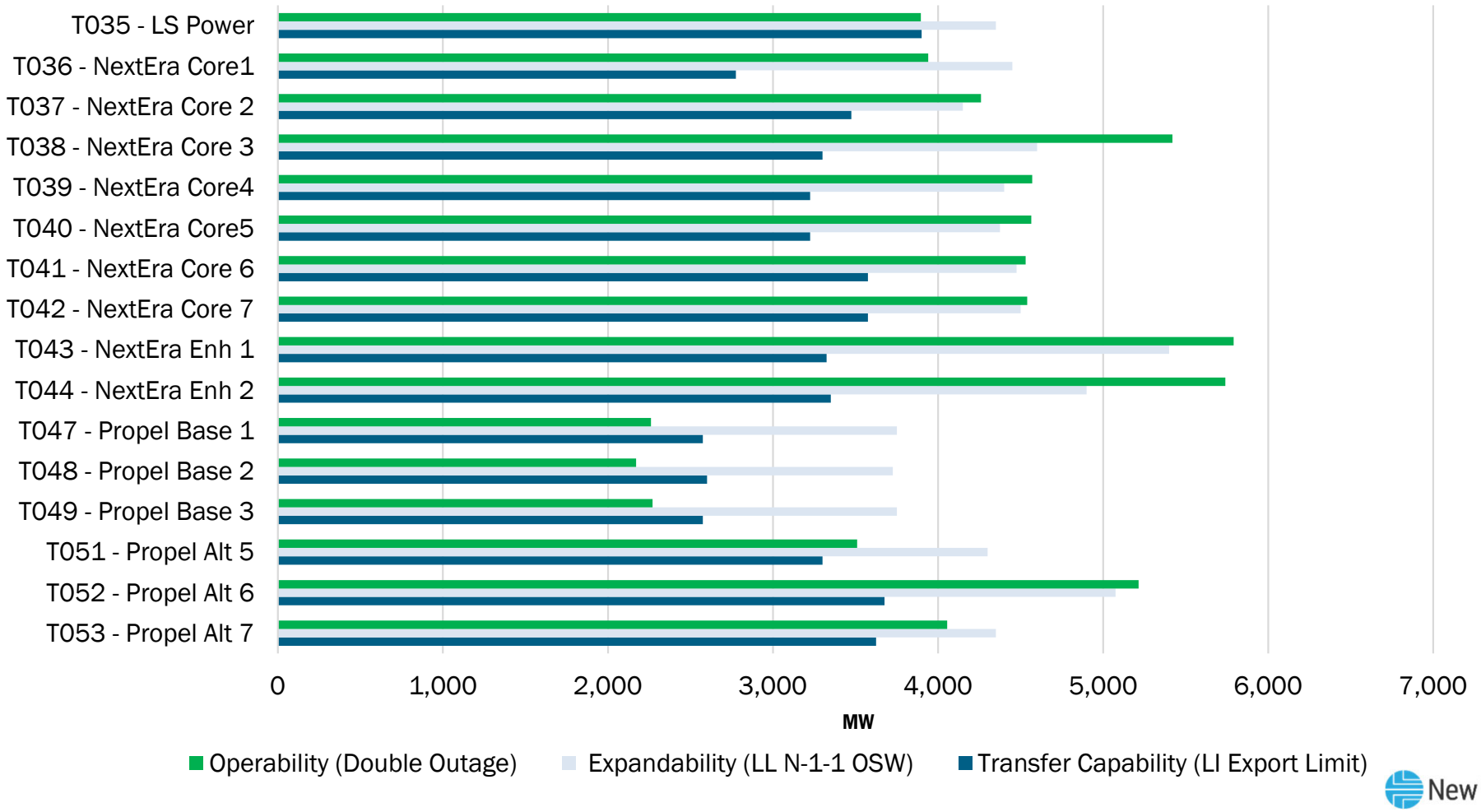
POWER FLOW RESULTS



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Next Steps

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Results Review Schedule

- February 8: Review power flow results
- February 16: Review production cost, performance, and capacity benefit results
- March 2: Review potential construction delays, property rights & routing
- March TPAS/ESPWG: Results follow-up
- April TPAS/ESPWG: Initial report review

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Comments

- **Further questions and comments regarding these results can be sent to PublicPolicyPlanningMailbox@nyiso.com**
  - Comments are requested as soon as they are available, but no later than February 15, 2023
- **Comments will be posted for stakeholder consideration**

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Questions?

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