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Long Island PPTN: Avoided Cost Assessment & Operability Sensitivity Results, Qualitative Cost Cap Criteria

Public Policy & Economic Planning Teams

Electric System Planning Working Group (ESPWG)

April 12th, 2023

Agenda

- Metrics Overview
- Avoided Cost Assessment
- Operability Sensitivity
- Qualitative Cost Cap Assessment Criteria
- Next Steps

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Evaluation Metrics Overview

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 must provide 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

*Metrics in red will be discussed today

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Avoided Cost Assessment

Avoided Cost Assessment

- The NYISO has investigated a new assessment for the capacity benefit metric for the Long Island PPTN
- The avoided cost assessment measures the reduction in capital cost to build future generation resources through 2040
- All proposed solutions to the Long Island PPTN greatly reduce curtailments of offshore wind energy. Additional energy released into system due to a transmission project could defer and/or reduce generation buildout elsewhere in the state that may otherwise be needed to meet energy demand and policy objectives
- The transmission projects provide varying levels of increased offshore wind energy to the system which displaces utility-scale solar (UPV), avoiding the need to build that capacity to meet state policy targets

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Avoided Cost Assessment

- **Methodology:**
  - Update the transfer limits associated with each transmission project
  - Offshore wind (OSW) energy profiles, consistent with outputs from production cost simulations, model the “un-curtailed” OSW energy associated with each project
  - Increased transfer capability of each project is translated to a reduction in the Zone K capacity reserve requirement
- **Evaluation:**
  - Measure the change in generation buildout costs driven by a project’s ability to (1) reduce OSW energy curtailment and (2) increase transfer capability to/from Long Island

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Key Findings

- **Primary factors that impact the capital cost savings for transmission projects assessed in this metric are:**
  - Project's ability to reduce curtailment of OSW energy, and
  - Increased transfer capability to Long Island associated with the project
- **Secondary factors that impact capital cost savings identified in this analysis are:**
  - Increased export capability out of Long Island associated with the project, and
  - Location of the new pipes (i.e., which zones the pipes connect to)

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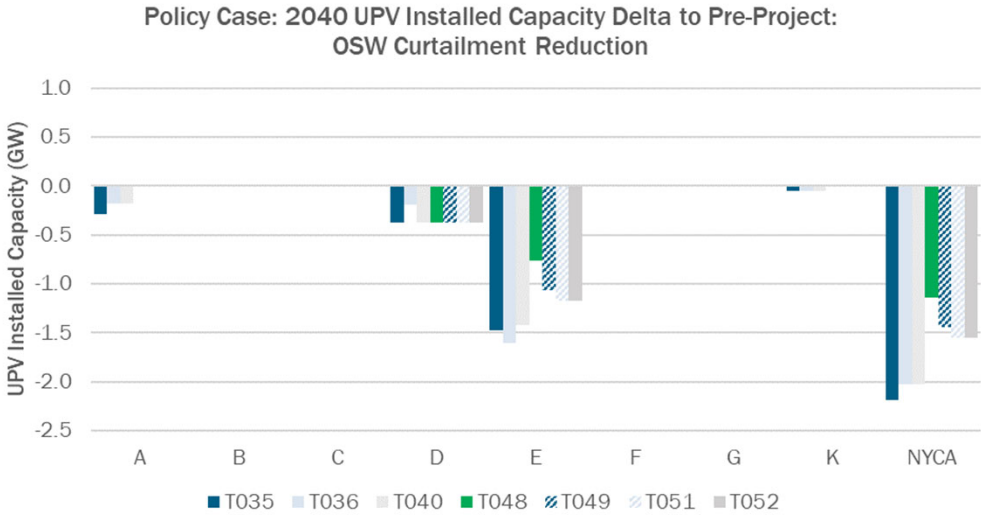
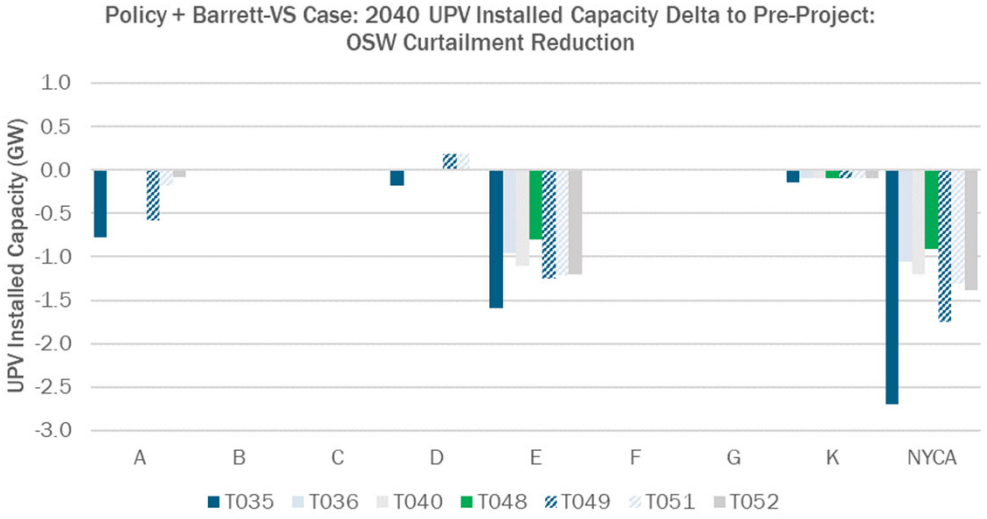
Impacts of OSW Curtailment Reduction

- **Analysis shows that a project's ability to reduce OSW energy curtailment (and increase OSW generation) offsets the energy contribution needed from other generators and results in the displacement of UPV capacity**
  - The majority of UPV displaced is in Zones A and E
  - Projects displace between 0.9–2.7 GW UPV capacity NYCA wide by 2040





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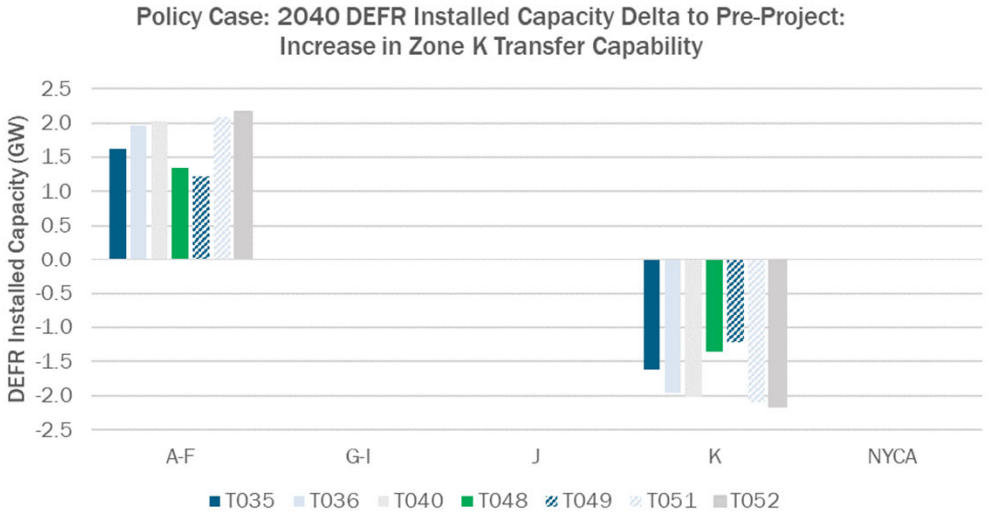
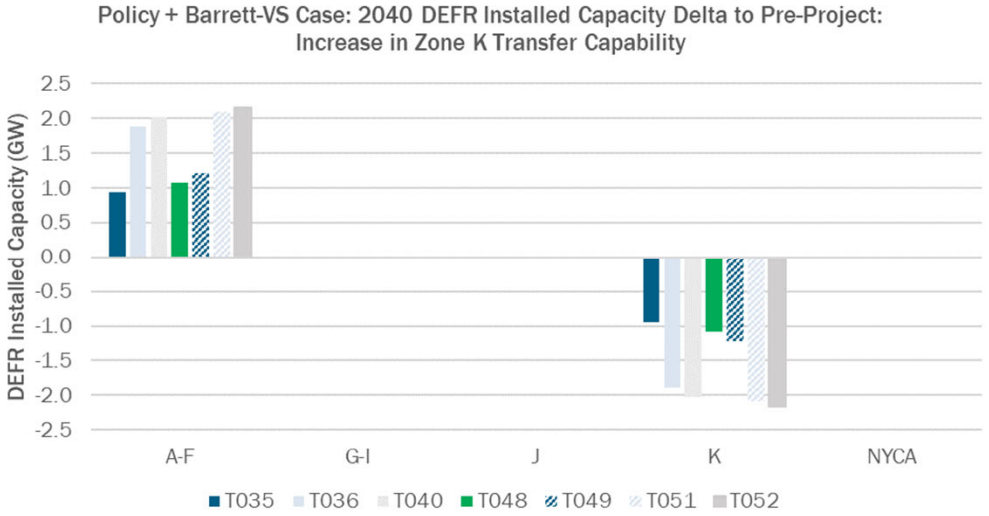
Impacts of Increasing Zone K Transfer Capability

- **Analysis shows that a project's ability to increase transfer capability into Zone K reduce the amount of Dispatchable Emission-Free Resource (DEFR) capacity needed in Long Island**
  - Projects displace between 0.9–2.2 GW DEFR capacity in Zone K and shift that capacity to upstate zones to satisfy the NYCA capacity reserve margin
  - DEFR capacity is shifted to upstate zones (A–F) where it is cheaper to build DEFR capacity
    - See Appendix for additional detail on DEFR capital costs





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Avoided Cost Assessment: Policy Scenario

- A project's ability to (1) reduce offshore wind curtailment and (2) increase transfer capability to Long Island are the primary drivers in avoided capital cost savings

Policy Scenario				
Project	Zone K Transmission Security Limit Increase (MW)	Zone K Export Capability Increase (MW)	OSW Curtailment Reduction (TWh)	Total Capital Cost Savings ($2022M)
T035 - LSPower	2,015	2,829	6.0	2,866
T036 - NextEra Core 1	2,330	1,823	5.8	3,066
T040 - NextEra Core 5	2,380	2,157	6.0	3,101
T048 - Propel Base 2	1,730	1,528	5.5	2,065
T049 - Propel Base 3	1,600	1,514	5.9	2,141
T051 - Propel Alt 5	2,420	2,228	6.2	2,873
T052 - Propel Alt 6	2,530	2,604	6.1	2,909

**OSW curtailment reduction is approximated using the model period 2030-2040 based on curtailment levels in 2030, 2035 and 2040 from the production cost simulations.*

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Avoided Cost Assessment: Policy + Barrett-VS Scenario

- A project's ability to (1) reduce offshore wind curtailment and (2) increase transfer capability to Long Island are the primary drivers in avoided capital cost savings

Policy + Barrett-VS Scenario				
Project	Zone K Transmission Security Limit Increase (MW)	Zone K Export Capability Increase (MW)	OSW Curtailment Reduction (TWh)	Total Capital Cost Savings ($2022M)
T035 - LSPower	1,355	2,829	27.1	3,240
T036 - NextEra Core 1	2,225	1,823	6.0	2,586
T040 - NextEra Core 5	2,380	2,157	6.5	2,731
T048 - Propel Base 2	1,455	1,528	13.1	2,033
T049 - Propel Base 3	1,600	1,514	26.6	2,801
T051 - Propel Alt 5	2,420	2,228	16.0	3,028
T052 - Propel Alt 6	2,530	2,604	15.1	3,081

**OSW curtailment reduction is approximated using the model period 2030-2040 based on curtailment levels in 2030, 2035 and 2040 from the production cost simulations.*

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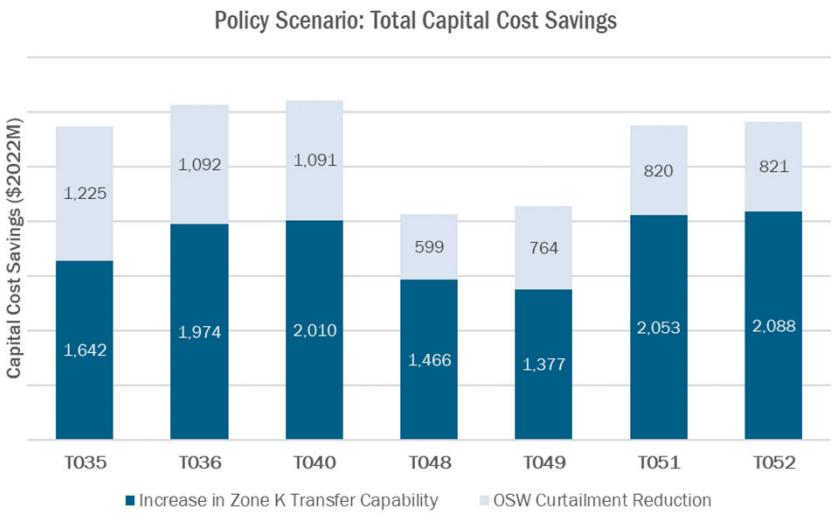
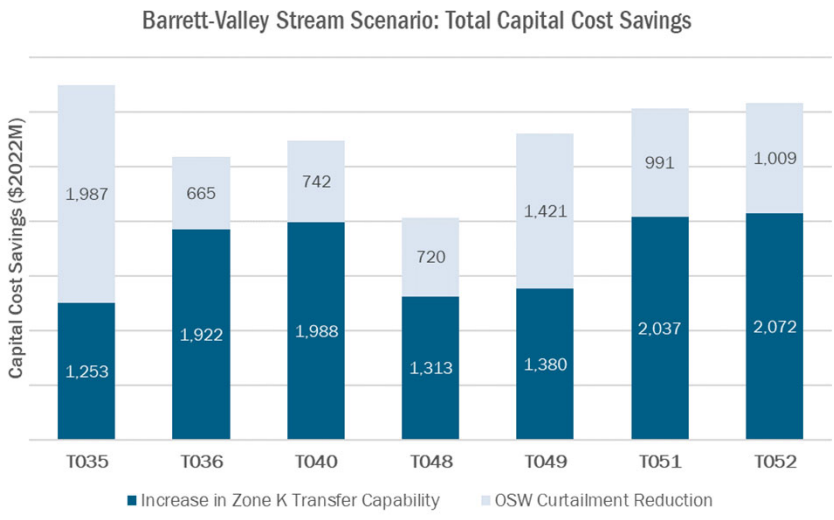
Avoided Cost Assessment

- **The figures below portray the total capital cost savings associated with each project**
  - Capital cost savings associated with **OSW Curtailment Reduction** are primarily driven by a decrease in the total amount of UPV capacity built as compared to the pre-project case
  - Capital cost savings associated with the **Increased Import Capability** are driven by a decrease in the amount of DEFR capacity built in Long Island due to the project's ability to increase transfer capability to Long Island
    - Note: the total DEFR capacity statewide remains the same in each project case, as the DEFR capacity is shifted to upstate zones to satisfy the NYCA IRM





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Key Findings

- **Avoided capital cost savings are driven by a project's (1) ability to reduce OSW energy curtailment and subsequently increase offshore wind generation and (2) ability to increase transfer capability to Long Island**
  - Projects' ability to increase offshore wind generation displace between 0.9–2.7 GW of UPV capacity
  - Projects' ability to increase transfer capability to Long Island displace between 0.9–2.2 GW of DEFR capacity in Long Island
- **Projects enable between $2.0–3.2B of avoided capital cost savings through 2040 under this set of assumptions***

**Capital cost savings would be even higher if technology capital costs do not decline as assumed in the input assumptions*
**Capital cost savings could be higher or lower depending on the cost to build DEFRs*

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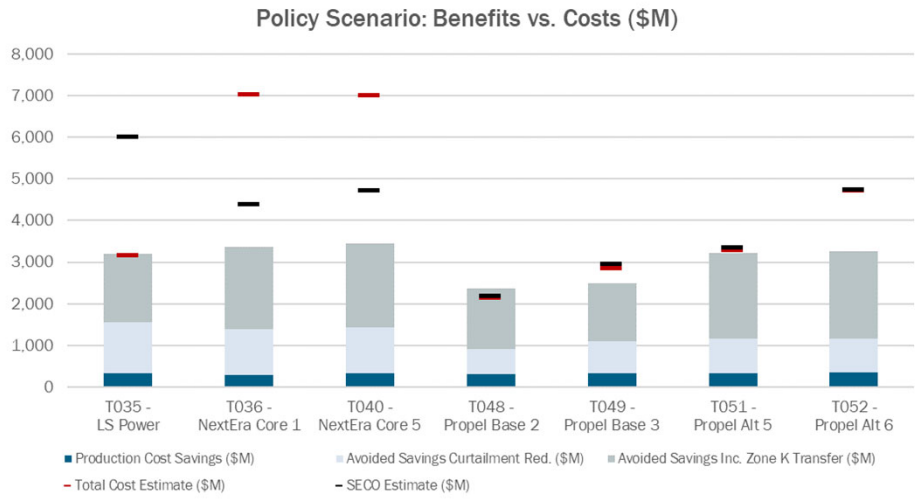
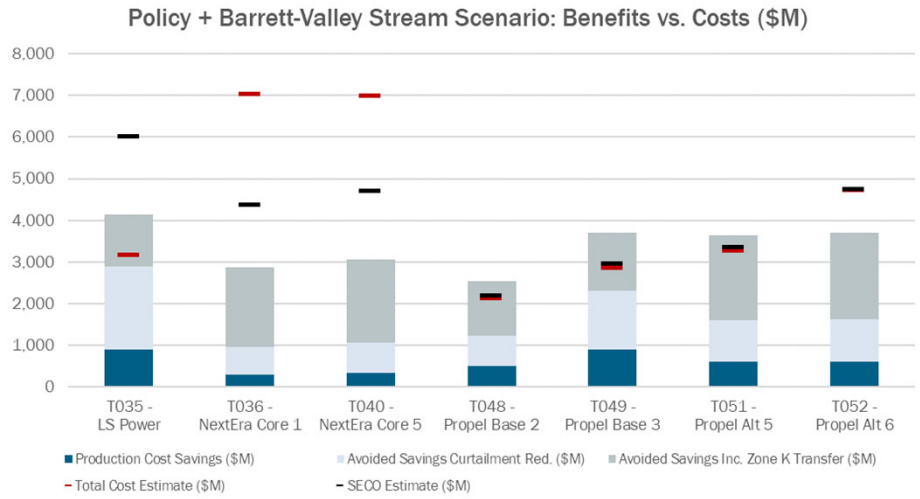
In Summary...





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Operability Sensitivity

Operability Sensitivity Review

- Sensitivity leverages Constraint Reliability Margin (CRM) to reserve transmission headroom to accommodate for variability between dispatch intervals
- Load/renewable forecast uncertainty would be in addition to the CRM
- The CRM was calculated using the net load ramp rate as below:

$$Net\ Load_i = Load_i\ - OSW\ gen_i - PV\ gen_i - BTM\ gen_i$$

$$Net\ Load\ Ramp_i = Net\ Load_i - Net\ Load_{i-1}$$

- The CRM was calculated by taking the 95th percentile of the Net Load Ramp for each year in the study period (2030, 2035, 2040 and 2045)

Year	P95 (MW)	P99 (MW)
2030	407	614
2035	544	788
2040	815	1228
2045	864	1289

- The CRM will be equally divided by the number of AC ties to NY zones from Long Island

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Transmission Operations– Transmission Reliability Margin

- Transmission Constraint Reliability Margin (CRM) is used in today's energy markets to account for unexpected or unscheduled changes or variability in load or power supplier output changes on the existing Long Island AC lines to Con Edison to manage reliable transmission operations
- For the future energy market, the expected increased variability on Long Island will result in increased CRM values, further reducing the AC line capability from and to Con Edison
- The CRM is a proxy for how a future grid may be operated based on the energy market constructs that exist today
- Additional transfer capability and production cost analysis were performed considering the impact of increased CRM values to provide an idea of how managing variability may impact the overall operability assessment of the projects

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Operability Range with Increased CRM

Project	Ranges (Without CRM)		Ranges (With CRM)		Differences	
	N1 Range	N2 Range	N1 Range	N2 Range	N1 Range	N2 Range
T035 – LSPower	4,505	2,275	3,905	2,025	-600	-250
T036 - NextEra Core 1	5,100	3,605	4,755	3,170	-345	-435
T040 - NextEra Core 5	5,210	3,695	4,735	3,145	-475	-550
T048 - Propel Base 2	3,180	1,750	2,810	1,590	-370	-160
T049 - Propel Base 3	3,635	2,245	3,130	1,915	-505	-330
T051 - Propel Alt 5	4,995	3,495	4,695	3,290	-300	-205
T052 - Propel Alt 6	6,390	5,205	6,205	5,025	-185	-180

- Certain projects—primarily those with multiple AC interconnections—tend to have better transfer limit performance under outage conditions when considering an increased level of CRM
  - A 600 MW CRM was utilized in the analysis

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Production Cost and Performance Results with Increased CRM

Project	Policy Case with Barrett-VS		Policy with Barrett-VS + P95 CRM Case	
	LI OSW Curtailment	Production Cost Savings (2022 $M)	LI OSW Curtailment	Production Cost Savings (2022 $M)
Pre-Project	15.8%	n/a	18.8%	n/a
T035 - LS Power	1.6%	$906	1.8%	$1,227
T036 - NextEra Core 1	8.0%	$291	8.0%	$634
T040 - NextEra Core 5	7.7%	$332	7.6%	$680
T048 - Propel Base 2	6.3%	$513	8.0%	$817
T049 - Propel Base 3	2.3%	$902	3.7%	$1,225
T051 - Propel Alt 5	4.5%	$609	4.6%	$956
T052 - Propel Alt 6	4.2%	$618	4.2%	$963

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Qualitative Cost Cap Assessment Criteria

Qualitative Cost Cap Assessment Criteria

- The tariff identifies three criteria to be used in the qualitative assessment for cost containment

1. Developer's Profit Motive – "The effectiveness of the proposed Cost Cap in providing an incentive to the developers to contain their Included Capital Costs"
   - How well aligned is the developer's incentive to maximize profits with cost minimization for consumers?
   - Generally tied tightly to the percentage of the proposed Cost Cap

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Qualitative Cost Cap Assessment Criteria

2. **Consumer Risk, Exposure & Uncertainty –"The effectiveness of the proposed Cost Cap in protecting ratepayers from Included Capital Cost overruns"**
   - Principally looking at the likelihood and magnitude of identified project risks in light of the protection from those overruns afforded to consumers by the developers' proposed Cost Cap
   - A comfortable buffer between the developer-submitted Cost Cap and independent cost estimates can help to alleviate concerns associated with identified project risks by ensuring adequate funding to overcome challenges during construction
   - This criterion needs to be considered in relation to the expected costs of the project and the absolute dollar risk a project may pose for consumers

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Qualitative Cost Cap Assessment Criteria

3. Expected Costs vs. Developer's Cap – "The magnitude of the difference between the Cost Cap and the independent cost estimate"

- Where a Cost Cap provided by a developer is significantly below the independent cost estimate, the developer's financial and technical qualifications and the severity of the cost cap inform the NYISO about the likelihood that the project can be constructed
- Conversely, where the developer's cost-contained estimate is significantly above the independent cost estimate, it must be considered whether the proposed Cost Cap will meaningfully contain capital costs
- This criterion needs to be considered in relation to the expected costs of the project and the absolute dollar differential

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Next Steps

Results Review Schedule

- April 17 Board Meeting: Developer presentations to NYISO Board of Directors
- April ESPWG: Detailed report appendices
- May: Report with recommended ranking

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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 April 19, 2023
- **Comments will be posted for stakeholder consideration**

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Questions?

Appendix

Renewable Generator Capital Cost Assumptions

Candidate Technology	Base Capital Cost ($2020)	Zonal Multiplier for Capital Costs							
		A	B	C	D	E	F	G	K
Utility PV	1,248	1.05	1.04	1.04	1.01	1.01	1.04	1.20	1.39
Land based wind	1,846	0.98	0.96	1.02	1.06	1.03	1.06	1.14	-

Candidate Technology	Base Capital Cost ($2020)	Technology Optimism Factors by Year				
		2020	2025	2030	2035	2040
Utility PV	1,248	1	0.81	0.62	0.59	0.56
Land based wind	1,846	1	0.90	0.79	0.75	0.71

**Capital cost estimates and zonal multipliers are based on the 2021 EIA Energy Outlook and Climate Action Council Integration Analysis*
**Technological optimism factors are applied to capital costs per NREL 2020-ATB-data*

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Renewable Generator Capital Cost Assumptions

Candidate Technology	Model Year	Capital Costs ($2020)							
		A	B	C	D	E	F	G	K
Utility PV	2020	1,310	1,298	1,298	1,260	1,260	1,298	1,498	1,735
Utility PV	2025	1,061	1,051	1,051	1,021	1,021	1,051	1,213	1,405
Utility PV	2030	812	805	805	781	781	805	929	1,076
Utility PV	2035	773	766	766	744	744	766	884	1,023
Utility PV	2040	734	727	727	706	706	727	839	971
Land based wind	2020	1,809	1,772	1,883	1,957	1,901	1,957	2,104	-
Land based wind	2025	1,628	1,595	1,695	1,761	1,711	1,761	1,894	-
Land based wind	2030	1,429	1,400	1,488	1,546	1,502	1,546	1,663	-
Land based wind	2035	1,357	1,329	1,412	1,468	1,426	1,468	1,578	-
Land based wind	2040	1,284	1,258	1,337	1,389	1,350	1,389	1,494	-

**Capital cost estimates and zonal multipliers are based on the 2021 EIA Energy Outlook and Climate Action Council Integration Analysis*

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DEFR Capital Cost Assumptions

- **Capital cost assumptions for DEFRs align with those assumed for Policy Case S2 in the 2021-2040 System & Resource Outlook**
  - Zonal multipliers are based on the 2021 EIA Energy Outlook and 2021-2025 Demand Curve Reset
  - Downstate zones have higher capital costs than upstate zone, which are reflective in the zonal multipliers

Candidate Technology	Base Capital Cost ($/kW)	Zonal Multipliers			
		A-F	GHI	J	K
DEFR (McMo)	4,500	1	1.14	1.39	1.30

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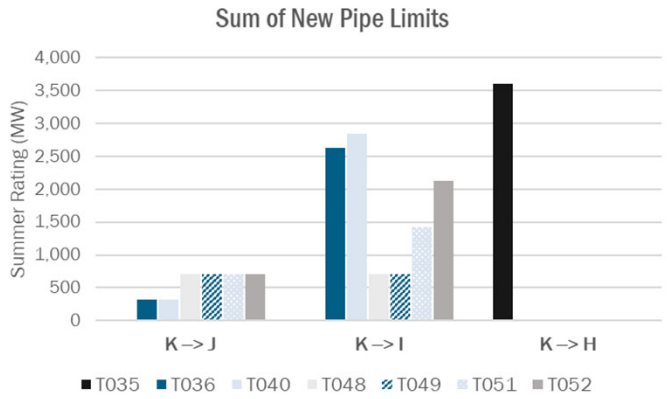
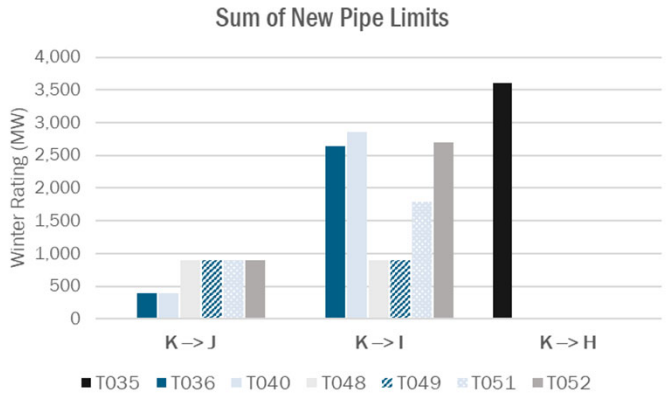
New Pipe Limits

Project	Sum of New Pipe Limits: Summer Rating (MW)		
	K –> J	K –> I	K –> H
T035	-	-	3,600
T036	324	2,634	-
T040	324	2,850	-
T048	709	709	-
T049	709	709	-
T051	709	1,418	-
T052	709	2,127	-

Project	Sum of New Pipe Limits: Winter Rating (MW)		
	K –> J	K –> I	K –> H
T035	-	-	3,600
T036	400	2,634	-
T040	400	2,850	-
T048	897	897	-
T049	897	897	-
T051	897	1,794	-
T052	897	2,691	-





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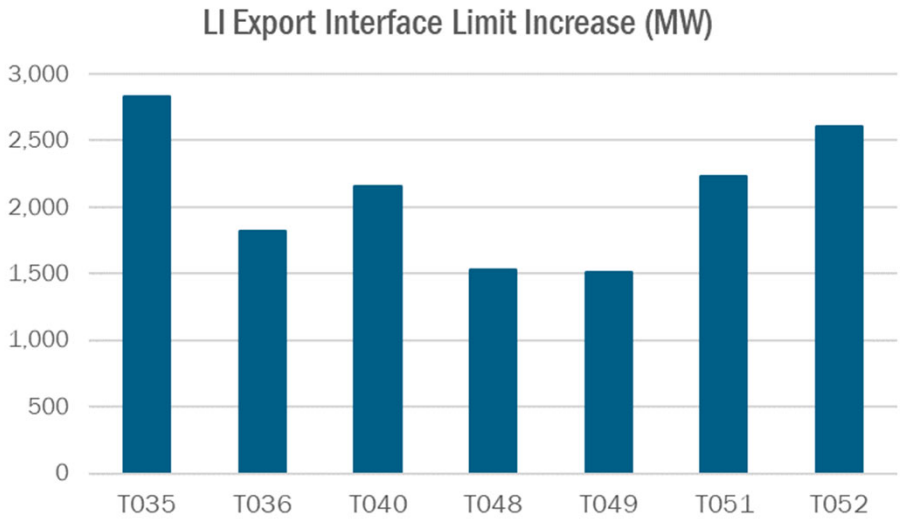
Long Island Export Limits Used in TSL Floor Calculations

Case	LI Export (MW)	LI Export Increase (MW)
Pre-Project	1,081	-
T035	3,910	2,829
T036	2,904	1,823
T040	3,238	2,157
T048	2,609	1,528
T049	2,595	1,514
T051	3,309	2,228
T052	3,685	2,604



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Increased Zone K Transfer Capability

- The methodology described on slide 7 is based on the TSL Floor calculation used in the NYISO's LCR process
- See below for an example of the TSL floor calculation

Transmission Security Limit Calculation	Formula	G-J	NYC	LI	Notes
Load Forecast (MW)	[A] = Given	15,407	11,285	5,133	[1]
Bulk Power Transmission Limit (MW)	[B] = Studied	3,425	2,875	325	[2]
UCAP Requirement (MW)	[C] = [A]-[B]	11,982	8,410	4,808	
UCAP Requirement Floor	[D] = [C]/[A]	77.8%	74.5%	93.7%	
5-Year Derating Factor	[E] = Given	5.4%	4.5%	6.3%	[3]
Special Case Resources (MW)	[F] = Given	496.6	417.5	33.7	[4]
ICAP Requirement (MW)	[G] = ([C]/(1-[E]))+[F]	13,162	9,224	5,165	
ICAP Requirement Floor (%)	[H] = [G]/[A]	85.4%	81.7%	100.6%	

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Operability Sensitivity – Outage Transfer Limits

Import with Barrett						
	No CRM			With CRM		
Project	All Lines In	N1	N2	All Lines In	N1	N2
T035 - LSPower	2,720	2,080	3,220	2,200	1,770	1,410
T036 - NextEra Core 1	3,400	2,950	3,405	3,350	2,920	2,105
T040 - NextEra Core 5	3,420	3,075	3,410	3,410	2,910	2,095
T048 - Propel Base 2	2,910	2,180	3,440	2,530	1,900	1,315
T049 - Propel Base 3	3,140	2,325	3,415	2,775	2,015	1,415
T051 - Propel Alt 5	3,465	3,145	3,420	3,465	2,900	2,120
T052 - Propel Alt 6	3,460	3,255	3,460	3,460	3,255	2,785

Export with Barrett						
	No CRM			With CRM		
Project	All Lines In	N1	N2	All Lines In	N1	N2
T035 - LSPower	3,350	2,425	865	3,050	2,135	615
T036 - NextEra Core 1	3,055	2,150	1,230	2,650	1,835	1,065
T040 - NextEra Core 5	3,095	2,135	1,215	2,815	1,825	1,050
T048 - Propel Base 2	1,795	1,000	285	1,570	910	275
T049 - Propel Base 3	2,145	1,310	635	1,910	1,115	500
T051 - Propel Alt 5	2,625	1,850	1,175	2,500	1,795	1,170
T052 - Propel Alt 6	3,850	3,135	2,420	3,655	2,950	2,240

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