

Appendix M: Capacity Benefits LOLE Reduction

Long Island Offshore Wind
Export Public Policy
Transmission Need Evaluation

**A Report from the New York
Independent System Operator**

DRAFT for May 16, 2023, ESPWG



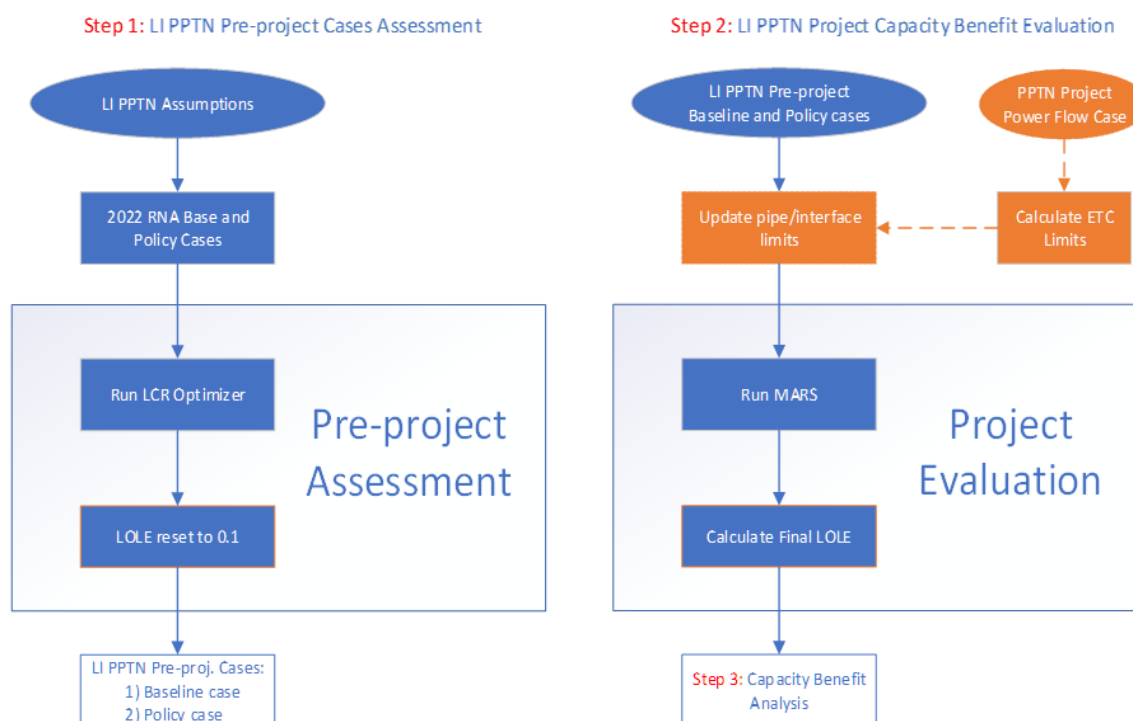
Appendix M: Capacity Benefits LOLE Reduction

Overview of Methodology

The capacity benefit metric evaluates the incremental capacity benefits created by each proposed project. The methodology compares the pre- and post-project system resource adequacy to identify the reduction in the NYCA loss of load expectation (LOLE).¹ A greater reduction in the NYCA LOLE, compared to the pre-project case, indicates greater capacity benefits created by a proposed project.

The methodology is comprised of three major steps, as illustrated in Figure 1. The first step evaluates and resets the NYCA LOLE of the pre-project Reliability Needs Assessment (RNA) base and policy cases (MARS cases) to criteria (i.e., 0.1 event-days per year) using NYISO's LCR Optimizer. The second step models transmission changes specific to a project by adding new interzonal pipes and updating the Emergency Transfer Criteria (ETC) limits of the associated interfaces. MARS is then run on the modified RNA cases with the project to evaluate the change in NYCA LOLE. The third and final step involves calculating the annual capacity benefit of a project by applying a cost of reliability improvement (CRI) (\$/0.001 LOLE) to the change in NYCA LOLE brought by each project.

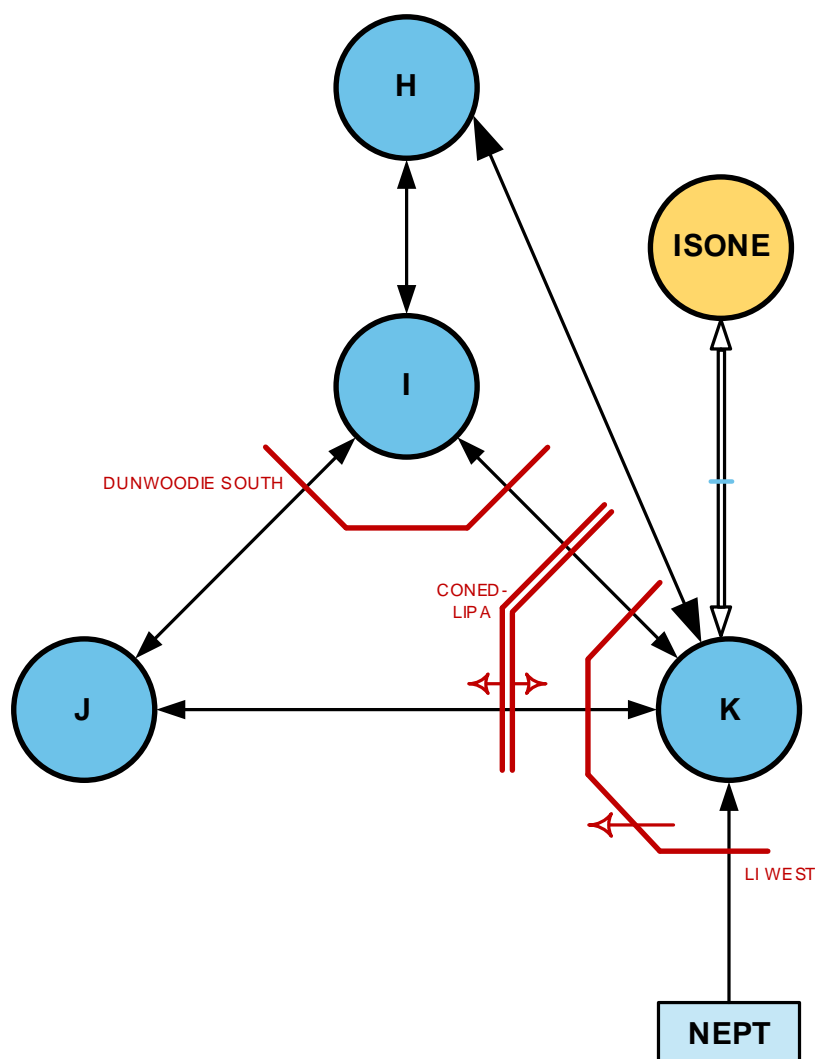
Figure 1: Capacity Benefits Evaluation Process



¹ The New York State bulk power system is planned to meet a LOLE that, at any given point in time, is less than or equal to an involuntary firm load disconnection that is not more frequent than once in every 10 years, or 0.1 events per year.

Thermal transfer limit analysis was performed using PowerGEM TARA, based on DC (linear) power flow, which assumes that voltages, reactive flows, or losses do not change with increased transfer levels. Emergency transfer limits of affected MARS topology interfaces were calculated with and without each project to determine the incremental impact transfer limits due to the addition of each project, as shown in the **Figure 2**.

Figure 2: Affected MARS Topology Interfaces



In accordance with NPCC criteria and NYSRC reliability rules, the contingency list was modified to include each project's related contingencies. Phase angle regulators maintained scheduled power flow in pre-contingency conditions but were fixed at their pre-contingency angle in post-contingency conditions. HVDC facilities maintained scheduled power flow in pre-contingency conditions but were fixed post-contingency conditions.

An emergency interface transfer limit is the transfer level where a) a branch flow reaches its normal rating under pre-contingency conditions or b) a branch flow reaches its short-term emergency (STE) rating following a single-line, multi-element, or generator outage. Affected MARS topology transfer limits for Export and Import are shown in

Figure 3 and **Figure 4**, respectively.

Figure 3: Post-Project Emergency Transfer Limits (MW): Export

| Project | K TO H | LIPA-ConEd | LI West | K TO NE | K TO I | K TO J | J TO I | J-I & K-I |
|---------------------|--------|------------|---------|---------|--------|--------|--------|-----------|
| Pre-Project | 0 | 190 | 104 | 414 | 515 | 505 | 1999 | 99999 |
| T035-LS Power | 3575 | 190 | 104 | 414 | 515 | 505 | 1999 | 99999 |
| T036-NextEra Core 1 | 0 | 3090 | 3004 | 414 | 3090 | 805 | 1999 | 99999 |
| T037-NextEra Core 2 | 0 | 3665 | 3579 | 414 | 2915 | 1555 | 1999 | 99999 |
| T038-NextEra Core 3 | 0 | 3940 | 3854 | 414 | 3290 | 1480 | 1999 | 99999 |
| T039-NextEra Core 4 | 0 | 3265 | 3179 | 414 | 3490 | 580 | 1999 | 99999 |
| T040-NextEra Core 5 | 0 | 4240 | 4154 | 414 | 4465 | 580 | 1999 | 99999 |
| T041-NextEra Core 6 | 0 | 3615 | 3529 | 414 | 3790 | 630 | 1999 | 99999 |
| T042-NextEra Core 7 | 0 | 3615 | 3529 | 414 | 3790 | 630 | 1999 | 99999 |
| T043-NextEra Enh1 | 1200 | 4915 | 4829 | 414 | 3940 | 1130 | 1999 | 99999 |
| T043-NextEra Enh 2 | 0 | 4915 | 4829 | 414 | 3940 | 1130 | 1999 | 99999 |
| T047-Propel Base 1 | 0 | 2065 | 1979 | 414 | 1690 | 1205 | 1999 | 99999 |
| T048-Propel Base 2 | 0 | 1815 | 1729 | 414 | 1340 | 1280 | 1999 | 99999 |
| T049-Propel Base 3 | 0 | 2115 | 2029 | 414 | 1740 | 1205 | 1999 | 99999 |
| T051-Propel Alt 5 | 0 | 2915 | 2829 | 414 | 2540 | 1205 | 1999 | 99999 |
| T052-Propel Alt 6 | 0 | 3815 | 3729 | 414 | 3365 | 1255 | 1999 | 99999 |
| T053-Propel Alt 7 | 0 | 3840 | 3754 | 414 | 3415 | 1255 | 1999 | 99999 |

Figure 4: Post-Project Emergency Transfer Limits (MW): Import

| Project | DunSouth (I-J&I-K) | I TO J | H TO K | ConEd-LIPA | LI West Reverse | NE TO K | I TO K | J TO K |
|-----------------------|--------------------|--------|--------|------------|-----------------|---------|--------|--------|
| Pre-Project | 5693 | 4400 | 0 | 1613 | 999999 | 404 | 1293 | 320 |
| T035 - LS Power | 5693 | 4400 | 3550 | 1613 | 999999 | 404 | 1293 | 320 |
| T036 - NextEra Core 1 | 7768 | 4400 | 0 | 3763 | 999999 | 404 | 3443 | 320 |
| T037 - NextEra Core 2 | 7993 | 4400 | 0 | 3763 | 999999 | 404 | 3343 | 545 |
| T038 - NextEra Core 3 | 7993 | 4400 | 0 | 3738 | 999999 | 404 | 3743 | 895 |
| T039 - NextEra Core 4 | 6143 | 4400 | 0 | 3588 | 999999 | 404 | 3268 | 320 |
| T040 - NextEra Core 5 | 7718 | 4400 | 0 | 3663 | 999999 | 404 | 3343 | 320 |
| T041 - NextEra Core 6 | 7493 | 4400 | 0 | 4638 | 999999 | 404 | 4343 | 320 |
| T042 - NextEra Core 7 | 7493 | 4400 | 0 | 4638 | 999999 | 404 | 4343 | 320 |
| T043 - NextEra Enh 1 | 6718 | 4400 | 1200 | 3188 | 999999 | 404 | 4043 | 595 |
| T043 - NextEra Enh 2 | 6718 | 4400 | 0 | 3188 | 999999 | 404 | 4043 | 595 |
| T047 - Propel Base 1 | 6393 | 4400 | 0 | 3013 | 999999 | 404 | 1993 | 1020 |
| T048 - Propel Base 2 | 6393 | 4400 | 0 | 3013 | 999999 | 404 | 1993 | 1020 |
| T049 - Propel Base 3 | 6393 | 4400 | 0 | 3013 | 999999 | 404 | 1993 | 1020 |
| T051 - Propel Alt 5 | 7093 | 4400 | 0 | 3738 | 999999 | 404 | 2693 | 1020 |
| T052 - Propel Alt 6 | 7793 | 4400 | 0 | 3788 | 999999 | 404 | 3293 | 470 |
| T053 - Propel Alt 7 | 7118 | 4400 | 0 | 3613 | 999999 | 404 | 3118 | 495 |

Capacity benefits can be theoretically evaluated by comparing the capacity procurement requirement in the downstate area before and after each of the proposed solutions to the Long Island Offshore Wind Export Public Policy Transmission Need are in service. Currently, the NYISO determines the capacity procurement requirements for the downstate area through the Locational Capacity Requirements (LCR) process. The methodology and assumptions used in the LCR process via the LCR Optimizer are based on current system and market configurations, as well as near-term economic conditions. They include, but are not limited to, the limitations on the NYCA topology and Net Cost of New Entry (CONE) for new technologies. Based on the NYISO's past experience, the outcomes from the LCR Optimizer are sensitive to small changes in any of these assumptions.

In developing the methodology for calculating the capacity benefits based on LOLE reduction, the NYISO staff considered but decided against using the LCR process directly to evaluate capacity benefits of proposed solutions to the Long Island PPTN. First, the assumptions used in the LCR Optimizer, as discussed above, are expected to go through significant changes in the next decade. The NYISO is also planning to explore enhancements to the LCR Optimizer in 2023. Assessment with the current LCR Optimizer might introduce unnecessary volatility in the evaluation outcomes. Second, applying the LCR Optimizer directly to evaluate each project would require significant efforts and computing time to develop and test different combinations of future system, economic and market assumptions. Based on the foregoing, the NYISO focused on methodologies other than the LCR process to directly evaluate capacity benefits for the purpose of its comparative evaluation.

However, the current LCR Optimizer provides a methodology in bringing a MARS database to meet the 0.1 event-days/year LOLE criterion. This will be discussed further in the following section.

LOLE Calculation Assumptions and Results

Pre-Project

To establish a reference point for post-project NYCA LOLE impact comparison, the NYISO developed two pre-project models—both based on the MARS models developed under the 2022 Reliability Need Assessment² study process for study year 2030:

1. The 2022 Reliability Need Assessment (RNA) Base Case for study year 2030 was further updated to reflect offshore wind targets (**Figure 5**) and also to remove the proposed Champlain

² Additional RNA details are available at the links below:

2022 RNA Report: <https://www.nyiso.com/documents/20142/2248793/2022-RNA-Report.pdf>

2022 RNA Appendices: <https://www.nyiso.com/documents/20142/34651464/2022-RNA-Appendices.pdf>

Hudson Power Express (CHPE) HVDC transmission project (**Figure 6**).

2. The 2022 Reliability Need Assessment (RNA) Policy Case Scenario 2 was further updated to reflect offshore wind targets (**Figure 5**). Both CHPE and the proposed Clean Path New York (CPNY) HVDC transmission projects continue to be modeled in this case (**Figure 6**).

Figure 5: Offshore Wind Capacity Assumptions (MW)

| | Baseline | Policy Case |
|--------------|----------|-------------|
| Zone K Total | 2,279 | 2,539 |
| Zone J Total | 2,046 | 2,046 |

Figure 6: Tier 4 Proposed HVDC Project Assumptions

| Tier 4 Projects | Baseline | Policy Case |
|-----------------|-------------|-------------|
| CHPE | Remove | Retain |
| CPNY | Not modeled | Retain |

Each of the two models were developed to reflect the expected system conditions of a specific planning study year and scenario and have much lower LOLE than the 0.1 event-days/year LOLE criterion. In order to have visible LOLE improvements to facilitate the evaluation, the NYISO applied the current LCR Optimizer and inputs used in the 2021 LCR study, adjusting these two models to meet the LOLE criterion of 0.1 event-days/year. With the adjustments, each of these two models became the reference point for the post-project NYCA LOLE impact. Better performance under this metric is represented by greater decreases in LOLE from 0.1 event-days/year reference, as lower NYCA LOLE means a more reliable system from resource adequacy perspective.

Post-Project

Starting from the two pre-project MARS models at-criterion described above, two models were developed for each of the projects, by reflecting their impacts on the affected MARS topology transfer limits, and as shown in the

Figure 3 and **Figure 4** above.

The NYCA LOLE results are summarized in

Figure 7 below.

Figure 7: NYCA LOLE Results

| LI PPTN Delta NYCA LOLE (event-day/year) on Study Year 2030 | | | | |
|---|----------|---------|----------|----------|
| Projects | Baseline | Policy | Delta | |
| | | | Baseline | Policy |
| Pre-Project | 0.01383 | 0.00708 | | |
| Pre-Project at Criteria | 0.10008 | 0.10047 | | |
| T035 - LS Power | 0.07430 | 0.07413 | -0.02578 | -0.02634 |
| T036 - NextEra Core 1 | 0.08012 | 0.07848 | -0.01996 | -0.02199 |
| T037 - NextEra Core 2 | 0.06279 | 0.06157 | -0.03729 | -0.03890 |
| T038 - NextEra Core 3 | 0.05754 | 0.05393 | -0.04254 | -0.04654 |
| T039 - NextEra Core 4 | 0.08854 | 0.08876 | -0.01154 | -0.01171 |
| T040 - NextEra Core 5 | 0.08854 | 0.08876 | -0.01154 | -0.01171 |
| T041 - NextEra Core 6 | 0.08672 | 0.08655 | -0.01336 | -0.01392 |
| T042 - NextEra Core 7 | 0.08672 | 0.08655 | -0.01336 | -0.01392 |
| T043 - NextEra Enh 1 | 0.05627 | 0.05231 | -0.04381 | -0.04816 |
| T044 - NextEra Enh 2 | 0.06311 | 0.05811 | -0.03697 | -0.04236 |
| T047 - Propel Base 1 | 0.05789 | 0.05533 | -0.04219 | -0.04514 |
| T048 - Propel Base 2 | 0.05786 | 0.05513 | -0.04222 | -0.04534 |
| T049 - Propel Base 3 | 0.05789 | 0.05533 | -0.04219 | -0.04514 |
| T051 - Propel Alt 5 | 0.05770 | 0.05498 | -0.04238 | -0.04549 |
| T052 - Propel Alt 6 | 0.06717 | 0.06251 | -0.03291 | -0.03796 |
| T053 - Propel Alt 7 | 0.06601 | 0.06166 | -0.03407 | -0.03881 |

Cost of Reliability Improvement

The monetary value of capacity benefits is measured by how each project affects LOLE and the Cost of Reliability Improvement (CRI). CRI represents the compensation that a generator would receive in the capacity market for providing comparable LOLE benefits. Based on the Net CONE values of the current capacity demand curves and the estimated reliability benefit from additional capacity, it is estimated that a generator would receive \$2.5 million per 0.001 change in LOLE per year. In the figure below, the Delta LOLE results of each project are multiplied by the \$2.5M CRI value to provide an annual capacity benefit of each project.

Figure 8: NYCA Delta LOLE Results and Annual Capacity Benefits

| LI PPTN Delta NYCA LOLE (event-day/year) on Study Year 2030 | | | | | | |
|---|----------|---------|----------|----------|------------------------------------|----------|
| Projects | | | Delta | | Annual Capacity Benefit (2022 \$M) | |
| | Baseline | Policy | Baseline | Policy | Baseline | Policy |
| Pre-Project | 0.01383 | 0.00708 | | | | |
| Pre-Project at Criteria | 0.10008 | 0.10047 | | | | |
| T035 - LS Power | 0.07430 | 0.07413 | -0.02578 | -0.02634 | \$ 64.45 | \$ 65.85 |
| T036 - NextEra Core 1 | 0.08012 | 0.07848 | -0.01996 | -0.02199 | \$ 49.90 | \$ 54.98 |
| T037 - NextEra Core 2 | 0.06279 | 0.06157 | -0.03729 | -0.03890 | \$ 93.23 | \$ 97.25 |
| T038 - NextEra Core 3 | 0.05754 | 0.05393 | -0.04254 | -0.04654 | \$106.35 | \$116.35 |
| T039 - NextEra Core 4 | 0.08854 | 0.08876 | -0.01154 | -0.01171 | \$ 28.85 | \$ 29.28 |
| T040 - NextEra Core 5 | 0.08854 | 0.08876 | -0.01154 | -0.01171 | \$ 28.85 | \$ 29.28 |
| T041 - NextEra Core 6 | 0.08672 | 0.08655 | -0.01336 | -0.01392 | \$ 33.40 | \$ 34.80 |
| T042 - NextEra Core 7 | 0.08672 | 0.08655 | -0.01336 | -0.01392 | \$ 33.40 | \$ 34.80 |
| T043 - NextEra Enh 1 | 0.05627 | 0.05231 | -0.04381 | -0.04816 | \$109.53 | \$120.40 |
| T044 - NextEra Enh 2 | 0.06311 | 0.05811 | -0.03697 | -0.04236 | \$ 92.43 | \$105.90 |
| T047 - Propel Base 1 | 0.05789 | 0.05533 | -0.04219 | -0.04514 | \$105.48 | \$112.85 |
| T048 - Propel Base 2 | 0.05786 | 0.05513 | -0.04222 | -0.04534 | \$105.55 | \$113.35 |
| T049 - Propel Base 3 | 0.05789 | 0.05533 | -0.04219 | -0.04514 | \$105.48 | \$112.85 |
| T051 - Propel Alt 5 | 0.05770 | 0.05498 | -0.04238 | -0.04549 | \$105.95 | \$113.73 |
| T052 - Propel Alt 6 | 0.06717 | 0.06251 | -0.03291 | -0.03796 | \$ 82.28 | \$ 94.90 |
| T053 - Propel Alt 7 | 0.06601 | 0.06166 | -0.03407 | -0.03881 | \$ 85.18 | \$ 97.03 |