SUBSTATION ENGINEERING COMPANY

AC Transmission New York Public Policy Transmission Need

Technical Review Report

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1. Introduction

This report documents the technical evaluation of the thirteen proposals submitted to the New York State Independent System Operator, Inc. ("NYISO") to satisfy the AC Transmission Public Policy Transmission Need (AC Transmission PPTN) that the New York Public Service Commission ("NYPSC") identified in December 2015. In its October 27, 2017 Viability and Sufficiency Assessment Report, the NYISO reported that the thirteen proposals were viable and would be able to satisfy the public policy transmission need criteria. Four Developers submitted proposals including National Grid/Transco ("NGRID"), NextEra Energy Transmission New York ("NextEra"), North American Transmission ("NAT") and New York Power Authority ("NYPA") collectively ("NAT/NYPA"), and ITC. The thirteen proposals evaluated are:

SEGMENT A

Proposal Number	Developer	Description
T018	National Grid/Transco (NGRID)	Base proposal
T021	NextEra Energy Transmission New York	Base Proposal
T025	North America Transmission/New York Power Authority (NAT/NYPA)	765kV Proposal
T026	North America Transmission/New York Power Authority (NAT/NYPA)	Base Proposal
T027	North America Transmission/New York Power Authority (NAT/NYPA)	Double Circuit
T028	North America Transmission/New York Power Authority (NAT/NYPA)	Enhanced
T031	ITC	Base Proposal

SEGMENT B

Proposal Number	Developer	Description
T019	National Grid/Transco (NGRID)	Base Proposal
T022	NextEra Energy Transmission New York	Base Proposal
T023	NextEra Energy Transmission New York	Alternative
T029	North America Transmission/New York Power Authority (NAT/NYPA)	Base Proposal
T030	North America Transmission/New York Power Authority (NAT/NYPA)	Enhanced
T032	ITC	Base Proposal

The primary scope and requirements of the AC Transmission PPTN, as identified and described in the NYPSC Order issued on December 17, 2015, is development and construction of the following facilities:

SEGMENT A: Edic/Marcy to New Scotland; Princetown to Rotterdam

Construction of new 345 kV line from Edic or Marcy to New Scotland on existing right-of-way (primarily using Edic to Rotterdam right-of-way west of Princetown); construction of two new 345 kV lines or two new 230 kV lines from Princetown to Rotterdam on existing Edic to Rotterdam right-of-way; decommissioning of two 230 kV lines from Edic to Rotterdam; related switching or substation work at Edic or Marcy, Princetown, Rotterdam and New Scotland.

SEGMENT B: Knickerbocker to Pleasant Valley

Construction of a new double circuit 345 kV/115 kV line from Knickerbocker to Churchtown on existing Greenbush to Pleasant Valley right-of-way; construction of a new double circuit 345 kV/115 kV line or triple circuit 345 kV/115 kV/115 kV line from Churchtown to Pleasant Valley on existing Greenbush to Pleasant Valley right-of-way; decommissioning of a double-circuit 115 kV line from Knickerbocker to Churchtown; decommissioning of one or two double-circuit 115 kV lines from Knickerbocker to Pleasant Valley; construction of a new tap of the New-Scotland-Alps 345 kV line and new Knickerbocker switching station; related switching or substation work at Greenbush, Knickerbocker, Churchtown and Pleasant Valley substations.

In addition to the Segments A and B, the NYPSC also identified in the AC Transmission PPTN upgrades to the Rock Tavern Substation and the rebuild of the Shoemaker to Sugarloaf with a new double circuit 138 kV and related substation work at Shoemaker, Hartley, South Goshen, Chester, and Sugarloaf.

The evaluation conducted by the review team included review of the thirteen proposals received from the NYISO, as well as responses to the Requests For Information (RFIs) issued to the Developers in June, September, and November 2017.

The review team's evaluation focused on the following areas:

- Site review and "walk down" of proposed sites and routes to evaluate their constructability and identify potential issues with the proposed design, siting and routing;

- Review of the environmental and permitting requirements for the project as proposed by Developers and identify gaps and issues, which were completed predominately using "desktop" analysis supplemented with occasional field review;
- Evaluate completeness and reasonableness of the proposed project schedules and sequencing plans, including identification of potential issues associated with delay in obtaining permits for and construction of the proposed project;
- Evaluate the Developer's cost estimates by preparing independent cost estimates for each project;
- Review, identify and estimate real estate requirements;
- Identify risks associated with the projects;
- Determine expandability of proposed project;
- Assess the Developer's plans for site control; and
- Evaluate the Developer's operating plan.

The review team's evaluation did not include further evaluation of Developers' qualifications or credentials beyond the screening performed earlier in the process.

2. Executive Summary

This technical review focused primarily on schedule, cost, identifiable risks, the ability to expand on the project in the future, site control plan and availability of Rights of Way ("ROW"), and the operating plan provided by each Developer. Below is a brief summary of our findings. Please see the remainder of the report for further detail.

2.1. Schedule

Each Developer's schedule for permitting and construction of its project was evaluated based on the review team's collective experience with transmission projects sited by the New York State Public Service Commission ("NYPSC") under Article VII of the New York State Public Service Law and constructed in New York State. A review of recent Article VII electric transmission project timelines was completed to identify comparable schedules for obtaining permits and approvals needed to begin construction. The review team also estimated the amount of time required to procure equipment, construct the facilities, and test and commission the facilities in order to be placed into service. A summary of the expected durations for each Developer's proposed scope is detailed in the table below:

Segment A Proposals	**Developer Proposed Total Duration**	**Estimated Minimum Duration (Note #1 and #2)**
T018 NGRID/Transco Segment A	48 Months	48 Months
T021 NextEra Segment A	29 Months	48 Months
T025 NAT/NYPA Segment A + 765kv	44 Months	50 Months
T026 NAT/NYPA Segment A Base	44 Months	48 Months
T027 NAT/NYPA Segment A Double Circuit	48 Months	51 Months
T028 NAT/NYPA Segment A Enhanced	44 Months	48 Months
T031 ITC Segment A	39 Months	48 Months
Segment B Proposals	**Developer Proposed Total Duration**	**Estimated Minimum Duration (Note #1)**
T019 NGRID/Transco Segment B	48 Months	45 Months
T022 NextEra Segment B	28 Months	43 Months
T023 NextEra Segment B - Alt	29 Months	45 Months
T029 NAT/NYPA Segment B Base	40 Months	45 Months
T030 NAT/NYPA Segment B Enhanced	41 Months	45 Months
T032 ITC Segment B	53 Months	47 Months

Note #1: "Estimated Minimum Duration" is calculated using the anticipated time for Article VII application preparation, the anticipated time for the Article VII approval process, ROW procurement where significant and the anticipated time for construction of the project. The review team also assumed that the Environmental Management and Construction Plan (EM&CP) preparation is completed and ready for submission when the Article VII certificate is received. All of these components will depend on the experience and the level of resources of the developer and the complexity of the project which is further discussed in the risk register. In order to establish a reasonable normal schedule for the purpose of establishing an in-service date an additional four months should be added to the estimated minimum duration.

Note #2: For the Edic to Princetown portion of Segment A, all Developers are proposing to use existing NYPA-owned transmission line structures for about 12.5 miles of their proposed projects. If detailed engineering indicates that the existing structures are inadequate and need to be replaced, the construction schedule may increase by about 4 months however; this would be consistent across all proposed projects.

2.2. Cost

In evaluating the construction cost of each proposal, Kenny Construction ("Kenny") prepared independent estimates for each proposal. Kenny reviewed the Developers' proposals with the costs redacted. GEI Consultants, Inc. estimated the environmental licensing and permitting costs. The results are shown below:

SEGMENT A (SUMMARY OF ESTIMATES COMPARISON WITH 30% OF CONTINGENCY)

Developer	Independent Estimate (2018 $)
T018 National Grid/ NY Transco	$521,137,870
T021 NextEra Energy	$495,730,704
T025 NYPA / NAT (Base+765kV)	$856,540,677
T026 NYPA / NAT (Base)	$487,016,692
T027 NYPA / NAT (Double Ckt)	$735,795,772
T028 NYPA / NAT (Enhanced)	$510,346,975
T031 ITC	$573,503,440

SEGMENT B (SUMMARY OF ESTIMATES COMPARISON WITH 30% OF CONTINGENCY)

Developer	Independent Estimate (2018 $)
T019 National Grid/ NY Transco	$443,800,261
T022 NextEra Energy	$357,285,084
T023 NextEra Energy (Alternate)	$389,345,587
T029 NYPA / NAT (Base)	$384,129,650
T030 NYPA / NAT (Enhanced)	$404,544,694
T032 ITC	$493,985,791

SEGMENT B (SUMMARY OF ESTIMATES COMPARISON WITH 30% OF CONTINGENCY and Global Addition of $113M)

Developer	Independent Estimate (2018 $)
T019 National Grid/ NY Transco	$556,800,261
T022 NextEra Energy	$470,285,084
T023 NextEra Energy (Alternate)	$502,345,587
T029 NYPA / NAT (Base)	$497,129,650
T030 NYPA / NAT (Enhanced)	$517,544,694
T032 ITC	$606,985,791

Notes:

1. Independent Estimates are adjusted to 2018 U.S. Dollars.
2. The estimates include the contingency rate of 30% included on the DPS estimate template. The review team has assumed the contingency to include allowance for unanticipated costs and estimating accuracy to forecast a reasonable worst case cost.
3. The Global Addition includes upgrades to the Rock Tavern Substation and the rebuild of the Shoemaker to Sugarloaf with a new double circuit 138 kV and related substation work at Shoemaker, Hartley, South Goshen, Chester, and Sugarloaf identified by the NYPSC in the AC Transmission Proceedings.

2.3. Risk

2.3.1. The review team completed a review of the potential risks associated with the proposals' schedules and cost, focusing on the most significant drivers, which include:

- Article VII review approval process and potential environmental issues
- Procurement of major equipment
- Construction
- Site Control and procurement of real estate
- Operational Plan

2.3.2. The proposals share many risks in common such as potential delays in preparation and approval of regulatory licenses and permits.

2.3.3. The most significant risks associated with the proposals are identified as follows:

SEGMENT A

- Need to obtain additional easements for exceedance of EMF levels. The existing corridor (345kV Lines #14 and #18, and 115kV Line #13) between Princetown Junction and New Scotland Substation currently is currently estimated to exceed NYS PSC guidelines for

EMF levels. The proposed designs improve the condition, but EMF levels are still estimated to exceed the guidelines for all proposals except T027 (NYPA/NAT Double Circuit). EMF levels will have to be confirmed during detailed engineering and may result in purchasing EMF easements from property owners along the ROW between Princetown and New Scotland.

- For proposal T025 (NYPA/NAT proposal to convert the existing line to 765kV) there is a significant risk to the project's cost and schedule due to (i) potential public opposition, (ii) the potential need to replace the transmission line hardware due to potential corona issues and (iii) additional EMF concerns due to the higher operating voltage of the facility. An allowance was added to the independent estimate to account for the potential cost of mitigation.

SEGMENT B

- While the NYPSC encouraged that new structures have minimal increase in height, the construction of new structures even with minimal increase in height may result in public opposition due to their visual impact.

2.4. Expandability

2.4.1. The review team evaluated the potential for future expansion of the proposed transmission solutions to increase their capacity. Many of the more common design approaches that could be employed on a transmission project to afford future expandability are not applicable since the objective of this project is to utilize existing transmission rights-of-way (ROW) and property. Much of the existing transmission ROW will be fully utilized in construction of this project but there is some opportunity for expansion described below.

2.4.1.1. All proposals for Segment A involve replacement of the existing Porter-Rotterdam 230 kV circuits #30 and #31 with a single Edic to New Scotland 345kV line. This will provide space for future use of the existing ROW and may allow the addition of another circuit from Edic/Porter to Princetown Junction. During detailed engineering the placement of structures should be optimized to maximize the remaining ROW.

2.4.1.2. The proposed new substations provide the potential for future line terminal and transformer additions.

2.5. Site Control and Real Estate

2.5.1. In all of the proposals, the following is common for the property rights acquisition process:

- All Developers propose to use existing ROW for their transmission facilities.

- Some additional real estate is required for new substation construction at Princetown Junction.
  - NextEra's project (T021) proposes a new greenfield site located between Princetown Junction and Rotterdam, and has an option to purchase the real estate for the substation.
  - ITC's project (T031) proposes a larger substation at Princetown Junction than the substations proposed by other projects, and will require additional property acquisition.
- All Developers have completed preliminary routing of their proposed lines.
- All Developers have documented plans to obtain site control.

2.5.2. The non-incumbent Developers all claim common rights in obtaining real property:

- The Developers cite to the NYPSC's December 17, 2015 order in the AC Transmission proceedings (Case Nos. 12-T-0502, *et al.*) as requiring incumbent utilities to engage in non-discriminatory, good faith negotiation of terms in obtaining the right to use an incumbent utility's ROW. The Order further stated that "incumbent utilities should offer competitors the same terms they offer Transco; there should be no bias shown to Transco."

2.6. Operational Plan

2.6.1. The review team conducted a review of the Developers' operations and maintenance plans associated with the proposals. The review team did not identify any major flaws with the Developer's plans and the plans are essentially the same.

2.6.2. For the non-incumbent Developer proposals, the following aspects are common:

- The Developers stated that all O&M activities will comply with required NERC regulations.
- Proposed facilities will have real-time reporting of operating data.

2.6.3. The non-incumbent Developers proposed the following arrangements for Control Center services:

- ITC proposes to use their Control Center in Novi MI. to provide control center services.
- NextEra proposes to construct a physical control center in New York to provide control center services.
- NAT/NYPA proposed to utilize the NYPA Control Center for control center services.

3. Discussion of Proposals

Brief descriptions of the proposed projects are provided below.

SEGMENT A

3.1. T018 - NGRID/Transco – New Energy Solution Segment A

NGRID/Transco proposal T018 includes the following major work items:

- New Rotterdam 345 kV Substation (Converted from 230 kV); Two New 345/115 kV transformers; New 345/230 kV transformer; New 135 MVAr Capacitor Bank
- New Scotland 345 kV Substation Upgrade and Expansion
- New Overhead Edic – New Scotland 345 kV line
- Two New Overhead Princetown Junction – Rotterdam 345 kV lines (Princetown Junction taps existing Edic – New Scotland 345 kV)
- Retire two existing Porter – Rotterdam 230 kV lines

3.2. T021 – NextEra – Enterprise Line - Segment A

NextEra proposal T021 includes the following major work items:

- New 345/230kV Princetown Substation (taps existing Marcy – New Scotland 345 kV line); Two New 345/230kV transformers
- Two New Overhead Princetown – Rotterdam 230 kV lines
- New Overhead Edic – New Scotland 345 kV line
- Retire two existing Porter – Rotterdam 230 kV lines

3.3. T025 – NAT/NYPA - Segment A – A + 765 KV

NAT/NYPA "Segment A + 765 KV" proposal T025 includes the following major work items:

- New Knickerbocker 765/345 kV Substation (taps existing New Scotland – Alps 345 kV line); Two New 765/345 kV transformers
- New Rotterdam 345 kV Substation (Converted from 230 kV, taps existing Edic – New Scotland 345 kV line); Two New 345/115 kV transformers; New 345/230 kV transformer
- New Princetown 345 kV Switching Station (taps existing Edic – New Scotland 345 kV line)
- New Overhead Edic – Princetown – New Scotland 345 kV line
- Terminal Upgrades at Marcy 345 kV and Edic 345 kV
- Convert existing Marcy – New Scotland – Alps 345 kV line to Marcy – Knickerbocker 765 kV line (Knickerbocker – Alps section remains operated at 345 kV)
- Retire two existing Porter – Rotterdam 230 kV lines

3.4. T026 – NAT/NYPA - Segment A - Base

NAT/NYPA Segment A "Base" proposal T025 includes the following major work items:

- Retire Porter to Rotterdam 230kV lines #30 and #31
- New Rotterdam 345 kV Substation with 2 new 345/115 kV transformers and 1 new 345/230 kV transformer
- New Edic to New Scotland 345kV transmission line (double-bundle)
- Loop existing Edic to New Scotland 345kV line #14 to Rotterdam 345kV substation with 2 new transmission lines
- Terminal upgrades at Marcy and Edic
- New Scotland 345 kV Substation reconfiguration

3.5. T027 – NAT/NYPA Segment A - Double Circuit

NAT/NYPA proposal T027 includes the following major work items:

- Retire Porter to Rotterdam 230kV lines #30 and #31
- New Rotterdam 345 kV Substation with 2 new 345/115 kV transformers(lower impedance) and 1 new 345/230 kV transformer
- Two new Edic to New Scotland 345kV transmission lines
- Loop existing Edic to New Scotland 345kV line #14 to Rotterdam 345kV substation with 2 new transmission lines
- New Princetown switching station, tapping the two new Edic-New Scotland lines and the Rotterdam - New Scotland 345kV line
- Terminal upgrades at Marcy and Edic
- New Scotland 345 kV Substation reconfiguration
- Retire Rotterdam to New Scotland 115 kV line

3.6. T028 – NAT/NYPA Segment A - Enhanced

NAT/NYPA proposal T028 includes the following major work items:

- Retire Porter to Rotterdam 230kV lines #30 and #31
- New Rotterdam 345 kV Substation with 2 new 345/115 kV transformers(lower impedance) and 1 new 345/230 kV transformer
- New Edic to New Scotland 345kV transmission line (double-bundle)
- Loop existing Edic to New Scotland 345kV line #14 to Rotterdam 345kV substation with 2 new transmission lines
- New Princetown switching station, tapping the new Edic-New Scotland and the Rotterdam - New Scotland 345kV lines
- Terminal upgrades at Marcy and Edic
- New Scotland 345 kV Substation reconfiguration

3.7. T031 – ITC Segment A - 16NYPP1-1A

ITC's "16NYPP1-1A" proposal T031 includes the following major work items:

- New Princetown 345 kV Switching Station (taps existing Marcy – New Scotland 345 kV and Edic – New Scotland 345 kV lines)
- New Rotterdam 345 kV Switching Station Expansion; Two New 345/230 kV transformers
- New Overhead Edic – Princetown 345 kV line
- New Overhead Princetown – New Scotland 345 kV line
- Two New Overhead Princetown – Rotterdam 345 kV lines
- Rebuild Princetown – New Scotland 345 kV line (existing Edic – New Scotland 345 kV line)
- Retire two existing Porter – Rotterdam 230 kV lines

SEGMENT B

All Segment B projects include terminal upgrades for Coopers Corners – Rock Tavern 345 kV lines to be performed by Central Hudson, and upgrades on Shoemaker – Sugarloaf to be performed by Orange & Rockland.

3.8. T019 – NGRID/Transco – New Energy Solution Segment B

NGRID/Transco's proposal T019 includes the following major work items:

- New Knickerbocker 345 kV Switching Station (taps existing New Scotland – Alps 345 kV line)
- Rebuild Churchtown 115 kV Switching Station
- Upgrade Pleasant Valley 345 kV and 115 kV substations; Two 135 MVAr Capacitor Banks at Pleasant Valley 345 kV
- Terminal Upgrades Roseton 345 kV (for Roseton – East Fishkill 345 kV line)
- Terminal Upgrades New Scotland 345 kV (for proposed New Scotland – Knickerbocker 345 kV line)
- New Overhead 345/115 kV double-circuit Knickerbocker – Pleasant Valley line (reconductor portions of the 115 kV line); 50% Series Compensation at Knickerbocker 345 kV
- Multiple retirements and reconfigurations on 115 kV lines between Greenbush – Pleasant Valley 115 kV

3.9. T022 – NextEra – Enterprise Line - Segment B

NextEra's proposal T022 includes the following major work items:

- New Knickerbocker 345kV Switching Station (taps existing New Scotland – Alps 345 kV line)
- New North Churchtown 115kV Switching Station (taps existing Churchtown – Valkin 115 kV line)
- New overhead 345kV line from Knickerbocker to Pleasant Valley. Line is double-circuit 345/115kV between Knickerbocker and Churchtown (new 115 kV line terminates at North Churchtown).
- Rebuild Greenbush – North Churchtown 115 kV line
- Multiple retirements and reconfigurations on 115 kV lines between Greenbush – Pleasant Valley 115 kV

3.10. T023 – NextEra– Enterprise Line Segment B

NextEra's proposal T023 builds on T022 by adding:

- Additional 115 kV upgrades between Churchtown - Pleasant Valley (Retires the 115 kV line from Churchtown-Pleasant Valley and extends the new 345/115 kV double circuit from Churchtown to Pleasant Valley) .

3.11. T029 – NAT/NYPA Segment B - Base

NAT/NYPA proposal T029 includes the following major work items:

- New Knickerbocker 345 kV Switching Station (taps existing New Scotland – Alps 345 kV line)
- Rebuild Churchtown 115 kV Switching Station
- New Overhead double-circuit Knickerbocker – Pleasant Valley 345/115 kV line (345 kV line is double-bundled)
- Multiple retirements and reconfigurations on 115 kV lines between Greenbush – Pleasant Valley 115 kV
- Replace Middletown Tap 345/138 kV transformer and reconductor Shoemaker tap to Shoemaker 138 kV line

3.12. T030 – NAT/NYPA Segment B - Enhanced

NAT/NYPA Segment B "Enhanced" proposal T030 includes the following major work items:

- New Knickerbocker 345 kV Switching Station (taps existing New Scotland – Alps 345 kV line)
- Rebuild Churchtown 115 kV Switching Station
- New Overhead double-circuit Knickerbocker – Pleasant Valley 345/115 kV line (345 kV line is triple-bundled)

- Multiple retirements and reconfigurations on 115 kV lines between Greenbush – Pleasant Valley 115 kV
- Replace Middletown Tap 345/138 kV transformer and reconductor Shoemaker tap to Shoemaker 138 kV line

3.13. T032 – ITC Segment B - 16NYPP1-1B

ITC Segment B "16NYPP1-1B" proposal T032 includes the following major work items:

- New Knickerbocker 345 kV and new Knickerbocker 115 kV Switching Station (taps existing New Scotland – Alps 345 kV and Greenbush – Pleasant Valley 115 kV, respectively)
- New Overhead double-circuit Knickerbocker – Pleasant Valley 345/115 kV line (triple–circuit 345/115/115 kV from Churchtown – Pleasant Valley)
- Terminal Upgrades at multiple 115 kV Substations: Greenbush 115 kV, Hudson 115 kV, LaFarge 115 kV, North Catskill 115 kV, Milan 115 kV
- Multiple retirements and reconfigurations on 115 kV lines between proposed Knickerbocker – Pleasant Valley 115 kV

4. Evaluation

4.1. Schedule

In evaluating the schedule for the proposed projects, the NYISO OATT section 31.4.8.1.7 provides the following evaluation criteria: "The potential issues associated with delay in constructing the proposed regulated Public Policy Transmission Project consistent with the major milestone schedule and the schedule for obtaining any permits and other certifications as required to timely meet the need."

The review team has completed an evaluation of the schedules submitted with each proposal. In its evaluation of the proposals, the review team leveraged its collective experience with the development, construction and maintenance of transmission line and substation projects in New York State, and compared the proposed schedules to actual Article VII electric transmission projects completed in New York.

Several Developers appear to assume that the selected project or projects could be subject to an expedited Article VII process. Since the NYPSC has not ruled on whether the expedited review process will be available for a specific project's application for an Article VII certification, this analysis is based on standard historical durations for siting review. Our conclusion for the Article VII process minimum durations based upon "best case" assumptions is as follows:

Task	Duration based on construction primarily on Existing ROW
Prepare and submit complete Article VII application (estimate)	6 mo.
PSC issue Certificate (minimum based on past comparable Article VII projects)	12 mo.
Prepare and submit EM&CP (best case: assumes no major changes to design required in Certificate, and prepared during Article VII proceedings)	0 mo.
DPS review and approve EM&CP (based on past comparable Article VII projects)	6 mo.
Total: Best Case Submit Article VII application until Start Construction	18 mo.
Total: Best Case Prepare Article VII application until Start Construction	24 mo.

The main drivers to the project schedule durations considered were:

- Article VII licensing process
- Procurement of major equipment
- Real Estate requirements
- Construction requirements.

The project minimum durations discussed in this evaluation assume that preparation of the Article VII application and real estate procurement negotiations will begin at the time the project is awarded to the Developer and that any preliminary work required has already been completed by the Developer prior to that date. Likewise, the review team assumes that work to file the first EM&CP segment is complete prior to receipt of Article VII Certificate and there are no major changes to the project's design required in the Article VII Certificate.

The review team developed Gantt chart schedules for each project to show a reasonable time line for each proposal, and appended them to this report as Attachment A.

An evaluation of the construction component of the proposals was completed by Kenny Construction.

Considering that the evaluation focused on establishing reasonable minimum schedule durations, the review team also recommended that some float be added to the schedule to establish a reasonable schedule recognizing the potential for minor delays for the purpose of determining the in-service date once a project is selected. The review team recommends adding 4 months total to each minimum schedule to account for the following float:

- Two months to the construction schedule for each proposal to account for typical slippage of construction activities (*i.e.*, potential weather events, delays if construction crews are needed to respond and provide storm support, unanticipated material and equipment issues, and inability to obtain outages on a timely basis); and
- Two months to the schedule for licensing and permitting activities between the NYPSC issuing the Article VII Certificate and the submittal of the EM&CP to account for possible delays in submitting the EMCP should the PSC require changes to the plan submitted in the application.

Summarized below are the review team's findings for Segment A:

4.1.1. National Grid/Transco Proposal T018 – Segment A

- The Developer included 5 months for Article VII application preparation. Based on experience the review team allocated six months.
- Overall Article VII process schedule is adequate.
- Time for procurement of major equipment is adequate.
- The project is to utilize ROW owned by National Grid and some additional easement to satisfy EMF requirements. The review team believes the Developer has adequate time in its schedule to acquire ROW.
- Overall Construction schedule is adequate.
- The proposed project duration is 48 months. The review team believes that is adequate for this project.

4.1.2. NextEra Proposal T021 – Segment A

- The Developer included six months for Article VII application preparation. Based on experience the review team believes that to be adequate.
- The Developer included nine months for the overall Article VII process (from submission of Article VII application to EM&CP approval). Based on comparable Article VII projects the review team believes that process will take at least 18 months.
- NextEra's schedule is showing that it expects substation EM&CP approval in about 3 months to allow for an earlier start on substation construction. Approval is unlikely to

be granted that quickly and the review team believes that approval will take a minimum of six months.

- Time for procurement of major equipment is adequate.
- The project is to utilize existing ROW owned by National Grid and some additional easement to satisfy EMF requirements. The review team believes the Developer has adequate time in its schedule to acquire ROW.
- Overall Construction schedule includes 14 months. Based on experience with similar work the review team believes the work will take at least 24 months.
- Their proposed project duration is 29 months. The review team believes that at least 48 months will be required to complete this project.

4.1.3. NYPA/NAT Segment A

4.1.3.1. Proposal T025 – Segment A + 765kv Proposal

- The Developer included six months for Article VII application preparation. Based on experience the review team believes that to be adequate.
- The Developer included 13 months for the overall Article VII process (from submission of Article VII application to EM&CP approval). Based on comparable Article VII projects the review team believes that process will take at least 20 months. (Two additional months were added to the estimated minimum time period to account for anticipated additional issues associated with the 765 kV line.) The Developer's schedule is showing start construction at receipt of Article VII Certificate. At least six months will be required for EM&CP approval.
- Time for procurement of major equipment is adequate.
- The project is to utilize existing ROW owned by National Grid and some owned by NYPA as well as some additional easement to satisfy EMF requirements. The review team believes the Developer has adequate time in its schedule to acquire ROW.
- Overall Construction schedule is adequate.
- Their proposed project duration is 44 months. The review team believes that at least 50 months will be required to complete this project.

4.1.3.2. Proposal T026 – Segment A Base Proposal

- The Developer has included six months for Article VII application preparation. Based on experience the review team believes that to be adequate.

- The Developer has included 13 months for the overall Article VII process (from submission of Article VII application to EM&CP approval). Based on comparable Article VII projects the review team believes that process will take at least 18 months. The Developer's schedule is showing start construction at receipt of Article VII Certificate. At least six months will be required for EM&CP approval.
- Time for procurement of major equipment is adequate.
- The project is to utilize existing ROW owned by National Grid and some additional easement to satisfy EMF requirements. The review team believes the Developer has adequate time in its schedule to acquire ROW.
- Overall Construction schedule is adequate.
- The Developer's proposed project duration is 44 months. The review team believes that at least 48 months will be required to complete this project.

4.1.3.3. Proposal T027 – Segment A Double Circuit

- The Developer has included six months for Article VII application preparation. Based on experience the review team believes that to be adequate.
- The Developer has included 13 months for the overall Article VII process (from submission of Article VII application to EM&CP approval). Based on comparable Article VII projects the review team believes that process will take at least 18 months. The Developer's schedule is showing start construction at receipt of Article VII Certificate. At least six months will be required for EM&CP approval.
- Time for procurement of major equipment is adequate.
- The project is to utilize existing ROW owned by National Grid. The review team believes the Developer has adequate time in its schedule to acquire ROW.
- The Developer's overall Construction schedule of 29 months is adequate. The review team believes that a minimum of 27 months will be required.
- The Developer's proposed project duration is 48 months. The review team believes that at least 51 months will be required to complete this project.

4.1.3.4. Proposal T028 – Segment A Enhanced Proposal

- The Developer has included six months for Article VII application preparation. Based on experience the review team believes that to be adequate.

- The Developer has have included 13 months for the overall Article VII process (from submission of Article VII application to EM&CP approval). Based on comparable Article VII projects the review team believes that process will take at least 18 months. The Developer's schedule is showing start construction at receipt of Article VII Certificate. At least six months will be required for EM&CP approval.
- Time for procurement of major equipment is adequate.
- The project is to utilize existing ROW owned by National Grid and some additional easement to satisfy EMF requirements. The review team believes the Developer has adequate time in its schedule to acquire ROW.
- Overall Construction schedule is adequate.
- The Developer's proposed project duration is 44 months. The review team believes that at least 48 months will be required to complete this project.

4.1.4. ITC Proposal T031 Segment A

- Inconsistencies exist between ITC's Milestone Schedule Table, Text in Attachment B, and their Gantt Chart which show different dates and durations for their schedule. Attachment C Milestone Schedule Table was used to document the developer proposed durations.
- The Developer has included seven months for Article VII application preparation. Based on experience the review team believes that to be adequate
- The Developer has included 10 months for the overall Article VII process (from submission of Article VII application to EM&CP approval). Based on comparable Article VII projects the review team believes that process will take at least 18 months.
- Time for procurement of major equipment is adequate.
- The project is to utilize existing ROW owned by National Grid and some additional easement to satisfy EMF requirements. The review team believes the Developer has adequate time in its schedule to acquire ROW.
- Overall Construction schedule includes 22 months. Based on experience with similar work the review team believes the work will take at least 24 months.
- The Developer's proposed project duration is 39 months. The review team believes that at least 48 months will be required for this project.

Summarized below are the review team's findings for Segment B:

4.1.5. National Grid/Transco Proposal T019 – Segment B

- The Developer has included five months for Article VII application preparation. Based on experience the review team would allocate six months.
- Overall Article VII process schedule is adequate.
- Time for procurement of major equipment is adequate.
- The project is to utilize ROW owned by National Grid.
- Overall Construction schedule of 24 months is adequate. The review team estimates that a minimum of 21 months will be required.
- The Developer's proposed project duration is 48 months. The review team believes that is adequate for this project.

4.1.6. NextEra Segment B Proposals

4.1.6.1. NextEra Proposal T022 – Segment B

- The Developer has included six months for Article VII application preparation. Based on experience the review team believes that to be adequate.
- They have included 9 months for the overall Article VII process (from submission of Article VII application to EM&CP approval). Based on comparable Article VII projects the review team believes that process will take at least 18 months.
- NextEra's schedule is showing that it expects substation EM&CP approval in about three months to allow for an earlier start on substation construction. The review team believes that it is unlikely for approval to be granted that quickly and believe that approval will take a minimum of six months.
- Time for procurement of major equipment is adequate.
- The project is to utilize existing ROW owned by National Grid. The review team believes the Developer has adequate time in its schedule to obtain a lease.
- Overall Construction schedule includes 13 months. Based on experience with similar work the review team believes the work will take at least 19 months.
- The Developer's proposed project duration is 28 months. The review team believes that at least 43 months will be required to complete this project.

4.1.6.2. NextEra Proposal T023 – Segment B Alt

- The Developer has included six months for Article VII application preparation. Based on experience the review team believes that to be adequate.
- The Developer has included nine months for the overall Article VII process (from submission of Article VII application to EM&CP approval). Based on

comparable Article VII projects the review team believes that process will take at least 18 months.

- NextEra's schedule is showing that it expects substation EM&CP approval in about three months to allow for an earlier start on substation construction. The review team believes that it is unlikely for approval to be granted that quickly and believe that approval will take a minimum of six months.
- Time for procurement of major equipment is adequate.
- The project is to utilize existing ROW owned by National Grid. The review team believes the Developer has adequate time in its schedule to transfer ownership.
- Overall Construction schedule includes 14 months. Based on experience with similar work the review team believes the work will take at least 21 months.
- The Developer's proposed project duration is 29 months. The review team believes that at least 45 months will be required to complete this project.

4.1.7. NYPA/NAT Segment B Proposals

4.1.7.1. NYPA/NAT Proposal T029 - Segment B Base

- The Developer has included six months for Article VII application preparation. Based on experience the review team believes that to be adequate.
- The Developer has included 13 months for the overall Article VII process (from submission of Article VII application to EM&CP approval). Based on comparable Article VII projects the review team believes that process will take at least 18 months. The Developer's schedule is showing start construction at receipt of Article VII certificate. At least six months will be required for EM&CP approval.
- Time for procurement of major equipment is adequate.
- The project is to utilize existing ROW owned by National Grid. The review team believes the Developer has adequate time in its schedule to obtain a lease.
- Overall Construction schedule is adequate.
- The Developer's proposed project duration is 40 months. The review team believes that at least 45 months will be required for this project.

4.1.7.2. NYPA/NAT Proposal T030 – Segment B Enhanced

- The Developer has included six months for Article VII application preparation. Based on experience the review team believes that to be adequate.

- The Developer has included 13 months for the overall Article VII process (from submission of Article VII application to EM&CP approval). Based on comparable Article VII projects the review team believes that process will take at least 18 months. The Developer's schedule is showing start construction at receipt of Article VII certificate. At least six months will be required for EM&CP approval.
- Time for procurement of major equipment is adequate.
- The project is to utilize existing ROW owned by National Grid. The review team believe the Developer has adequate time in its schedule to obtain a lease.
- Overall Construction schedule is adequate.
- The Developer's proposed project duration is 41 months. The review team believes that at least 45 months will be required for this project.

4.1.8. ITC Proposal T032 – Segment B

- Inconsistencies exist between ITC's Milestone Schedule Table, Text in Attachment B, and their Gantt Chart which show different dates and durations for their schedule. Attachment C Milestone Schedule Table was used to document the developer proposed durations.
- ITC's schedule assumes that Segment A is to be constructed first followed by Segment B and that both segments cannot be constructed at the same time due to outage constraints. The Developer states that if that is not the case, its construction schedule for Segment B could be moved back by one year.
- The Developer has included seven months for Article VII application preparation. Based on experience the review team believes that to be adequate
- Overall Article VII process schedule is adequate.
- Time for procurement of major equipment is adequate.
- The project is to utilize existing ROW owned by National Grid. The review team believes the Developer has adequate time in their schedule to obtain a lease.
- Overall Construction schedule includes 19 months. Based on experience with similar work the review team believes the work will take at least 23 months.
- The Developer's proposed project duration is 53 months. The review team believes that 47 months is adequate for this project.

Conclusion

Based on its review, the review team estimates the following total project durations:

Segment A Proposals	Developer Proposed Total Duration	Estimated Minimum Duration (Note #1 and #2)
T018 NGRID/Transco Segment A	48 Months	48 Months
T021 NextEra Segment A	29 Months	48 Months
T025 NAT/NYPA Segment A + 765kv	44 Months	50 Months
T026 NAT/NYPA Segment A Base	44 Months	48 Months
T027 NAT/NYPA Segment A Double Circuit	48 Months	51 Months
T028 NAT/NYPA Segment A Enhanced	44 Months	48 Months
T031 ITC Segment A	39 Months	48 Months

Segment B Proposals	Developer Proposed Total Duration	Estimated Minimum Duration (Note #1)
T019 NGRID/Transco Segment B	48 Months	45 Months
T022 NextEra Segment B	28 Months	43 Months
T023 NextEra Segment B - Alt	29 Months	45 Months
T029 NAT/NYPA Segment B Base	40 Months	45 Months
T030 NAT/NYPA Segment B Enhanced	41 Months	45 Months
T032 ITC Segment B	53 Months	47 Months

Note #1: "Estimated Minimum Duration" is calculated using the anticipated time for Article VII application preparation, the anticipated time for the Article VII approval process, ROW procurement where significant and the anticipated time for construction of the project. The review team also assumed that the EM&CP preparation is completed and ready for submission when the Article VII Certificate is received. All of these components will depend on the experience and the level of resources of the developer and the complexity of the project which is further discussed in the risk register. In order to establish a reasonable normal schedule for the purpose of establishing an in-service date, an additional four months should be added to the estimated minimum duration.

Note #2: For the Edic to Princetown portion of segment A, all developers are proposing to reuse existing NYPA owned transmission line structures for about 12.5 miles. If detailed engineering indicates that the structures are not adequate and need to be replaced the construction schedule may increase by about 4 months however, this would be consistent across all proposed projects.

4.2. Cost

In evaluating the cost of proposed Public Policy Transmission Project, the NYISO OATT section 31.4.8.1.1 specifies the following criteria: "The capital cost estimates for the proposed regulated Public Policy Transmission Project, including the accuracy of the proposed estimates. For this evaluation, the Developer shall provide the ISO with credible capital cost estimates for its proposed project, with itemized supporting work sheets that identify all

material and labor cost assumptions, and related drawings to the extent applicable and available. The work sheets should include an estimated quantification of cost variance, providing an assumed plus/minus range around the capital cost estimate. The estimate shall include all components that are needed to meet the Public Policy Transmission Need. To the extent information is available, the Developer should itemize: material and labor cost by equipment, engineering and design work, permitting, site acquisition, procurement and construction work, and commissioning needed for the proposed project, all in accordance with Good Utility Practice. For each of these cost categories, the Developer should specify the nature and estimated cost of all major project components and estimate the cost of the work to be done at each substation and/or on each feeder to physically and electrically connect each facility to the existing system. The work sheets should itemize to the extent applicable and available all equipment for: (i) the proposed project, (ii) interconnection facilities (including Attachment Facilities and Direct Assignment Facilities), and (iii) Network Upgrade Facilities, System Upgrade Facilities, System Deliverability Upgrades, Network Upgrades, and Distribution Upgrades."

In evaluating the construction cost of each proposal, Kenny Construction ("Kenny") prepared independent estimates independent estimates of the construction costs for each proposal. In doing so, Kenny reviewed the Developers' proposals with the costs redacted. GEI Consultants, Inc. estimated the environmental licensing and permitting costs.

The estimates were prepared in accordance with the Association for the Advancement of Cost Engineering International Recommended Practice for Class 4 Accuracy. The expected accuracy range typically varies from a low of (-15% to -30%) and high of (+20% to +50%).

ESTIMATE CLASS	MATURITY LEVEL OF PROJECT DEFINITION DELIVERABLES Expressed as % of complete definition	END USAGE Typical purpose of estimate	METHODOLOGY Typical estimating method	EXPECTED ACCURACY RANGE Typical variation in low and high ranges
Class 4	1% to 15%	Study or feasibility	Equipment factored or parametric models	L: -15% to -30% H: +20% to +50%

The estimates include the contingency rate of 30% included on the DPS estimate template. The review team assumes the contingency to include allowance for unanticipated costs and estimating accuracy to forecast a reasonable worst case cost.

A summary of the results are shown below:

SEGMENT A (SUMMARY OF ESTIMATE COMPARISON)

Developer	Independent Estimate (2018 $)
T018 National Grid/ NY Transco	$400,875,285
T021 NextEra Energy	$381,331,311
T025 NYPA / NAT (Base+765kV)	$658,877,444
T026 NYPA / NAT (Base)	$374,628,225
T027 NYPA / NAT (Double Ckt)	$565,996,747
T028 NYPA / NAT (Enhanced)	$392,574,596
T031 ITC	$441,156,492

SEGMENT A (SUMMARY OF ESTIMATES COMPARISON WITH 30% OF CONTINGENCY)

Developer	Independent Estimate (2018 $)
T018 National Grid/ NY Transco	$521,137,870
T021 NextEra Energy	$495,730,704
T025 NYPA / NAT (Base+765kV)	$856,540,677
T026 NYPA / NAT (Base)	$487,016,692
T027 NYPA / NAT (Double Ckt)	$735,795,772
T028 NYPA / NAT (Enhanced)	$510,346,975
T031 ITC	$573,503,440

SEGMENT B (SUMMARY OF ESTIMATE COMPARISON)

Developer	Independent Estimate (2018 $)
T019 National Grid/ NY Transco	$341,384,816
T022 NextEra Energy	$274,834,680
T023 NextEra Energy (Alternate)	$299,496,606
T029 NYPA / NAT (Base)	$295,484,346
T030 NYPA / NAT (Enhanced)	$311,188,226
T032 ITC	$379,989,070

SEGMENT B (SUMMARY OF ESTIMATES COMPARISON WITH 30% OF CONTINGENCY)

Developer	Independent Estimate (2018 $)
T019 National Grid/ NY Transco	$443,800,261
T022 NextEra Energy	$357,285,084
T023 NextEra Energy (Alternate)	$389,345,587
T029 NYPA / NAT (Base)	$384,129,650
T030 NYPA / NAT (Enhanced)	$404,544,694
T032 ITC	$493,985,791

SEGMENT B (SUMMARY OF ESTIMATES COMPARISON WITH 30% OF CONTINGENCY and Global Addition of $113M)

Developer	Independent Estimate (2018 $)
T019 National Grid/ NY Transco	$556,800,261
T022 NextEra Energy	$470,285,084
T023 NextEra Energy (Alternate)	$502,345,587
T029 NYPA / NAT (Base)	$497,129,650
T030 NYPA / NAT (Enhanced)	$517,544,694
T032 ITC	$606,985,791

Notes:

1. Independent Estimates are adjusted to 2018 U.S. Dollars.
2. The estimates include the contingency rate of 30% included on the DPS estimate template. We have assumed the contingency to include allowance for unanticipated costs and estimating accuracy to forecast a reasonable worst case cost.
3. The Global Addition includes upgrades to the Rock Tavern Substation and the rebuild of the Shoemaker to Sugarloaf with a new double circuit 138 kV and related substation work at Shoemaker, Hartley, South Goshen, Chester, and Sugarloaf identified by the NYPSC in the AC Transmission Proceedings.

The following tables highlight the significant technical differences between the proposals that drive the differences in estimated costs.

Segment A					
Developer	Project	Major Technical Differences in Proposals			
		Princetown Substation	Rotterdam Substation	Transmission Lines	Other
NGRID/Transco	T018 Base	No	Rebuilds with GIS and includes 345kV Capacitor	Proposed heavier structures than NYPA/NAT, which has a similar design. Concrete foundations on all structures	
NextEra	T021 Base	Includes Princetown at new site. Includes (2) 345-230kV transformers and 230kV yard	No, retains existing Rotterdam	Monopole Design - less ROW rqd. Concrete Poles	
NYPA/NAT	T025 765kV	Yes	Rebuilds, no capacitor	Direct embedded tangent structures	765Kv line (converted from 345 kV) and new Knickerbocker 765kV substation
	T026 Base	No	Rebuilds, no capacitor		
	T027 Dbl Ckt	Yes, is GIS	Rebuilds, no capacitor	Double Circuit Edic to NS	
	T028 Enhanced	Yes	Rebuilds, no capacitor	Same as T026, but adds Princetown Sub	
ITC	T031 Base	Yes -with all 8 lines terminated.	Adds new 345/230 Transformers and retains existing station	Rebuilds #14 line from Princetown to NS. Has approx. 30% more trans structures	

Segment B					
Developer	Project	Major Technical Differences in Proposals			
		Churchtown Substation	Other Substations	Transmission Lines	Other
NGRID/Transco	T019 Base	Complete Rebuild	Includes 345 kV Series Comp at Knickerbocker, Capacitors at P.V., Breakers at Schodak 115 kV	Proposed heavier structures than NYPA/NAT. Concrete foundations on all structures	
NextEra	T022 Base	New "North" Churchtown and retains existing Churchtown SS.		Monopole Design - less ROW rqd. Concrete Poles. Does not include replacement of 32 miles of Ckts 12 and 13.	
	T023	Similar to T022 but has one less line terminal		Includes replacement of 32 miles of 115kV Churchtown to PV	
NYPA/NAT	T029 Base	Complete Rebuild	Breakers at Schodak		
	T030	Complete Rebuild	Breakers at Schodak	Same as T029 but triple bundled 345kV conductor	
ITC	T032 Base	Adds breaker at existing station, and builds new Knickerbocker 115kV		Has approx. 30% more trans structures	

A summary of the independent estimate (raw costs in $1,000's) for each Developer's proposal follows:

Segment A Proposals

4.2.1. **T018 National Grid/Transco Segment A**

National Grid and NY Transco (T018)			
Description			**Total Amount** (In thousand $)
Direct Cost	1	**Transmission Lines**	
	1.1	Clearing & Access	$52,139
	1.2	Foundations	$38,037
	1.3	Structures	$67,033
	1.4	Conductor, Shieldwire and OPGW	$35,990
	1.5	Insulators, Fitting and Hardware	$11,291
		Subtotal (1)	**$204,489**
	2	**Substations**	
	2.1	Rotterdam Substation	$48,141
	2.2	Edic Substation	$2,117
	2.3	Princetown Substation	$0
	2.4	New Scotland Substation	$7,037
	2.5	Porter Substation	$546
	2.6	Knickerbocker Substation	$0
	2.7	Marcy Substation	$0
	2.8	Substation Interconnections	$8,557
		Subtotal (2)	**$66,399**
		Total (1+2)	$270,889
		Contractors Mark-up (15% of Total 1+2)	$40,633
		Total Direct Cost (A)	**$311,522**
Indirect Cost	3	**Technical Services Costs**	
	3.1	Contractor Mobilization / Demobilization	$2,716
	3.2	Project Management, Material Handling & Amenities	$18,439
	3.3	Engineering	$18,154
	3.4	Testing & Commissioning	$1,559
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs	$20,171
	3.6	Compensation for use of NYPA Structures (1 Ckt.)	$8,919
	3.7	Legal, Env. Lisc. & Permit and Env. Mitigation	$7,719
		Total Indirect Cost (3)	**$77,677**
		Subtotal Project Cost (B=A+3) 2017 $	**$389,199**
	4	**Network Upgrade Facilities (NUF)**	
	4.1	NUF proposed as element of the Project	$0
	4.2	NUF identified during Evaluation	$0
		Subtotal NUF Cost (C)	**$0**

Total Project Cost (B+C) 2017 $	**$389,199**
Total Project Cost 2018 $	**$400,875**

4.2.2. **T021 NextEra Segment A**

NextEra Energy (T021)			
Description			**Total Amount** (In thousand $)
Direct Cost	1	**Transmission Lines**	
	1.1	Clearing & Access	$55,279
	1.2	Foundations	$18,318
	1.3	Structures	$78,675
	1.4	Conductor, Shieldwire and OPGW	$38,661
	1.5	Insulators, Fitting and hardware	$13,339
		Subtotal (1)	**$204,272**
	2	**Substations**	
	2.1	Rotterdam Substation	$850
	2.2	Edic Substation	$2,153
	2.3	Princetown Substation	$40,296
	2.4	New Scotland Substation	$6,883
	2.5	Porter Substation	$546
	2.6	Knickerbocker Substation	$0
	2.7	Marcy Substation	$0
	2.8	Substation Interconnections	$4,461
		Subtotal (2)	**$55,189**
		Total (1+2)	$259,461
		Contractors Mark-up (15% of Total 1+2)	$38,919
		Total Direct Cost (A)	**$298,380**
Indirect Cost	3	**Technical Services Costs**	
	3.1	Contractor Mobilization / Demobilization	$2,595
	3.2	Project Management, Material Handling & Amenities	$18,378
	3.3	Engineering	$17,274
	3.4	Testing & Commissioning	$1,435
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs	$15,379
	3.6	Compensation for use of NYPA Structures (1 Ckt.)	$8,919
	3.7	Legal, Env. Lisc. & Permit and Env. Mitigation	$7,865
		Total Indirect Cost (3)	**$71,844**
		Subtotal Project Cost (B=A+3) 2017 $	**$370,225**
	4	**Network Upgrade Facilities (NUF)**	
	4.1	NUF proposed as element of the Project	$0
	4.2	NUF identified during Evaluation	$0
		Subtotal NUF Cost (C)	**$0**

Total Project Cost (B+C) 2017 $	**$370,225**
Total Project Cost 2018 $	**$381,331**

4.2.3. **T025 NAT/NYPA Segment A + 765kv**

NY Power Authority and North American Transmission (T025)			
Description			**Total Amount** (In thousand $)
Direct Cost	1	**Transmission Lines**	
	1.1	Clearing & Access	$54,770
	1.2	Foundations	$35,794
	1.3	Structures	$67,800
	1.4	Conductor, Shieldwire and OPGW	$37,454
	1.5	Insulators, Fitting and hardware	$11,666
		Subtotal (1)	**$207,485**
	2	**Substations**	
	2.1	Rotterdam Substation	$46,629
	2.2	Edic Substation	$2,153
	2.3	Princetown Substation	$12,713
	2.4	New Scotland Substation	$0
	2.5	Porter Substation	$546
	2.6	Knickerbocker Substation	$67,167
	2.7	Marcy Substation	$17,553
	2.8	Substation Interconnections	$8,399
		Subtotal (2)	**$155,160**
		Total (1+2)	$362,645
		Contractors Mark-up (15% of Total 1+2)	$54,397
		Total Direct Cost (A)	**$417,042**
Indirect Cost	3	**Technical Services Costs**	
	3.1	Contractor Mobilization / Demobilization	$3,626
	3.2	Project Management, Material Handling & Amenities	$20,353
	3.3	Engineering	$26,100
	3.4	Testing & Commissioning	$3,826
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs	$26,499
	3.6	Compensation for use of NYPA Structures (1 Ckt.)	$8,919
	3.7	Legal, Env. Lisc. & Permit and Env. Mitigation	$9,589
		Total Indirect Cost (3)	**$98,914**
		Subtotal Project Cost (B=A+3) 2017 $	**$515,955**
	4	**Network Upgrade Facilities (NUF)**	
	4.1	NUF proposed as element of the Project (Marcy and Edic Terminals)	$7,727
	4.2	NUF identified during Evaluation (765kV Corona Mitigation)	$116,005
		Subtotal NUF Cost (C)	**$123,731**

Total Project Cost (B+C) 2017 $	**$639,687**

Total Project Cost 2018 $	**$658,877**

4.2.4. **T026 NAT/NYPA Segment A Base**

NY Power Authority and North American Transmission (T026)			
		Description	**Total Amount** (In thousand $)
Direct Cost	1	**Transmission Lines**	
	1.1	Clearing & Access	$50,021
	1.2	Foundations	$23,713
	1.3	Structures	$60,645
	1.4	Conductor, Shieldwire and OPGW	$35,492
	1.5	Insulators, Fitting and hardware	$10,802
		Subtotal (1)	**$180,672**
	2	**Substations**	
	2.1	Rotterdam Substation	$47,340
	2.2	Edic Substation	$2,153
	2.3	Princetown Substation	$0
	2.4	New Scotland Substation	$5,264
	2.5	Porter Substation	$546
	2.6	Knickerbocker Substation	$0
	2.7	Marcy Substation	$0
	2.8	Substation Interconnections	$8,399
		Subtotal (2)	**$63,702**
		Total (1+2)	$244,374
		Contractors Mark-up (15% of Total 1+2)	$36,656
		Total Direct Cost (A)	**$281,030**
Indirect Cost	3	**Technical Services Costs**	
	3.1	Contractor Mobilization / Demobilization	$2,444
	3.2	Project Management, Material Handling & Amenities	$18,000
	3.3	Engineering	$16,495
	3.4	Testing & Commissioning	$1,498
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs	$19,684
	3.6	Compensation for use of NYPA Structures (1 Ckt.)	$8,919
	3.7	Legal, Env. Lisc. & Permit and Env. Mitigation	$7,920
		Total Indirect Cost (3)	**$74,960**
		Subtotal Project Cost (B=A+3) 2017 $	**$355,990**
	4	**Network Upgrade Facilities (NUF)**	
	4.1	NUF proposed as element of the Project (Marcy and Edic Terminals)	$7,727
	4.2	NUF identified during Evaluation	$0
		Subtotal NUF Cost (C)	**$7,727**

Total Project Cost (B+C) 2017 $	**$363,717**
Total Project Cost 2018 $	**$374,628**

4.2.5. **T027 NAT/NYPA Segment A Double Circuit**

NY Power Authority and North American Transmission (T027)			
	Description		**Total Amount** (In thousand $)
Direct Cost	1	**Transmission Lines**	
	1.1	Clearing & Access	$56,801
	1.2	Foundations	$31,116
	1.3	Structures	$106,166
	1.4	Conductor, Shieldwire and OPGW	$62,279
	1.5	Insulators, Fitting and hardware	$23,408
		Subtotal (1)	**$279,769**
	2	**Substations**	
	2.1	Rotterdam Substation	$47,340
	2.2	Edic Substation	$5,333
	2.3	Princetown Substation	$29,872
	2.4	New Scotland Substation	$7,717
	2.5	Porter Substation	$546
	2.6	Knickerbocker Substation	$0
	2.7	Marcy Substation	$0
	2.8	Substation Interconnections	$8,399
		Subtotal (2)	**$99,207**
		Total (1+2)	$378,976
		Contractors Mark-up (15% of Total 1+2)	$56,846
		Total Direct Cost (A)	**$435,822**
Indirect Cost	3	**Technical Services Costs**	
	3.1	Contractor Mobilization / Demobilization	$3,790
	3.2	Project Management, Material Handling & Amenities	$21,983
	3.3	Engineering	$25,529
	3.4	Testing & Commissioning	$2,532
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs	$26,011
	3.6	Compensation for use of NYPA Structures (1 Ckt.)	$17,838
	3.7	Legal, Env. Lisc. & Permit and Env. Mitigation	$8,278
		Total Indirect Cost (3)	**$105,962**
		Subtotal Project Cost (B=A+3) 2017 $	**$541,784**
	4	**Network Upgrade Facilities (NUF)**	
	4.1	NUF proposed as element of the Project (Marcy and Edic Terminals)	$7,727
	4.2	NUF identified during Evaluation	$0
		Subtotal NUF Cost (C)	**$7,727**

Total Project Cost (B+C) 2017 $	**$549,511**
Total Project Cost 2018 $	**$565,996**

4.2.6. **T028 NAT/NYPA Segment A Enhanced**

NY Power Authority and North American Transmission (T028)			
Description			**Total Amount** (In thousand $)
Direct Cost	1	**Transmission Lines**	
	1.1	Clearing & Access	$50,021
	1.2	Foundations	$23,713
	1.3	Structures	$60,645
	1.4	Conductor, Shieldwire and OPGW	$35,494
	1.5	Insulators, Fitting and hardware	$10,802
		Subtotal (1)	**$180,675**
	2	**Substations**	
	2.1	Rotterdam Substation	$47,340
	2.2	Edic Substation	$2,153
	2.3	Princetown Substation	$12,718
	2.4	New Scotland Substation	$5,264
	2.5	Porter Substation	$546
	2.6	Knickerbocker Substation	$0
	2.7	Marcy Substation	$0
	2.8	Substation Interconnections	$8,399
		Subtotal (2)	**$76,420**
		Total (1+2)	$257,094
		Contractors Mark-up (15% of Total 1+2)	$38,564
		Total Direct Cost (A)	**$295,659**
Indirect Cost	3	**Technical Services Costs**	
	3.1	Contractor Mobilization / Demobilization	$2,571
	3.2	Project Management, Material Handling & Amenities	$18,274
	3.3	Engineering	$17,615
	3.4	Testing & Commissioning	$1,815
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs	$20,464
	3.6	Compensation for use of NYPA Structures (1 Ckt.)	$8,919
	3.7	Legal, Env. Lisc. & Permit and Env. Mitigation	$8,096
		Total Indirect Cost (3)	**$77,755**
		Subtotal Project Cost (B=A+3) 2017 $	**$373,414**
	4	**Network Upgrade Facilities (NUF)**	
	4.1	NUF proposed as element of the Project (Marcy and Edic Terminals)	$7,727
	4.2	NUF identified during Evaluation	$0
		Subtotal NUF Cost (C)	**$7,727**

Total Project Cost (B+C) 2017 $	**$381,140**
Total Project Cost 2018 $	**$392,575**

4.2.7. **T031 ITC Segment A**

ITC (T031)			
Description			**Total Amount** (In thousand $)
Direct Cost	1	**Transmission Lines**	
	1.1	Clearing & Access	$53,084
	1.2	Foundations	$43,503
	1.3	Structures	$80,620
	1.4	Conductor, Shieldwire and OPGW	$41,525
	1.5	Insulators, Fitting and hardware	$20,528
		Subtotal (1)	**$239,260**
	2	**Substations**	
	2.1	Rotterdam Substation	$19,805
	2.2	Edic Substation	$2,185
	2.3	Princetown Substation	$27,974
	2.4	New Scotland Substation	$3,615
	2.5	Porter Substation	$546
	2.6	Knickerbocker Substation	$0
	2.7	Marcy Substation	$0
	2.8	Substation Interconnections	$8,399
		Subtotal (2)	**$62,523**
		Total (1+2)	$301,784
		Contractors Mark-up (15% of Total 1+2)	$45,268
		Total Direct Cost (A)	**$347,051**
Indirect Cost	3	**Technical Services Costs**	
	3.1	Contractor Mobilization / Demobilization	$3,018
	3.2	Project Management, Material Handling & Amenities	$19,047
	3.3	Engineering	$19,947
	3.4	Testing & Commissioning	$1,560
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs	$20,824
	3.6	Compensation for use of NYPA Structures (1 Ckt.)	$8,919
	3.7	Legal, Env. Lisc. & Permit and Env. Mitigation	$7,941
		Total Indirect Cost (3)	**$81,256**
		Subtotal Project Cost (B=A+3) 2017 $	**$428,307**
	4	**Network Upgrade Facilities (NUF)**	
	4.1	NUF proposed as element of the Project	$0
	4.2	NUF identified during Evaluation	$0
		Subtotal NUF Cost (C)	**$0**
		Total Project Cost (B+C) 2017 $	**$428,307**
		Total Project Cost 2018 $	**$441,156**

Segment B Proposals

4.2.8. **T019 NGRID/Transco Segment B**

National Grid and NY Transco (T019)			
Description			**Total Amount** (In thousand $)
Direct Cost	1	**Transmission Lines**	
	1.1	Clearing & Access	$34,641
	1.2	Foundations	$44,405
	1.3	Structures	$56,279
	1.4	Conductor, Shieldwire and OPGW	$30,070
	1.5	Insulators, Fitting and hardware	$10,334
		Subtotal (1)	**$175,729**
	2	**Substations**	
	2.1	Knickerbocker Substation	$26,306
	2.2	East Greenbush Substation	$61
	2.3	Schodack Substation	$2,226
	2.4	Churchtown Substation	$14,616
	2.5	Pleasant Valley Substation	$6,939
	2.6	Substation Interconnections	$5,689
		Subtotal (2)	**$55,838**
		Total (1+2)	$231,566
		Contractors Mark-up (15% of Total 1+2)	$34,735
		Total Direct Cost (A)	**$266,301**
Indirect Cost	3	**Technical Services Costs**	
	3.1	Contractor Mobilization / Demobilization	$2,316
	3.2	Project Management, Material Handling & Amenities	$16,122
	3.3	Engineering	$15,485
	3.4	Testing & Commissioning	$1,324
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs	$16,963
	3.6	Legal, Env. Lisc. & Permit and Env. Mitigation	$7,428
		Total Indirect Cost (3)	**$59,638**
		Subtotal Project Cost (B=A+3) 2017 $	**$325,939**
	4	**Network Upgrade Facilities (NUF)**	
	4.1	NUF proposed as element of the Project (Fishkill and New Scotland Terminals)	$1,085
	4.2	NUF identified by System Impact Study (Cricket Valley Line Upgrade)	$4,417
		Subtotal NUF Cost (C)	**$5,502**
		Total Project Cost (B+C) 2017 $	**$331,442**
		Total Project Cost 2018 $	**$341,385**

4.2.9. T022 NextEra Segment B

NextEra Energy (T022)			
Description			**Total Amount** (In thousand $)
Direct Cost	1	**Transmission Lines**	
	1.1	Clearing & Access	$33,783
	1.2	Foundations	$17,271
	1.3	Structures	$58,961
	1.4	Conductor, Shieldwire and OPGW	$25,925
	1.5	Insulators, Fitting and hardware	$9,756
		Subtotal (1)	**$145,696**
	2	**Substations**	
	2.1	Knickerbocker Substation	$15,110
	2.2	East Greenbush Substation	$61
	2.3	Schodack Substation	$0
	2.4	Churchtown Substation	$14,897
	2.5	Pleasant Valley Substation	$2,798
	2.6	Substation Interconnections	$7,378
		Subtotal (2)	**$40,244**
		Total (1+2)	$185,940
		Contractors Mark-up (15% of Total 1+2)	$27,891
		Total Direct Cost (A)	**$213,832**
Indirect Cost	3	**Technical Services Costs**	
	3.1	Contractor Mobilization / Demobilization	$1,859
	3.2	Project Management, Material Handling & Amenities	$15,279
	3.3	Engineering	$12,296
	3.4	Testing & Commissioning	$920
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs	$10,600
	3.6	Legal, Env. Lisc. & Permit and Env. Mitigation	$7,628
		Total Indirect Cost (3)	**$48,581**
		Subtotal Project Cost (B=A+3) 2017 $	**$262,413**
	4	**Network Upgrade Facilities (NUF)**	
	4.1	NUF proposed as element of the Project	$0
	4.2	NUF identified by System Impact Study (Cricket Valley Line Upgrade)	$4,417
		Subtotal NUF Cost (C)	**$4,417**
		Total Project Cost (B+C) 2017 $	**$266,830**
		Total Project Cost 2018 $	**$274,835**

4.2.10. **T023 NextEra Segment B – Alt**

NextEra Energy (T023)			
Description			**Total Amount** (In thousand $)
Direct Cost	1	**Transmission Lines**	
	1.1	Clearing & Access	$34,215
	1.2	Foundations	$21,257
	1.3	Structures	$67,904
	1.4	Conductor, Shieldwire and OPGW	$30,529
	1.5	Insulators, Fitting and hardware	$10,956
		Subtotal (1)	**$164,861**
	2	**Substations**	
	2.1	Knickerbocker Substation	$15,110
	2.2	East Greenbush Substation	$61
	2.3	Schodack Substation	$0
	2.4	Churchtown Substation	$13,040
	2.5	Pleasant Valley Substation	$2,798
	2.6	Substation Interconnections	$6,697
		Subtotal (2)	**$37,706**
		Total (1+2)	$202,567
		Contractors Mark-up (15% of Total 1+2)	$30,385
		Total Direct Cost (A)	**$232,952**
Indirect Cost	3	**Technical Services Costs**	
	3.1	Contractor Mobilization / Demobilization	$2,026
	3.2	Project Management, Material Handling & Amenities	$16,683
	3.3	Engineering	$13,243
	3.4	Testing & Commissioning	$874
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs	$12,951
	3.6	Legal, Env. Lisc. & Permit and Env. Mitigation	$7,628
		Total Indirect Cost (3)	**$53,404**
		Subtotal Project Cost (B=A+3) 2017 $	**$286,356**
	4	**Network Upgrade Facilities (NUF)**	
	4.1	NUF proposed as element of the Project	$0
	4.2	NUF identified by System Impact Study (Cricket Valley Line Upgrade)	$4,417
		Subtotal NUF Cost (C)	**$4,417**
		Total Project Cost (B+C) 2017 $	**$290,773**
		Total Project Cost 2018 $	**$299,497**

4.2.11. **T029 NAT/NYPA Segment B Base**

NY Power Authority and North American Transmission (T029)			
	Description		**Total Amount** (In thousand $)
Direct Cost	1	**Transmission Lines**	
	1.1	Clearing & Access	$33,958
	1.2	Foundations	$17,769
	1.3	Structures	$52,916
	1.4	Conductor, Shieldwire and OPGW	$30,069
	1.5	Insulators, Fitting and hardware	$9,844
		Subtotal (1)	**$144,556**
	2	**Substations**	
	2.1	Knickerbocker Substation	$14,982
	2.2	East Greenbush Substation	$61
	2.3	Schodack Substation	$2,226
	2.4	Churchtown Substation	$15,925
	2.5	Pleasant Valley Substation	$2,798
	2.6	Substation Interconnections	$5,581
		Subtotal (2)	**$41,573**
		Total (1+2)	$186,129
		Contractors Mark-up (15% of Total 1+2)	$27,919
		Total Direct Cost (A)	**$214,049**
Indirect Cost	3	**Technical Services Costs**	
	3.1	Contractor Mobilization / Demobilization	$1,861
	3.2	Project Management, Material Handling & Amenities	$15,211
	3.3	Engineering	$12,412
	3.4	Testing & Commissioning	$973
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs	$14,067
	3.6	Legal, Env. Lisc. & Permit and Env. Mitigation	$7,628
		Total Indirect Cost (3)	**$52,151**
		Subtotal Project Cost (B=A+3) 2017 $	**$266,200**
	4	**Network Upgrade Facilities (NUF)**	
	4.1	NUF proposed as element of the Project (Middletown Line and Transformer)	$16,261
	4.2	NUF identified by System Impact Study (Cricket Valley Line Upgrade)	$4,417
		Subtotal NUF Cost (C)	**$20,678**
		Total Project Cost (B+C) 2017 $	**$286,878**
		Total Project Cost 2018 $	**$295,484**

4.2.12. **T030 NAT/NYPA Segment B Enhanced**

NY Power Authority and North American Transmission (T030)			
Description			**Total Amount** (In thousand $)
Direct Cost	1	**Transmission Lines**	
	1.1	Clearing & Access	$34,378
	1.2	Foundations	$18,131
	1.3	Structures	$56,775
	1.4	Conductor, Shieldwire and OPGW	$35,969
	1.5	Insulators, Fitting and hardware	$10,473
		Subtotal (1)	**$155,727**
	2	**Substations**	
	2.1	Knickerbocker Substation	$14,982
	2.2	East Greenbush Substation	$61
	2.3	Schodack Substation	$2,226
	2.4	Churchtown Substation	$16,010
	2.5	Pleasant Valley Substation	$2,778
	2.6	Substation Interconnections	$6,398
		Subtotal (2)	**$42,455**
		Total (1+2)	$198,182
		Contractors Mark-up (15% of Total 1+2)	$29,727
		Total Direct Cost (A)	**$227,910**
Indirect Cost	3	**Technical Services Costs**	
	3.1	Contractor Mobilization / Demobilization	$1,982
	3.2	Project Management, Material Handling & Amenities	$15,498
	3.3	Engineering	$13,105
	3.4	Testing & Commissioning	$972
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs	$14,352
	3.6	Legal, Env. Lisc. & Permit and Env. Mitigation	$7,628
		Total Indirect Cost (3)	**$53,537**
		Subtotal Project Cost (B=A+3) 2017 $	**$281,446**
	4	**Network Upgrade Facilities (NUF)**	
	4.1	NUF proposed as element of the Project (Middletown Line and Transformer)	$16,261
	4.2	NUF identified by System Impact Study (Cricket Valley Line Upgrade)	$4,417
		Subtotal NUF Cost (C)	**$20,678**
		Total Project Cost (B+C) 2017 $	**$302,124**
		Total Project Cost 2018 $	**$311,188**

4.2.13. **T032 ITC Segment B**

ITC (T032)			
Description			**Total Amount** (In thousand $)
Direct Cost	1	**Transmission Lines**	
	1.1	Clearing & Access	$35,253
	1.2	Foundations	$82,888
	1.3	Structures	$67,205
	1.4	Conductor, Shieldwire and OPGW	$33,769
	1.5	Insulators, Fitting and hardware	$11,614
		Subtotal (1)	**$230,729**
	2	**Substations**	
	2.1	Knickerbocker Substation	$21,112
	2.2	East Greenbush Substation	$0
	2.3	Schodack Substation	$0
	2.4	Churchtown Substation	$1,977
	2.5	Pleasant Valley Substation	$3,101
	2.6	Substation Interconnections	$5,921
		Subtotal (2)	**$32,111**
		Total (1+2)	$262,840
		Contractors Mark-up (15% of Total 1+2)	$39,426
		Total Direct Cost (A)	**$302,266**
Indirect Cost	3	**Technical Services Costs**	
	3.1	Contractor Mobilization / Demobilization	$2,628
	3.2	Project Management, Material Handling & Amenities	$17,904
	3.3	Engineering	$16,723
	3.4	Testing & Commissioning	$755
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs	$16,601
	3.6	Legal, Env. Lisc. & Permit and Env. Mitigation	$7,628
		Total Indirect Cost (3)	**$62,238**
		Subtotal Project Cost (B=A+3) 2017 $	**$364,504**
	4	**Network Upgrade Facilities (NUF)**	
	4.1	NUF proposed as element of the Project	$0
	4.2	NUF identified by System Impact Study (Cricket Valley Line Upgrade)	$4,417
		Subtotal NUF Cost (C)	**$4,417**
		Total Project Cost (B+C) 2017 $	**$368,921**
		Total Project Cost 2018 $	**$379,989**

4.3. Risk

The review team completed an evaluation of the potential risks associated with the proposals and has summarized the significant risks, including those previously identified by each Developer. The review team's evaluation was based on the team's collective experience with transmission line and substation projects in New York State.

The significant drivers to the project risks considered were:

- Article VII review approval process and potential environmental issues
- Procurement of major equipment
- Real Estate acquisition
- Construction

The most significant risks are summarized below. The review team also recommends that a Risk Management Program be implemented in the execution of the project or projects selected by the NYISO. A Risk Management Program will highlight items such as safety management, materials management, construction operations, outage planning, QA/QC program, field inspection, and environmental controls that are critical in identifying both risk areas and specific mitigation strategies. It is also important that Risk Management become a living project component that is constantly monitored and updated as the project progresses.

4.3.1. Common Risks

The risks common to all proposals are summarized below. The costs for these risks are adequately covered by the project contingency:

#	Risk Title	Description	Comment
1	Article VII Certificate	Article VII review approval process could take longer than estimated in schedule for a variety of reasons (*i.e.,* additional special studies requested by involved agencies, lack of stakeholder consensus).	Developer needs early outreach with all stakeholders and to prepare a comprehensive application. Developer's experience with Article VII process will be essential.
2	Other environmental approvals	Federal agency and other approvals could take longer than the state Article VII process. This	Developer needs early outreach with Federal agencies and others to prepare

		could become more likely if cutbacks of funding to regulatory agencies affect employee staffing.	comprehensive applications and obtain approvals in parallel with Article VII process.
3	Public Opposition	If local groups or citizens oppose the project, it could cause significant delays especially if opposition results in litigation.	Developer needs early outreach to solicit public involvement, incorporate public concerns during planning stage before project execution, build mitigation into design, and foster community buy-in.
4	EM&CP Approval	EM&CP approval process could take longer than estimated by the Developer in schedule.	Developer needs to prepare a comprehensive EM&CP that will meet regulatory agency requirements. Developer's experience with DPS, DEC, Ag. & Markets, and other agency requirements will be essential.
5	Environmental Study Findings	Environmental studies could find critical habitat, wetlands, agricultural lands, rare, threatened or endangered species, cultural or archeological sites, etc. that could require re-routing of lines or special conditions such as seasonal restriction on construction. The time of year when studies can be conducted could also affect project schedule. Access to structures in Black Creek Marsh may require design or construction modifications.	Studies need to be scheduled and conducted early in the process to ensure design and the EM&CP adequately minimizes, mitigates or avoids environmental impacts.

6	Unknown environmental conditions discovered during construction	During construction, the Developer could encounter previously unidentified issues, such as contaminated soil, archeological remains, rare, threatened or endangered species, unidentified utilities, etc.	Environmental monitor will be on-site during construction. Such findings could require relocating and redesigning structures resulting in construction delays.
7	Violation of environmental requirements during construction	Construction activities could result in violations of environmental permits/approvals due to inadequate control measures or not following plans (i.e., storm water discharges) resulting in stop work notice.	The risk can be mitigated by following Best Management Practices and ensure crews are adequately trained to implement EM&CP and other environmental permit/approval requirements.
8	Gas pipeline mitigation	Transmission line crossings and paralleling of natural gas pipelines may require grounding or other mitigation, and natural gas pipeline entities are increasingly aware of this issue and demanding mitigation to be installed by transmission utilities.	The cost of gas pipeline mitigation studies and mitigation requirements are relatively small compared to the overall project cost. The risk can be mitigated by a study to determine the exact location of gas pipeline(s) and recommend mitigation requirements.
9	Transmission line crossings	Crossing of other transmission and distribution lines: creates additional schedule risk, to the extent an outage needs to be scheduled; creates additional operating risk, to the extent a single event could remove both elements from services; and	This risk is mitigated by early identification of all necessary crossings. For example, this risk is best minimized during construction through frequent coordination with the existing transmission line owner and installation of protective netting and other protection prior to pulling sock line and conductor. This risk can be

		creates cost risk to the extent unexpected costs such as raising, lowering, or relocating an existing line is required.	mitigated through the development of High Risk Evolution Plans for transmission crossings, which include, at a minimum, coordination with all involved utility owners, contractors, construction and project management planning sessions and a detailed schedule of events for crossing.
10	Highway, Rail Road & Navigable Waterway crossings	Crossing of Highways, Rail Roads, and Navigable Waterways creates additional risk to the project schedule and cost, depending on the requirements imposed during construction.	The risks can be mitigated by early identification of all necessary crossings. Prior to and during construction this risk is best minimized through frequent coordination with those responsible for the operation of the facilities being crossed. Develop High Risk Evolution Plans for all major highway, RR or waterway crossings which include at a minimum coordination with RR, flaggers, contractors, Local and state police / highway patrol, construction and project management planning sessions and a detailed schedule of events for crossing.
11	Material Shortages	Material and equipment shortages and delayed shipments.	The risks can be mitigated by proper quality assurance during engineering to insure adequate quantities ordered. Procurement with sufficient

			period of float between scheduled deliveries from suppliers and when material is needed for construction and proactive monitoring and expediting.
12	Operational Issues	Need to maintain resources for emergency response for the life of the facility.	This risk can be mitigated by maintaining a local staff, contracting with emergency restoration provider in the project area, and entering into mutual assistance agreements with neighboring utilities.
13	Need for additional System Upgrade Facilities	Completion of the detailed studies, such as fault studies and protection coordination for the project, will normally be completed during the SIS, the Facilities Study and detailed engineering.	The system modifications proposed by the Developers may require replacement of breakers and protection equipment on the existing system. Additional thermal overloads may be identified.
14	Catastrophic HSE / Safety Event	High voltage transmission and substation work is inherently dangerous. Accidents that occur on projects of this nature frequently result in serious injury or fatality. Catastrophic safety events such as loss of life can result in extended work stoppages across all stages of the project.	This risk can be mitigated through a robust Project and Site Safety Program implementation. Project Orientations which verify training of ALL project personnel. Extensive Health, Safety and Environmental (HSE)management presence during construction to ensure compliance.

15	Construction Quality Control	Compliance with project specifications and quality can be compromised if installations are not properly monitored. Structure misalignments, improper structure framing, use of incorrect materials, etc. can result in re-work, unnecessary delays and project overruns. Larger and complex projects that require greater resources are more susceptible to Quality Control Issues. If the NYPSC cited a contractor as being in non-compliance, the result can be extended work stoppages.	This risk can be mitigated by detailed Quality Control/Quality Assurance Plans during early planning stages and in a detailed Project Execution Plan; ensuring inspection processes are in place for all components of construction; and considering the utilization of third-party inspectors to ensure compliance.
16	Change Order Management - Construction Impacts	Unresolved Change Orders may result in delays to construction and impact the schedule.	This risk can be mitigated by including detailed Change Order Management Plan and process in the Project Execution Plan in order to mitigate potential delays.

4.3.2. Project-Specific Risks

Summarized below are the review team's most significant risk findings specific to each proposal. This is not all inclusive but is intended to highlight those items that pose the most critical risks to the projects' completion.

4.3.2.1. **SEGMENT A**:

T018 – New York Energy Solution Segment A - National Grid/Transco			
#	**Risk Title**	**Description**	**Comment**
1	Design Concern - New Scotland Substation (National Grid Owned)	A significant issue is the lack of space in Control House #3--i.e., the most up-to-date building of the three existing control houses.	To keep the new 345kV panels with the existing panel line up will likely require expanding the building to the east where the cable trench entrances and a communication tower are located. *(While the Developer did not include expanding the control house in its estimate, the review team's independent cost estimate includes this scope of work.)*
2	Obtaining Site Control and Property Acquisition	National Grid owns all property required for new facilities. *De minimis* property may need to be acquired for access and construction marshalling yards.	National Grid's control of the property obviates any significant issue. Property will ultimately be transferred to the NY Transco.
3	Design Concern - EMF	The existing corridor (345kV Lines #14 and #18, and 115kV Line #13) between Princetown Junction and New Scotland Substation is currently estimated to exceed NPSC guidelines for EMF levels. The proposed design improves the condition, but EMF levels are still	EMF levels will have to be addressed during detailed engineering and may result in purchasing EMF easements from property owners along the ROW between Princetown and New Scotland. *(The review*

		estimated to exceed the guidelines.	*team's independent cost estimate includes the cost for additional EMF easements.)* This is considered a critical risk for all Segment A proposals with exception of T027 (double circuit proposal).
4	Re-use of existing structures	During construction the Developer could discover that structures originally planned for re-use are in worse condition than expected or inadequate and require repair or replacement.	The Developer proposes re-using 92 structures on the double circuit Edic/Fraser and 230kV Line 30 beginning at Edic/Porter and continuing east for 12.6 miles. A cursory visual inspection indicate the structures are in good physical condition. Thorough inspection and analysis of existing structures is advisable prior to completing final design.

T021 – Enterprise Line: Segment A - NextEra			
#	**Risk Title**	**Description**	**Comment**
1	Design Concern - New Scotland Substation (National Grid Owned)	A significant issue is the lack of space in Control House #3-i.e., the most up-to-date building of the three existing control houses.	To keep the new 345kV panels with the existing panel line up will likely require expanding the building to the east where the cable trench entrances and a communication tower are located. *(While the Developer did not include expanding the control house in its estimate,*

			the review team's independent cost estimate includes this scope of work.)
2	Obtaining Site Control and Property Acquisition	Proposal utilizes existing ROW owned by National Grid. *De minimis* property may need to be acquired for access and construction marshalling yards. Additionally, Developer must procure property for Princetown substation.	Negotiations with the incumbent utility could result in potential cost and schedule implications. The review team's schedule provides two years for negotiation and procurement of ROW beginning with the notice to proceed. This should be sufficient time making this a potential but low risk. The estimate contingency should be sufficient to cover potential increased costs which is considered a low probability. For Princetown substation, Developer has already obtained a purchase option on property for its proposed location.
3	Construction Concern – Use of Concrete Poles	Developer proposes using concrete poles for the majority of transmission line structures and has considered some of the concerns associated with transportation, public protection and community impact.	Developer needs to evaluate each proposed structure location during detailed engineering to verify delivery and installation feasibility, and develop a robust risk mitigation plan taking account of the project risks, planning and clear mitigation for problem areas. Issues encountered with delivery or installation of these poles may result in schedule

			delays and increased costs.
4	Design Concern - EMF	The existing corridor (345kV Lines #14 and #18, and 115kV Line #13) between Princetown Junction and New Scotland Substation is currently estimated to exceed NPSC guidelines for EMF levels. The proposed design improves the condition, but EMF levels are still estimated to exceed the guidelines.	EMF levels will have to be addressed during detailed engineering and may result in purchasing EMF easements from property owners along the right-of-way between Princetown and New Scotland. *(The review team's independent cost estimate includes the cost for additional EMF easements.)* This is considered a critical risk for all Segment A proposals with exception of T027 (double circuit proposal).
5	Re-use of existing structures	During construction, the Developer could discover that structures originally planned for re-use are in worse condition than expected or inadequate and require repair or replacement.	The Developer proposes re-using 92 structures on the double circuit Edic/Fraser and 230kV Line 30 beginning at Edic/Porter and continuing east for 12.6 miles. A cursory visual inspection indicate the structures are in good physical condition. Thorough inspection and analysis of existing structures is advisable prior to completing final design.

T025 – Segment A + 765 kV Proposal - North American Transmission/NYPA			
#	**Risk Title**	**Description**	**Comment**
1	Design Concern - Rotterdam Substation	Proposed substation layout is directly over two existing gas transmission lines and is likely to	Relocation of the existing gas transmission lines is likely and could require relocating the

	(National Grid Owned)	be resisted by the owner of that facility.	substation and/or purchasing additional property. *(The review team's independent cost estimate includes the cost for relocating these gas transmission lines.)*
2	Property Acquisition Concern - Princetown Substation	NAT/NYPA's proposed design for Princetown Substation appears to just fit within the existing National Grid ROW.	If the final design requires purchasing additional property it will likely be difficult and increase cost. *(The review team's independent cost estimate does not include the cost for additional property/easements.)* This is considered the highest risk for this proposal
3	Design Concern – Princetown Substation location (on National Grid Owned ROW)	Proposed substation is located close to existing homes and buildings. These property owners may oppose the siting of a substation near their property due to concerns with visual impact, noise, security lights, etc.	Public opposition to this site may result in delays associated with obtaining regulatory approvals and increased costs. An alternative design such as GIS or site may need to be identified such as NextEra proposed location midway between the Junction and Rotterdam which has adequate space and would not be as close to existing buildings or roads, minimizing the visual impact and possible opposition.
4	Design Concern - Marcy 765kV Substation (NYPA Owned)	As proposed, the Developer's layout has a single span of conductors crossing the bus between the new 765kV breaker and the south main bus, and	A dropped conductor will trip out the south main bus as well as the bus between the new breaker and breaker 7202.

		between the new breaker and breaker 7202.	
5	Design Concern - New Scotland Substation (National Grid Owned)	A significant issue is the lack of space in Control House #3—i.e., the most up-to-date building of the three existing control houses.	To keep the new 345kV panels with the existing panel line up will likely require expanding the building to the east where the cable trench entrances and a communication tower are located. *(While the Developer did not include expanding the control house in its estimate, the review team's independent cost estimate includes this scope of work.)*
6	Obtaining Site Control and Property Acquisition	Proposal utilizes existing ROW owned by National Grid. *De minimis* property may need to be acquired for access and construction marshalling yards.	Negotiations with the incumbent utility could result in potential cost and schedule implications. The review team's schedule provides two years for negotiation and procurement of ROW beginning with the notice to proceed. This should be sufficient time making this a potential but low risk. The estimate contingency should be sufficient to cover potential increased costs which is considered a low probability.
7	Design Concern - EMF	The existing corridor (345kV Lines #14 and #18, and 115kV Line #13) between Princetown Junction and New Scotland Substation is currently estimated to exceed NYS	EMF levels will have to be addressed during detailed engineering and may result in purchasing EMF easements totaling approximately 76 acres

		PSC guidelines for EMF levels. Additionally, conversion of the 345kV line between Marcy substation and proposed Knickerbocker substation to 765kV is estimated to likely increase EMF levels beyond NYPSC guidelines.	from property owners along the ROW between Marcy and New Scotland. *(The review team's independent cost estimate includes the cost for additional EMF easements.)* This is considered a critical risk for all Segment A proposals with exception of T027 (double circuit proposal).
8	Public Opposition - 765 kV Transmission Line	New York State's only 765kV transmission line between Massena and Marcy was completed in 1975 amidst heavy public opposition. As such, it is highly likely that converting the 345kV line between Marcy substation and the proposed Knickerbocker substation will be controversial due increased EMF, noise from corona and increased structure heights, and result in delays associated with obtaining regulatory approvals and EMF easements likely based on public opposition.	This risk could be mitigated with a targeted and well-planned public outreach effort. However, negative public opposition may result in delays associated with the project's schedule and affect the project's cost and the ability to obtain required EMF easements.
9	Design Concern - 765 kV Transmission Line	The 345kV line between Marcy substation and the proposed Knickerbocker substation was designed and constructed to 765kV standards over 40 years ago.	Design clearances will have to be verified against current standards during detailed design. Also, the condition of insulators and hardware will have to be evaluated due to age. Changing out hardware due to age or modifications to reduce corona could have

			significant cost and schedule implications. *(The review team's independent cost estimate includes an allowance for potential remedial work that may be identified.)*
10	Re-use of existing structures	During construction the Developer could discover that structures originally planned for re-use are in worse condition than expected or inadequate and require repair or replacement.	The Developer proposes re-using 92 structures on the double circuit Edic/Fraser and 230kV Line 30 beginning at Edic/Porter and continuing east for 12.6 miles. A cursory visual inspection indicate the structures are in good physical condition. Thorough inspection and analysis of existing structures is advisable prior to completing final design.

T026 – Segment A Base Proposal - North American Transmission/NYPA			
#	**Risk Title**	**Description**	**Comment**
1	Design Concern - Rotterdam Substation (National Grid Owned)	Proposed substation layout is directly over two existing gas transmission lines and is likely to be resisted by the owner of that facility.	Relocation of the existing gas transmission lines is likely and could require relocating the substation and/or purchasing additional property. *(The review team's independent cost estimate includes the cost for relocating these gas transmission lines.)*

2	Design Concern - New Scotland Substation (National Grid Owned)	A significant issue is the lack of space in Control House #3—i.e., the most up-to-date building of the three existing control houses.	To keep the new 345kV panels with the existing panel line up will likely require expanding the building to the east where the cable trench entrances and a communication tower are located. *(While the Developer did not include expanding the control house in its estimate, the review team's independent cost estimate includes this scope of work.)*
3	Obtaining Site Control and Property Acquisition	Proposal utilizes existing ROW owned by National Grid. *De minimis* property may need to be acquired for access and construction marshalling yards.	Negotiations with the incumbent utility could result in potential cost and schedule implications. The review team's schedule provides two years for negotiation and procurement of ROW beginning with the notice to proceed. This should be sufficient time making this a potential but low risk. The estimated contingency should be sufficient to cover potential increased costs which is considered a low probability.
4	Design Concern - EMF	The existing corridor (345kV Lines #14 and #18, and 115kV Line #13) between Princetown Junction and New Scotland Substation is currently estimated to exceed NYS PSC guidelines for EMF levels. The proposed design improves the condition, but EMF levels are still	EMF levels will have to be addressed during detailed engineering and may result in purchasing EMF easements from property owners along the right-of-way between Princetown and New Scotland. *(The review team's independent*

		estimated to exceed the guidelines.	*cost estimate includes the cost for additional EMF easements.)* This is considered a critical risk for all Segment A proposals with exception of T027 (double circuit proposal).
5	Re-use of existing structures	During construction the Developer could discover that structures originally planned for re-use are in worse condition than expected or inadequate and require repair or replacement.	The Developer proposes re-using 92 structures on the double circuit Edic/Fraser and 230kV Line 30 beginning at Edic/Porter and continuing east for 12.6 miles. A cursory visual inspection indicate the structures are in good physical condition. Thorough inspection and analysis of existing structures is advisable prior to completing final design.

T027 – Segment A Double Circuit Proposal - North American Transmission/NYPA

#	Risk Title	Description	Comment
1	Design Concern - Rotterdam Substation (National Grid Owned)	Proposed substation layout is directly over two existing gas transmission lines and is likely to be resisted by the owner of that facility.	Relocation of the existing gas transmission lines is likely and could require relocating the substation and/or purchasing additional property. *(The review team's independent cost estimate includes the cost for relocating these gas transmission lines.)*
2	Property Acquisition Concern -	NAT/NYPA's proposed design for Princetown Substation appears to just fit within the existing National	If required by the final design purchasing additional property will likely be difficult and

	Princetown Substation	Grid ROW.	increase cost. *(The review team's independent cost estimate does not include the cost for additional property/easements.)*
3	Design Concern – Princetown Substation location (on National Grid Owned ROW)	Proposed substation is located close to existing homes and buildings. These property owners may oppose the siting of a substation near their property due to concerns with visual impact, noise, security lights, etc.	Public opposition to this site may result in delays associated with obtaining regulatory approvals and increased costs. An alternative site may need to be identified such as NextEra proposed location midway between the Junction and Rotterdam which has adequate space and would not be as close to existing buildings or roads, minimizing the visual impact and possible opposition.
4	Design Concern - New Scotland Substation (National Grid Owned)	A significant issue is the lack of space in Control House #3—i.e., the most up-to-date building of the three existing control houses.	To keep the new 345kV panels with the existing panel line up will likely require expanding the building to the east where the cable trench entrances and a communication tower are located. *(While the Developer did not include expanding the control house in its estimate, the review team's independent cost estimate includes this scope of work.)*
5	Obtaining Site Control and Property Acquisition	Proposal utilizes existing ROW owned by National Grid. *De minimis* property may need to be acquired for access and	Negotiations with the incumbent utility could result in potential cost and schedule implications. The review team's schedule

		construction marshalling yards.	provides two years for negotiation and procurement of ROW beginning with the notice to proceed. This should be sufficient time making this a potential but low risk. The estimate contingency should be sufficient to cover potential increased costs which is considered a low probability.
6	Design Concern - EMF	Based on preliminary calculations provided by the Developer, it is possible that EMF design levels will be within NYPSC guidelines.	EMF levels will have to be confirmed during detailed engineering. It is anticipated that the double circuit alternative will reduce EMF levels to below NYS PSC guideline levels on the Princetown Junction to New Scotland corridor.
7	Re-use of existing structures	During construction the Developer could discover that structures originally planned for re-use are in worse condition than expected or inadequate and require repair or replacement.	The Developer proposes re-using 92 structures on the double circuit Edic/Fraser and 230kV Line 30 beginning at Edic/Porter and continuing east for 12.6 miles. A cursory visual inspection indicate the structures are in good physical condition. Thorough inspection and analysis of existing structures is advisable prior to completing final design.

T028 – Segment A Enhanced Proposal - North American Transmission/NYPA

#	Risk Title	Description	Comment
1	Design Concern - Rotterdam Substation (National Grid Owned)	Proposed substation layout is directly over two existing gas transmission lines and is likely to be resisted by the owner of that facility.	Relocation of the existing gas transmission lines is likely and could require purchasing additional property. *(The review team's independent cost estimate includes the cost for relocating these gas transmission lines.)*
2	Property Acquisition Concern - Princetown Substation	NAT/NYPA's proposed design for Princetown Substation appears to just fit within the existing National Grid rights-of-way.	If required by the final design purchasing additional property will likely be difficult and increase cost. *(The review team's independent cost estimate does not include the cost for additional property/easements.)*
3	Design Concern – Princetown Substation location (on National Grid Owned ROW)	Proposed substation is located close to existing homes and buildings. These property owners may oppose the siting of a substation near their property due to concerns with visual impact, noise, security lights, etc.	Public opposition to this site may result in delays associated with obtaining regulatory approvals and increased costs. An alternative design such as GIS or site may need to be identified such as a new location midway between the Junction and Rotterdam which has adequate space and would not be as close to existing buildings or roads, minimizing the visual impact and possible opposition.
4	Design Concern - New Scotland Substation	A significant issue is the lack of space in Control House #3, the most up-to-date building of the	To keep the new 345kV panels with the existing panel line up will likely require expanding the

	(National Grid Owned)	three existing control houses.	building to the east where the cable trench entrances and a communication tower are located. *(While the Developer did not include expanding the control house in its estimate, the review team's independent cost estimate will include this scope of work.)*
5	Obtaining Site Control and Property Acquisition	Proposal utilizes existing ROW owned by National Grid. *De minimis* property may need to be acquired for access and construction marshalling yards.	Negotiations with the incumbent utility could result in potential cost and schedule implications. The review team's schedule provides two years for negotiation and procurement of ROW beginning with the notice to proceed. This should be sufficient time making this a potential but low risk. The estimate contingency should be sufficient to cover potential increased costs which is considered a low probability.
6	Design Concern - EMF	The existing corridor (345kV Lines #14 and #18, and 115kV Line #13) between Princetown Junction and New Scotland Substation is currently estimated to exceed NYS PSC guidelines for EMF levels. The proposed design improves the condition, but EMF levels are still estimated to exceed the guidelines.	EMF levels will have to be addressed during detailed engineering and may result in purchasing EMF easements from property owners along the right-of-way between Princetown and New Scotland. *(The review team's independent cost estimate includes the cost for additional EMF easements.)* This is considered a critical risk

			for all Segment A proposals with exception of T027 (double circuit proposal).
7	Re-use of existing structures	During construction the Developer could discover that structures originally planned for re-use are in worse condition than expected or inadequate and require repair or replacement.	The Developer proposes re-using 92 structures on the double circuit Edic/Fraser and 230kV Line 30 beginning at Edic/Porter and continuing east for 12.6 miles. A cursory visual inspection indicate the structures are in good physical condition. Thorough inspection and analysis of existing structures is advisable prior to completing final design.

T031 – 16NYPP1-1A AC Transmission - ITC			
#	**Risk Title**	**Description**	**Comment**
1	Reliability Concern - New Scotland Substation (National Grid Owned)	ITC proposes connecting a new 345kV transmission line into New Scotland by adding a 345kV terminal structure, circuit breaker with disconnect switches connected to the main bus.	While this may be the simplest arrangement, it also provides the least amount of reliability. With this configuration, a failed breaker or a bus fault will cause a loss of the following: New 345kV line to Princetown 345kV Line to Princetown (formally line14 to Edic), 345kV Line 93 to Leeds, 345kV Line 2 to Alps, Bank #2, Capacitor Banks #1 and #3. The review team recognizes that a failed breaker on any of the existing lines, capacitor

			banks or Bank #2 will also cause a similar loss to those stated. However, the proposed arrangement does not improve the reliability and will exacerbate the situation.
2	Design Concern - New Scotland Substation (National Grid Owned)	A significant issue is the lack of space in Control House #3, the most up-to-date building of the three existing control houses.	To keep the new 345kV panels with the existing panel line up will likely require expanding the building to the east where the cable trench entrances and a communication tower are located. *(While the Developer did not include expanding the control house in its estimate, the review team's independent cost estimate includes this scope of work.)*
3	Design Concern - Rotterdam Substation (National Grid Owned)	Proposed substation layout is directly over an existing gas transmission line and is likely to be resisted by the owner of that facility.	Relocation of the existing gas transmission line is likely and could require relocating the substation and/or purchasing additional property. *(The review team's independent cost estimate includes the cost for relocating this gas transmission line.)*
4	Reliability Concern - Rotterdam Substation (National Grid Owned)	ITC proposes a straight bus arrangement by installing two new 345kV T-line terminals with circuit breakers, disconnect switches, a 345kV tie breaker, and two 345kV - 230kV transformers. Each transformer will have a 230kV circuit breaker connected to the	With this configuration, and because the 230kV Lines 30 and 31 are eliminated, a failed 230kV breaker or a 230kV bus fault will cause a loss of the entire 230kV yard.

		230kV main bus.	
5	Property Acquisition Concern - Princetown Substation	ITC's proposed design for Princetown Substation will not fit within the existing National Grid ROW.	Purchasing additional property will likely be difficult and increase the cost of the project. *(The review team's independent cost estimate includes the cost for additional property/easements.)*
6	Design Concern – Princetown Substation location (on National Grid Owned ROW)	Proposed substation is located close to existing homes and buildings. These property owners may oppose the siting of a substation near their property due to concerns with visual impact, noise, security lights, etc.	Public opposition to this site may result in delays associated with obtaining regulatory approvals and increased costs. An alternative design such as GIS or site may need to be identified such as NextEra proposed location midway between the Junction and Rotterdam which has adequate space and would not be as close to existing buildings or roads, minimizing the visual impact and possible opposition.
7	Obtaining Site Control and Property Acquisition	Proposal utilizes existing ROW owned by National Grid. *De minimis* property may need to be acquired for access and construction marshalling yards.	Negotiations with the incumbent utility could result in potential cost and schedule implications. The review team's schedule provides two years for negotiation and procurement of ROW beginning with the notice to proceed. This should be sufficient time making this a potential but low risk. The estimate contingency should be

			sufficient to cover potential increased costs which is considered a low probability.
8	Design Concern - EMF	The Developer's calculations for EMF are currently estimated to exceed NYPSC guidelines for entire section.	EMF calculations will need to be confirmed during detail engineering. It is possible that EMF easements will need to be purchased for the entire ROW between Edic and New Scotland. At a minimum, easements will likely be required between Princetown and New Scotland. *(The review team's independent cost estimate includes the cost for additional EMF easements.)* This is considered a critical risk for all Segment A proposals with exception of T027 (double circuit proposal).
9	Re-use of existing structures	During construction the Developer could discover that structures originally planned for re-use are in worse condition than expected or inadequate and require repair or replacement.	The Developer proposes re-using 92 structures on the double circuit Edic/Fraser and 230kV Line 30 beginning at Edic/Porter and continuing east for 12.6 miles. A cursory visual inspection indicate the structures are in good physical condition. Thorough inspection and analysis of existing structures is advisable prior to completing final design.

SEGMENT B

T019 – New York Energy Solution Segment B - National Grid/Transco			
#	**Risk Title**	**Description**	**Comment**
1	FAA requirements	Additional requirements may be required to accommodate air traffic.	Green Acres Airport is located about 700 feet east of the proposed ROW. The risks are mitigated by early and frequent coordination with the FAA and the local airport.
2	Design Concern - Pleasant Valley Substation (Con Ed Owned)	The Developer proposes terminating the new 345kV line from Knickerbocker Substation in Bay #2 of Pleasant Valley Substation, which could require Network Upgrade Facilities to expand the Pleasant Valley Substation depending on the outcome of the NYISO's 2017 Class Year Study.	This will likely require adding two 345kV breakers with disconnect switches to Bay #1. The Cricket Valley line will be moved from Bay #2 to Bay #1. Bay #2 will then be available for the new line from Knickerbocker. Additionally, the substation yard will have to be expanded to the southwest to accommodate one of the proposed 345kV capacitor banks. *(This additional work is not included in the independent estimates.)*
3	Design Concern - Pleasant Valley Substation (Con Ed Owned)	Lack of space for additional panels in the control house.	The control house will need to be expanded to accommodate the additional panels. This is more apparent with the additional line for the Cricket Valley Project. *(Expansion of the control house is included in the independent estimates.)*

4	Construction Concern - Churchtown Substation (NYSEG Owned)	Developer proposes constructing a new 115kV, three-bay, breaker-and-a-half substation on the same property currently occupied by NYSEG's Churchtown Substation, eventually demolishing the entire existing substation.	The existing Churchtown substation feeds a radial 115kV line to NYSEG's Craryville and Klinekill Substations. Construction sequencing will have to be developed to maintain service to this line during construction of the new Churchtown substation.
5	Visual Concern – Proposed Transmission Lines	Potential of public opposition due to visual impact. NYPSC has encouraged that new structures have minimal increase in height.	Need to address during detail engineering. The Developer's proposal has the same number of structures as the existing line but 48% of them have an increase in height between 5 ft. and 20 ft. and 5% have a height increase of more than 20 ft. This is considered the highest risk for this proposal
6	Obtaining Site Control and Property Acquisition	National Grid owns all property required for new facilities. *De minimis* property may need to be acquired for access and construction marshalling yards.	National Grid's control of the property obviates any significant issue. Property will ultimately be transferred to the NY Transco.

T022 – Enterprise Line: Segment B – NextEra			
#	**Risk Title**	**Description**	**Comment**
1	FAA requirements	Additional requirements may be required to accommodate air traffic.	Green Acres Airport is located about 700 feet east of the proposed ROW. The risks are mitigated by early and frequent coordination with the FAA and the local airport.
2	Construction Concern – Use of Concrete Poles	Developer proposes using concrete poles for the majority of transmission line structures and has considered some of the concerns associated with transportation, public protection and community impact.	Developer needs to evaluate each proposed structure location during detailed engineering to verify delivery and installation feasibility, and develop a robust risk mitigation plan taking account of the project risks, planning and clear mitigation for problem areas.
3	Design Concern - Pleasant Valley Substation (Con Ed Owned)	The Developer proposes terminating the new 345kV line from Knickerbocker Substation in Bay #2 of Pleasant Valley Substation, which could require Network Upgrade Facilities to expand the Pleasant Valley Substation depending on the outcome of the NYISO's 2017 Class Year Study.	This will likely require adding two 345kV breakers with disconnect switches to Bay #1. The Cricket Valley line will be moved from Bay #2 to Bay #1. Bay #2 will then be available for the new line from Knickerbocker. *(This additional work is not included in the independent estimates.)*
4	Design Concern - Pleasant Valley Substation (Con Ed Owned)	Lack of space for additional panels in the control house.	The control house will need to be expanded to accommodate the additional panels. This is more apparent with the additional line for the Cricket Valley Project. *(Expansion of*

			the control house is included in the independent estimates.)
5	Construction Concern - Churchtown Substation (NYSEG Owned)	Developer proposes constructing a new 115kV, two-bay, breaker-and-a-half substation north of NYSEG's Churchtown Substation. NYSEG's substation will remain in service upon completion of the AC Transmission Project.	Additional property may be required to accommodate storm water management system.
6	Visual Concern – Proposed Transmission Lines	Potential of public opposition due to visual impact. NYPSC has encouraged that new structures have minimal increase in height.	Need to address during detail engineering. The Developer's proposal has the same number of structures as the existing line but 73% of them have an increase in height between 5 ft. and 20 ft. This is considered the highest risk for this proposal
7	Obtaining Site Control and Property Acquisition	Proposal utilizes existing ROW owned by National Grid. *De minimis* property may need to be acquired for access and construction marshalling yards.	Negotiations with the incumbent utility could result in potential cost and schedule implications. The review team's schedule provides two years for negotiation and procurement of ROW beginning with the notice to proceed. This should be sufficient time making this a potential but low risk. The estimate contingency should be sufficient to cover potential increased costs which is considered a low probability.

T023 – Enterprise Line: Segment B Alt. – NextEra			
#	**Risk Title**	**Description**	**Comment**
1	FAA requirements	Additional requirements may be required to accommodate air traffic	Green Acres Airport is located about 700 feet east of the proposed ROW. The risks are mitigated by early and frequent coordination with the FAA and the local airport.
2	Construction Concern – Use of Concrete Poles	Developer proposes using concrete poles for the majority of transmission line structures and has considered some of the concerns associated with transportation, public protection and community impact.	Developer needs to evaluate each proposed structure location during detailed engineering to verify delivery and installation feasibility, and develop a robust risk mitigation plan taking account of the project risks, planning and clear mitigation for problem areas.
3	Design Concern - Pleasant Valley Substation (Con Ed Owned)	The Developer proposes terminating the new 345kV line from Knickerbocker Substation in Bay #2 of Pleasant Valley Substation, which could require Network Upgrade Facilities to expand the Pleasant Valley Substation depending on the outcome of the NYISO's 2017 Class Year Study.	This will likely require adding two 345kV breakers with disconnect switches to Bay #1. The Cricket Valley line will be moved from Bay #2 to Bay #1. Bay #2 will then be available for the new line from Knickerbocker. *(This additional work is not included in the independent estimates.)*
4	Design Concern - Pleasant Valley Substation (Con Ed Owned)	Lack of space for additional panels in the control house.	The control house will need to be expanded to accommodate the additional panels. This is more apparent with the additional line for the Cricket

			Valley Project. *(Expansion of the control house is included in the independent estimates.)*
5	Construction Concern - Churchtown Substation (NYSEG Owned)	Developer proposes constructing a new 115kV, two-bay, breaker-and-a-half substation north of NYSEG's Churchtown Substation. NYSEG's substation will remain in service upon completion of the AC Transmission Project.	Additional property may be required to accommodate storm water management system.
6	Visual Concern – Proposed Transmission Lines	Potential of public opposition due to visual impact. NYS PSC has encouraged that new structures have minimal increase in height.	Need to address during detail engineering. The Developer's proposal has the same number of structures as the existing line but 83% of them have an increase in height between 5-ft. and 20-ft. This is considered the highest risk for this proposal
7	Obtaining Site Control and Property Acquisition	Proposal utilizes existing ROW owned by National Grid. *De minimis* property may need to be acquired for access and construction marshalling yards.	Negotiations with the incumbent utility could result in potential cost and schedule implications. The review team's schedule provides two years for negotiation and procurement of ROW beginning with the notice to proceed. This should be sufficient time making this a potential but low risk. The estimate contingency should be sufficient to cover potential increased costs which is

			considered a low probability.

T029 – Segment B Base Proposal - North American Transmission/NYPA			
#	**Risk Title**	**Description**	**Comment**
1	FAA requirements	Additional requirements may be required to accommodate air traffic	Green Acres Airport is located about 700 feet east of the proposed ROW. The risks are mitigated by early and frequent coordination with the FAA and the local airport.
2	Design Concern - Pleasant Valley Substation (Con Ed Owned)	The Developer proposes terminating the new 345kV line from Knickerbocker Substation in Bay #2 of Pleasant Valley Substation, which could require Network Upgrade Facilities to expand the Pleasant Valley Substation depending on the outcome of the NYISO's 2017 Class Year Study.	This will likely require adding two 345kV breakers with disconnect switches to Bay #1. The Cricket Valley line will be moved from Bay #2 to Bay #1. Bay #2 will then be available for the new line from Knickerbocker. *(This additional work is not included in the independent estimates.)*
3	Design Concern - Pleasant Valley Substation (Con Ed Owned)	Lack of space for additional panels in the control house.	The control house will need to be expanded to accommodate the additional panels. This is more apparent with the additional line for the Cricket Valley Project. *(Expansion of the control house is included in the independent estimates.)*
4	Visual Concern – Proposed Transmission	Potential of public opposition due to visual impact. NYS PSC has encouraged that new structures	Need to address during detail engineering. The Developer's proposal has the same number of structures as the existing line

	Lines	have minimal increase in height.	but 14% of them have an increase in height between 5-ft. and 20-ft.
5	Obtaining Site Control and Property Acquisition	Proposal utilizes existing ROW owned by National Grid. *De minimis* property may need to be acquired for access and construction marshalling yards.	Negotiations with the incumbent utility could result in potential cost and schedule implications. The review team's schedule provides two years for negotiation and procurement of ROW beginning with the notice to proceed. This should be sufficient time making this a potential but low risk. The estimate contingency should be sufficient to cover potential increased costs which is considered a low probability.

T030 – Segment B Enhanced Base Proposal - North American Transmission/NYPA			
#	**Risk Title**	**Description**	**Comment**
1	FAA requirements	Additional requirements may be required to accommodate air traffic	Green Acres Airport is located about 700 feet east of the proposed ROW. The risks are mitigated by early and frequent coordination with the FAA and the local airport.
2	Design Concern - Pleasant Valley Substation (Con Ed Owned)	The Developer proposes terminating the new 345kV line from Knickerbocker Substation in Bay #2 of Pleasant Valley Substation, which could require Network Upgrade Facilities to expand the Pleasant Valley Substation depending on the outcome of the NYISO's 2017 Class Year Study.	This will likely require adding two 345kV breakers with disconnect switches to Bay #1. The Cricket Valley line will be moved from Bay #2 to Bay #1. Bay #2 will then be available for the new line from Knickerbocker. *(This additional work is not included in the independent estimates.)*
3	Design Concern - Pleasant Valley Substation (Con Ed Owned)	Lack of space for additional panels in the control house.	The control house will need to be expanded to accommodate the additional panels. This is more apparent with the additional line for the Cricket Valley Project. *(Expansion of the control house is included in the independent estimates.)*
4	Visual Concern – Proposed Transmission Lines	Potential of public opposition due to visual impact. NYS PSC has encouraged that new structures have minimal increase in height.	Need to address during detail engineering. The Developer's proposal has the same number of structures as the existing line but 14% of them have an increase in height between 5-ft.

			and 20-ft. This is considered the highest risk for this proposal
5	Obtaining Site Control and Property Acquisition	Proposal utilizes existing ROW owned by National Grid. *De minimis* property may need to be acquired for access and construction marshalling yards.	Negotiations with the incumbent utility could result in potential cost and schedule implications. The review team's schedule provides two years for negotiation and procurement of ROW beginning with the notice to proceed. This should be sufficient time making this a potential but low risk. The estimate contingency should be sufficient to cover potential increased costs which is considered a low probability.

T032 – 16NYPP1-1B AC Transmission - ITC			
#	**Risk Title**	**Description**	**Comment**
1	FAA requirements	Additional requirements may be required to accommodate air traffic	Green Acres Airport is located about 700 feet east of the proposed ROW. The risks are mitigated by early and frequent coordination with the FAA and the local airport.
2	Design Concern - Pleasant Valley Substation (Con Ed Owned)	The Developer proposes terminating the new 345kV line from Knickerbocker Substation in Bay #2 of Pleasant Valley Substation, which could require	This will likely require adding two 345kV breakers with disconnect switches to Bay #1. The Cricket Valley line will be moved from Bay #2 to Bay #1.

		Network Upgrade Facilities to expand the Pleasant Valley Substation depending on the outcome of the NYISO's 2017 Class Year Study.	Bay #2 will then be available for the new line from Knickerbocker. *(This additional work is not included in the independent estimates.)*
3	Design Concern - Pleasant Valley Substation (Con Ed Owned)	Lack of space for additional panels in the control house.	The control house will need to be expanded to accommodate the additional panels. This is more apparent with the additional line for the Cricket Valley Project. *(Expansion of the control house is included in the independent estimates.)*
4	Visual Concern – Proposed Transmission Lines	Potential of public opposition due to visual impact. NYS PSC has encouraged that new structures have minimal increase in height.	ITC's proposal has a less significant structure height increase than other developer proposals (46% with 5-ft. or less increase and only 1% with 5-ft. to 10-ft. increase) but increases the total number of structures by 15%. Impact of structure placement will have to be determined during detailed engineering. This is considered the highest risk for this proposal
5	Obtaining Site Control and Property Acquisition	Proposal utilizes existing ROW owned by National Grid. *De minimis* property may need to be acquired for access and construction marshalling yards.	Negotiations with the incumbent utility could result in potential cost and schedule implications. The review team's schedule provides two years for negotiation and procurement of ROW beginning with the notice to proceed. This should

			be sufficient time making this a potential but low risk. The estimate contingency should be sufficient to cover potential increased costs which is considered a low probability.
6	Operation Concern – Triple Circuit Transmission Design	Developer proposes using triple circuit structures between Churchtown Substation and Pleasant Valley Substation. The proposed structures are in a two-pole configuration with one 345kV circuit attached horizontally to an upper crossarm and two 115kV circuits attached side by side horizontally to a lower crossarm.	The proposed compact design conserves space within the transmission corridor but creates an operations concern. Future maintenance of the transmission circuits and associated structures may depend on the outage availability of all the circuits attached. A maintenance plan must be developed prior to putting this configuration into service.

4.4. Expandability

In evaluating the expandability of a proposed regulated Public Policy Transmission Project, the NYISO OATT section 31.4.8.1.3 prescribed the following: "The ISO will consider the impact of the proposed project on future construction. The ISO will also consider the extent to which any subsequent expansion will continue to use this proposed project within the context of system expansion."

The review team conducted an initial review of the expansion capability of the Developers' proposals. The review centered predominately on the Developers' claimed expandability as presented in their proposals:

4.4.1. **Items that may be considered common to all proposals:**

Many of the more common design approaches that could be employed on a transmission project to afford future expandability are not applicable since the objective of this project is to utilize existing rights-of-way (ROW). Much of the existing transmission ROW will be fully utilized in construction of this project but there is some opportunity for expansion.

Potential transmission expansion includes the following:

- All proposals for Segment A involve replacement of the existing Porter-Rotterdam 230 kV circuits #30 and #31 with a single Edic to New Scotland 345kV line. This will provide space for future use of the existing ROW and may allow for the addition of another circuit from Edic/Porter to Princetown Junction within the existing ROW, based on current electrical clearance requirements. Any proposal to construct an additional circuit is subject to the applicable permitting and regulatory requirements, such as public acceptance of visual impact, EMF compliance, compatibility with existing gas facilities and regulatory approvals.
    - For the base proposals, NextEra affords the most efficient use of the ROW by utilizing 100 ft. single-pole delta structures. National Grid/Transco, NAT/NYPA and ITC propose using 65-85 ft. H-pole structures, which requires the use of more space within the ROW. In all base proposals, there may be adequate space in the ROW remaining for an additional 345kV line. However, a compact transmission line configuration may be required to fit a future 345kV line in the remaining ROW.
    - All alternative proposals may also provide adequate space within the ROW for a future line with the exception of NAT/NYPA T027. The NAT/NYPA T027 double circuit line proposal utilizes all 4 existing circuit positions for the first 12 miles out of Edic.
    - During detailed engineering the placement of structures should be optimized to maximize the remaining ROW.
    - Refer to the table below for summary of the ROW requirements for each Developer's projects in the Edic to Princetown Junction corridor.

Segment-A							
Sector	Corridor Width (ft.)	Developer	Proposal	Proposed Structure Configuration	ROW Reqd. (ft.)	ROW Corridor Remaining (ft.)	Remarks
Edic SS to Prince -town Jct	200	NGRID/ Transco	T018	1 Ckt – 345kV H-pole Horizontal	120	80	Sufficient reserved ROW for expansion utilizing Compact Vertical Configuration
		NextEra	T021	1 Ckt – 345kV Single Pole Delta	80	120	Sufficient reserved ROW for expansion utilizing H-pole Horizontal Configuration
		NYPA/NAT	T026 & T028	1 Ckt – 345kV H-pole Horizontal	140 *(a)*	60 *(a)*	Sufficient reserved ROW for expansion utilizing Compact Vertical Configuration
		NYPA/NAT	T027	2 Ckt – 345kV Single Pole Vertical	105	95	Sufficient reserved ROW for expansion utilizing Single Pole Delta Configuration with exception of the first 12.6 miles out of Edic
		ITC	T031	1 Ckt – 345kV H-pole Horizontal	100 *(b)*	100 *(b)*	Sufficient reserved ROW for expansion utilizing Single Pole Delta Configuration

(a) For NYPA/NAT proposals T026 & T028, 24 spans are limiting the remaining corridor to 60 ft. If, in the final design, the ROW requirement can be kept to within 60 ft. of either side of centerline (through increased tension, shorter span lengths or special design), the ROW required would be 120 ft., leaving 80 ft. for future expansion.

(b) The ITC proposal T031 is able to have less of an ROW requirement due to using more structures and shorter span lengths.

- The new Edic to New Scotland line for Segment A could be designed for double circuit capability similar to the NAT/NYPA T027 double circuit line proposal.
- Transmission lines could be constructed with higher ampacity conductor or re-conductored in the future.
- Most proposals provide for future expansion of substations or could be modified to provide for additional line terminals and transformers in the new substations.

4.4.2. **Items specific to each proposal:**

Potential transmission expansion for each Developer's specific proposal is discussed in the summary table below.

Significant items specific to each developer:

Proposal	Segment	Developer	Transmission Line Expandability	Substation Expandability
T018 - New York Energy Solution Segment A	A	National Grid/Transco	No significant expandability to NGRID's proposal beyond the common items mentioned above.	At Rotterdam Substation, the 345kV gas-insulated substation design provides one open 345kV bay position and room for additional 345kV bays. Design also provides ability to connect one additional 345kV/115kV transformer to support the local transmission system. Lastly, the design allows for the rebuilding of the 115kV straight bus configuration into a breaker-and-a-half configuration.
T021 - Enterprise Line: Segment A	A	NextEra	No significant expandability to NextEra's proposal beyond the common items mentioned above.	NextEra is proposing a "Princetown" substation approximately 3 miles east of the junction and 2 miles west of Rotterdam Substation on a new greenfield site. The design provides two open 345kV bay positions and room on the property for adding bays. NextEra's proposal maintains the existing and aging Rotterdam 230kV yard intact.
T025 - Segment A + 765kV Proposal	A	NYPA/North American Transmission	Including the common items above, the Developer states that converting the Marcy-New Scotland-Knickerbocker 345kV transmission lines to 765kV could significantly increase Central East transfer	At Rotterdam, rebuilding and relocating the 345kV substation allows for the rebuilding of the 115kV straight bus configuration into a breaker-and-a-half configuration. A new Princetown Substation is proposed at the junction of the 345kV

			capability. (Note that T025 includes this conversion.)	Edic-New Scotland line and the 230kV Porter to Rotterdam lines. Due to the proximity to the neighboring properties, constructing or expanding the substation will be difficult.
T026 - Segment A Base Proposal	A	NYPA/North American Transmission	No significant expandability to NYPA/NAT's proposal beyond the common items mentioned above.	At Rotterdam, rebuilding and relocating the 345kV substation allows for the rebuilding of the 115kV straight bus configuration into a breaker-and-a-half configuration.
T027 - Segment A Double Circuit Proposal	A	NYPA/North American Transmission	No significant expandability to NYPA/NAT's proposal beyond the common items mentioned above.	At Rotterdam, rebuilding and relocating the 345kV substation allows for the rebuilding of the 115kV straight bus configuration into a breaker-and-a-half configuration. A new Princetown Substation is proposed at the junction of the 345kV Edic-New Scotland line and the 230kV Porter to Rotterdam lines. Due to the proximity to the neighboring properties, constructing or expanding the substation will be difficult. *At Edic, it should be noted that a potential spare terminal position (shown on the Developer's drawings) in the proposed bay north of Bay #1 is already occupied by a*

				345kV capacitor bank.
T028 - Segment A Enhanced Proposal	A	NYPA/North American Transmission	No significant expandability to NYPA/NAT's proposal beyond the common items mentioned above.	At Rotterdam, rebuilding and relocating the 345kV substation allows for the rebuilding of the 115kV straight bus configuration into a breaker-and-a-half configuration. A new Princetown Substation is proposed at the junction of the 345kV Edic-New Scotland line and the 230kV Porter to Rotterdam lines. Due to the proximity to the neighboring properties, constructing or, if constructed, expanding the substation will be difficult.
T031 - 16NYPP1-1A AC Transmission	A	ITC	No significant expandability to ITC's proposal beyond the common items mentioned above.	ITC's proposal does not provide any additional bays at Princetown or Rotterdam Substations. ITC's proposal maintains the existing and aging Rotterdam 230kV yard intact. Additionally, physical limitations at these properties may preclude future expansions without purchasing additional property.

Proposal	Segment	Developer	Transmission Line Expandability	Substation Expandability
T019 - New York Energy Solution Segment B	B	National Grid/Transco	No significant expandability to NGRID's proposal beyond the common	At Knickerbocker Substation, the proposed design provides one open 345kV bay position. The

			items mentioned above.	Knickerbocker design also allows the 345kV ring bus configuration to be converted to a breaker-and-a-half configuration with room on the property for adding bays. At Churchtown Substation, design provides one open 115kV bay position. Additional breaker-and-a-half bays can be added in the future.
T022 - Enterprise Line: Segment B	B	NextEra	No significant expandability to NextEra's proposal beyond the common items mentioned above.	At North Churchtown Substation, the proposed design provides one open 115kV bay position and with room on the property for adding bays. The southern-most bay could also be built out to a breaker-and-a-half configuration. At Knickerbocker Substation, the proposed design provides one open 345kV bay position. The Knickerbocker design also allows the 345kV ring bus configuration to be converted to a breaker-and-a-half configuration with room on the property for adding bays.
T023 - Enterprise Line: Segment B-Alt	B	NextEra	No significant expandability to NextEra's proposal beyond the common items mentioned above.	Same comments as stated for T022 also apply to T023.

T029 - Segment B Base Proposal	B	NYPA/North American Transmission	No significant expandability to NYPA/NAT's proposal beyond the common items mentioned above.	The Developer proposes a new 115kV breaker-and-a-half substation south of the existing NYSEG Churchtown substation. The three-bay substation is proposed for south of the existing substation and north of Orchard Road. This location does not permit future expansion of the substation without completely removing the NYSEG substation to the north.
T030 - Segment B Enhanced Proposal	B	NYPA/North American Transmission	No significant expandability to NYPA/NAT's proposal beyond the common items mentioned above.	The Developer proposes a new 115kV breaker-and-a-half substation south of the existing NYSEG Churchtown substation. The three-bay substation is proposed for south of the existing substation and north of Orchard Road. This location does not permit future expansion of the substation without completely removing the NYSEG substation to the north.
T032 - 16NYPP1-1B AC Transmission	B	ITC	No significant expandability to ITC's proposal beyond the common items mentioned above.	At Knickerbocker Substation, the design provides one open 345kV bay position and one open 115kV bay position. The Knickerbocker design also allows the 345kV and 115kV ring bus configurations to be converted to a breaker-and-a-half configuration. The detailed design could

				also optimize the physical layout on the property possibly providing room for additional bays. Additionally, during detailed design, the ability to connect up to two 345kV – 115kV transformers to support the local transmission system could be provided.

4.5. **Site Control and Real Estate**

4.5.1. **Site Control**

In evaluating site control of a proposed regulated Public Policy Transmission Project, The NYISO OATT section 31.4.8.1.6 specifies that the evaluation will assess the following: "The extent to which the Developer of a proposed regulated Public Policy Transmission Project has the property rights, or ability to obtain the property rights, required to implement the project. The ISO will consider whether the Developer: (i) already possesses the rights of way necessary to implement the project; (ii) has completed a transmission routing study, which (a) identifies a specific routing plan with alternatives, (b) includes a schedule indicating the timing for obtaining siting and permitting, and (c) provides specific attention to sensitive areas (*e.g.,* wetlands, river crossings, protected areas, and schools); or (iii) has specified a plan or approach for determining routing and acquiring property rights."

The review team conducted a review of the Developers' property rights acquisition plans contained in their proposals. The review centered on the Developers' information and plans presented in their proposals and additional information provided in response to NYISO RFIs.

In all proposals, the following is common for the property rights acquisition process:

- The NYPSC prescribed specific requirements in Appendix B of its Order Finding Transmission Needs Driven by Public Policy Requirements, dated December 17, 2015.
    - No transmission solution shall be selected that requires the acquisition of new permanent transmission ROW, except for de-minimis acquisitions that cannot

be avoided due to unique circumstances. The NYPSC specified that for the purposes of meeting this criterion, the transfer or lease of existing transmission ROW property or access rights from a current utility company owner to a Developer shall not be considered such an acquisition.

- The selection process for transmission solutions shall favor transmission solutions that minimize the acquisition of property rights for new substations and substation expansions. The NYPSC specified that for the purposes of this criterion, the transfer or lease of existing property rights from a current utility company owner to a Developer shall not be considered such an acquisition.
- No transmission solution shall be selected that includes a crossing of the Hudson River, either overhead, underwater, in riverbed, or underground, or in any other way, by any component of the transmission facility.

The non-incumbent Developers all claim two common rights in obtaining property:

- The Developers cite to the NYPSC's December 15, 2015 order in the AC Transmission proceeding (Case Nos. 12-T-0502, et al.) as requiring incumbent utilities to engage in non-discriminatory, good faith negotiation of terms in obtaining rights to use an incumbent utility's ROW. The NYPSC's order specifically stated that the *"Commission expects the utility company owner to bargain in good faith to reach an agreement with the developer of the transmission solution as to property access and compensation as it would for other linear project developers that seek to co-locate on utility property.*" Further, the NYPSC stated that *"incumbent utilities should offer competitors the same terms they offer Transco; there should be no bias shown to Transco."*
- If negotiations with private land owners are unsuccessful, the Developers believe that under New York State Law, they will have eminent domain authority after certification of a route by the NYPSC.

Below is a summary of the teams' review:

#	Developer	Property Rights Acquisition
T018 T019	National Grid/Transco	NGRID completed a routing study and states that "the ROW targeted for this project is either fee-owned by, or under the control (via easement or permit)," of NGRID. NGRID will transfer ownership all assets to the Transco.

T025 T026 T027 T028 T029 T030	NYPA/North American Transmission	The proposed project's route would use existing ROW owned by the incumbent utility (National Grid). NYPA/NAT lays out a plan in their proposal (Attachment C.2AProperty Right Acquisition Plan) for obtaining site control. They would rely on NYPA, which has extensive experience in negotiating and obtaining easements, including from other incumbent utilities, to lead negotiations with the other New York Transmission Owners. NYPA/NAT does not yet possess the required ROWs. However, they have a documented plan to obtain the real property.
T021 T022 T023	NextEra	The proposed project's route would use existing ROW owned by the incumbent utility (National Grid) with the exception of property to be acquired for the Princetown Junction substation. NextEra has already obtained an option to purchase the real estate for the proposed substation site. NextEra lays out a plan for obtaining site control in their proposal (Attachment B Requirement #7). NextEra does not yet possess the required ROWs. However, it has a documented plan to obtain the necessary real property.
T031 T032	ITC	Their route would use existing ROW owned by the incumbent utility (National Grid). It is likely that some additional property will be required to construct their proposed Princetown Junction Substation. ITC lays out a plan for obtaining site control in their proposal (Attachment C.2A) ITC does not yet possess the required ROWs. However, they have a documented plan to obtain the real property.

4.5.2. **Real Estate Analysis**

A review of the proposed routing for the transmission lines and substations was completed to identify property that each Developer would need to obtain for their proposed project. Estimates for the property were derived by obtaining recent comparable sales and tax assessments from municipal tax records in the town and county where the property is located and commercially available software. The estimated cost of the required property was included in the independent estimates.

All Developers propose to utilize existing incumbent-owned property and ROW with the following exceptions:

- All proposals for Segment A with the exception of NAT/NYPA Double Circuit Alternative T027 proposal will likely require the acquisition of easements to meet EMF guidelines in the Princetown Junction to New Scotland corridor. NYPA/NAT's T025 765kv line conversion also requires additional easements to meet EMF guidelines.
- *De minimis* property rights may be required for construction laydown area and access, tree trimming or danger tree clearing.
- Development of a new substation at the Princetown Junction may require additional property or easements.
    - Proposals T018 and T026 do not include a substation at Princetown Junction.
    - NextEra proposal T021 proposes to build the substation at Princetown Junction on a new greenfield site for which they have obtained an option to acquire.
    - Proposal T031 proposes to tie all seven lines into a substation at Princetown Junction, which will require additional property.
    - Proposals T025, T027, and T028 propose smaller substations at Princetown Junction with four breaker ring bus arrangements or GIS equipment that may fit in the existing property. Although it appears that placing these stations on the site is possible, the review team has identified this as a potential risk that will need to be carefully considered and potentially mitigated during detailed engineering and licensing development.
    - A summary of substation property requirements for Segment A is shown below. The amount of property required for each proposal is listed by the acreage within exiting utility owned property and the amount that needs to be acquired from a non-utility owner.

PROPOSAL	DEVELOPER	SUBSTATION	COUNTY	OWNER NAME	
				NATIONAL GRID/ NIAGARA MOHAWK (ACRES)	NON-UTILITY (ACRES)
T018	National Grid / NY Transco	Rotterdam Substation (Extension)	Schenectady	2.60	
T021	NextEra Energy	Princetown Substation (New)	Schenectady		24.0
T025	NYPA / NAT	Knickerbocker Substation (New)	Rensselaer	30.00	
		Princetown Substation (New)	Schenectady	3.00	
		Rotterdam Substation (New)	Schenectady	7.50	
T026	NYPA / NAT	Rotterdam Substation (New)	Schenectady	7.50	
T027	NYPA / NAT	Edic Substation (Extension)	Oneida	1.25	
		Princetown Substation (New)	Schenectady	3.00	
		Rotterdam Substation (New)	Schenectady	7.50	
T028	NYPA / NAT	Princetown Substation (New)	Schenectady	3.00	
		Rotterdam Substation (New)	Schenectady	7.50	
T031	ITC	Princetown Substation (New)	Schenectady	5.50	2.6
		Rotterdam Substation (Extension)	Schenectady	2.50	

4.6. Operational Plan

The review team conducted an evaluation of the Developers' operations and maintenance (O&M) plans detailed in their proposals. The review centered on the Developers' proposals and additional information provided in response to a NYISO RFI submitted to Developers in November 2017. The following are common elements of the Developers O&M plans. :

- All O&M activities will comply with NERC regulations.
- Real time system operations will be conducted by the NYISO.
- Control center schedules will be 24-7-365.

Below is a summary of the teams' review of the proposed O&M plans . The review team did not identify any major flaw with any Developers' plans. With the exception of ITC, all Developers propose to operate their facilities from an in-state control center.

#	Developer	Operations	Maintenance
T018 T019	National Grid / TRANSCO	NGRID/TRANSCO did not provide an O&M plan with its proposal. However, the review team recognizes that as a New York Transmission Owner, NGRID has a demonstrated history of operating and maintaining its transmission and distribution systems.	See comment under Operations.
T021 T022 TO23	NextEra	NextEra will build and operate a primary and backup control center within New York State. Multi-site EMS with redundant servers and telecommunication will interface real-time situational awareness with the NYISO and neighboring control areas. Power Delivery and Support Center in Florida provides added backup. Policies and training program for operators to meet NERC, Transmission Owner's and System Operator standards.	Transmission line and substation maintenance activities will be managed and performed by NextEra staff supplemented with third-party contractors. NextEra has experience maintaining transmission systems in other areas of the country and provided a detailed maintenance plan.
T025 T026 T027 T028 T029 T030	North American Transmission/ New York Power Authority	Developer states real-time system monitoring and control center services will be provided by NYPA from their Blenheim Gilboa Facility.	Transmission line and substation maintenance will be managed by local NYPA staff. Maintenance activities will be performed by third-party contractors. NYPA has experience maintaining 1400 miles of transmission with an in-house staff of engineers, operators, planners, electricians and line engineers.
T031 T032	ITC	ITC Holdings currently operates and maintains 15,000 miles of transmission and 557 substations from a control center in Novi, Michigan and	ITC uses dedicated O&M contractors under exclusive contract for storm restoration. ITC Holdings in-house staff of engineer's designers, P&C,

		proposes to operate the proposed facilities from that center.	SCADA and construction supervisors are available to assist after the project is put in-service. ITC has Line Outage Guidelines and an Emergency Operations Plan that incorporates use of a local utility's workforce with whom they would partner to provide O&M services.

4.7. Field Reviews

Field review of proposed transmission line routes and substations was completed by the review team. The results of those field reviews are documented in a report supplemented with checklists and maps marked with comments and observations. The review team used the results to develop the project scheduling and cost estimates and identify potential issues and risks with the proposed design, siting and routing.

4.8. Work Plans

The Developers' work plans should provide a detailed description of the overall work plan from start to finish; should list items to be done by in-house staff; and list services that will be performed by consultants or contractors. No significant deficiencies were found in the work plans and processes proposed by any of the Developers. A high-level summary of work plans follows:

- All selected Developers have a history of managing successful transmission and substation design and construction projects. There was variation in the degree of self-performance of work versus using third-party contractors. All Developers propose to manage internal and external resources.
- All Developers include work plan activities in their estimates and schedules. More detailed analysis of the construction work plans is discussed in the Schedule analysis section of this report.
- All Developers propose Permitting and Regulatory activities to be performed by a mix of in-house staff and outside consultants.
- All Developers propose to contract for a portion of the engineering and self-perform the remainder.
- All Developers propose to contract transmission line and substation surveying.

- All Developers propose to contract for site work and construction. National Grid plans to contract out or self-perform above grade/structures and electrical construction.
- NextEra and ITC indicate that they would share public outreach efforts with public relations firms. All Developers signal the importance of early and careful attention to public outreach.
- It was not possible to evaluate external team members at this stage, as they are expected to be selected competitively after award from among leading engineering, geo-technical, environmental and construction firms.

4.9. Environmental

All of the Developers' proposals recognize the need for environmental studies, permits and approvals from various federal and state government agencies. Standard permit requirements include: transmission approval from the NYPSC under Article VII; wetland delineation and protection; archeological studies; storm water pollution prevention requirements; stream protection; invasive species management; agricultural land protection; and rare, threatened and endangered species surveys and protection. The Developers acknowledge the possibility that their proposals could require modification to address additional permit conditions. At this point in the project planning process, it is difficult to ascertain what those permit conditions would be. Based on available information, there do not appear to be any environmental issues that would prevent the projects from being constructed. The following is a general discussion of the most significant environmental issues and factors that could affect each of the proposals.

4.9.1. **Transmission Lines**

All the projects propose utilizing the same existing ROW for the transmission lines, except for the additional 765-kV line proposed in T025. Any additional clearing of the ROW to accommodate the proposed transmission lines is expected to proportionally increase the environmental impacts and risks. These impacts and risks are further described below.

4.9.1.1. Clearing of ROW

The tables below present the estimated acreage that would need to be cleared of trees to accommodate the transmission lines for each proposed project. The ROW being cleared will require environmental and archeological studies. These studies could discover sensitive areas that may require re-routing of the transmission line or relocating structures to avoid area impacts. The projects will also require vegetative mowing within existing ROWs, which is typically considered a slight environmental impact, and has not been included in the tables below.

AC TRANSMISSION PROJECT SEGMENT A: Estimate of Heavy Clearing (Acres)						
T018	T021	T025	T026	T027	T028	T031
19	0	132	34	0	34	38

AC TRANSMISSION PROJECT SEGMENT B: Estimate of Heavy Clearing (Acres)					
T019	T022	T023	T029	T030	T032
40	10	19	28	34	19

4.9.1.2. ROW Access, Clearing, and New Structures in Wetlands

The projects, including the substation footprint and/or the new transmission structures, could have a permanent impact on regulated wetlands. The table below presents the estimated acreage of wetland impacts including permanent wetland loss from the new structure footprints, and the estimated acreage of forested wetlands that will likely be cleared by each project due to the proposed transmission lines. Forested wetlands are a very valuable ecological resource in New York, and proposed tree clearing will require mitigation of impacts, including possible replacement offsite. While an estimate of these mitigation costs has been provided, there is the potential that project regulatory approval could take additional time, and an alternate structure location or construction access may be required to avoid the wetland entirely.

Access through wetlands and locating structures in wetlands will need to be avoided to the greatest extent practical. Black Creek Marsh State Wildlife Management Area, located on the Princetown-New Scotland section of Segment A, will present some difficult access issues that will have to be approved by the New York State Department of Environmental Conservation (NYSDEC). This could require the use of specialized equipment or possible relocation of the transmission line.

Additionally, temporary wetland impacts are anticipated to allow construction access and the placement of temporary matting will be required to minimize surface damages to wetlands. Post-construction restoration efforts may also be required depending on the severity of these construction impacts (*e.g.,* soil disturbance, vegetation dieback).

Regarding permanent impacts to wetlands, loss of wooded wetlands due to ROW clearing, and loss of any wetlands due to proposed structure installations (assuming 60 square feet for each pole footprint) are estimated in the tables below. If on-site mitigation is not possible due to required ROW maintenance, then offsite mitigation may be necessary.

AC TRANSMISSION PROJECT A: Estimate of Impacted Wetlands (Acres)						
T018	T021	T025	T026	T027	T028	T031
0.456	0.198	1.257	0.46	0.493	0.463	0.561

AC TRANSMISSION PROJECT SEGMENT B: Estimate of Impacted Wetlands (Acres)					
T019	T022	T023	T029	T030	T032
0.055	0.064	0.064	0.064	0.064	0.072

For the project to be approved under the USACE Nationwide Permit Program (NWP 12 Utility Line Activities), the actions required for the construction, maintenance, repair, and removal of utility lines and associated facilities (including the construction of access roads) in waters of the United States (*i.e.* wetlands) cannot result in the loss of greater than ½ acre of non-tidal waters for a single and complete project. If the project does not qualify for the Nationwide Permit, an Individual Permit will be required, which may involve a longer review timeframe.

4.9.1.3. Clearing of Protected Species Habitat

The project area may include critical habitats for rare, threatened or endangered plant or animal species, such as the Northern Long Eared Bat, Bog Turtle, Karner Blue Butterfly and/or Dwarf Wedgemussel. If such habitat is identified, agency review and response times are likely to increase along with timeframe for

obtaining project approvals, and an alternate route may be required to protect the critical habitat. Seasonal restrictions may also be imposed to control ROW mowing or clearing, which could further delay the project construction timeline.

4.9.1.4. Visual Impacts

Typically, visual impacts are categorized as minor, moderate or significant/major with regards to how project structures may be seen from sensitive receptors (i.e., parks, trails, scenic roads, historic sites) and overall community/neighborhood character. Visual assessments of the proposed transmission lines may also be required, which would include visual simulations and viewshed maps. If the line is determined to impact scenic resources or is not compatible with the character of the community, the line configuration could require modifications. The type of structure will affect its visibility with lattice type towers having the highest impact. No lattice towers are proposed for this project and most of the structures being removed are lattice towers. All Developers have proposed the use of steel or concrete monopole and H frame structures. In in its December 17, 2015 Order, the NYPSC encouraged Developers to minimize structure heights.

Segment A

The height of the structure will increase its visibility and, therefore, potentially increase the visual impact. The following tables summarize the estimated difference in height of the existing structures being removed and proposed structures for the Segment A projects. The comparison demonstrates the relative height differences for the proposed projects. It should be noted that the proposed lines parallel the existing line #18, between Princetown Junction and New Scotland, which is constructed for 765kV construction and has structures ranging in height from 135 feet to 195 feet and the proposed structures range in height from 60-145 ft. Green highlight indicates that no visual impacts are expected due to the height of the proposed structures. When structures are replaced, height increases over 10 feet are typically classified as “severe” visual impacts.

	Number of Structures					
	T018	**T021**	**T025**	**T026/T028**	**T027**	**T031**
1. Less than 0 ft.	62	0	269	269	19	28
2. Same Ht.	9	0	7	7	11	581
3. From 0.1ft to 5 ft.	30	3	51	51	76	69
4. From 5.1 ft to 10 ft.	56	5	33	33	5	10
5. From 10.1 ft to 15 ft.	72	45	35	34	47	0
6. From 15.1 ft to 20 ft.	97	72	65	66	40	2
7. From 20.1 ft to 25 ft.	74	490	38	38	69	1
8. From 25.1 ft to 30 ft.	68	67	9	9	204	0
9. From 30.1 ft to 40 ft.	52	67	18	18	95	0
10. From 40.1 ft to 50 ft.	21	21	10	9	34	0
11. From 50.1 ft to 60 ft.	23	4	6	1	22	0
12. From 60.1 to 70 ft.	8	1	1	0	1	0
13. From 70.1 to 80 ft.	2	1	1	1	4	0
14. From 80.1 to 90 ft.	0	0	5	0	4	0
15. From 90.1 to 100 ft.	1	0	3	1	0	0
16. From 100.1 to 110 ft.	0	0	0	0	0	0
17. From 110.1 to 120 ft.	0	0	2	0	0	0
Total	575	776	553	537	631	691

	Percent of Structures					
	T018	**T021**	**T025**	**T026/T028**	**T027**	**T031**
1. Less than 0 ft.	10.8%	0.0%	48.6%	50.1%	3.0%	4.1%
2. Same Ht.	1.6%	0.0%	1.3%	1.3%	1.7%	84.1%
3. From 0.1ft to 5 ft.	5.2%	0.4%	9.2%	9.5%	12.0%	10.0%
4. From 5.1 ft to 10 ft.	9.7%	0.6%	6.0%	6.1%	0.8%	1.4%
5. From 10.1 ft to 15 ft.	12.5%	5.8%	6.3%	6.3%	7.4%	0.0%
6. From 15.1 ft to 20 ft.	16.9%	9.3%	11.8%	12.3%	6.3%	0.3%
7. From 20.1 ft to 25 ft.	12.9%	63.1%	6.9%	7.1%	10.9%	0.1%
8. From 25.1 ft to 30 ft.	11.8%	8.6%	1.6%	1.7%	32.3%	0.0%
9. From 30.1 ft to 40 ft.	9.0%	8.6%	3.3%	3.4%	15.1%	0.0%
10. From 40.1 ft to 50 ft.	3.7%	2.7%	1.8%	1.7%	5.4%	0.0%
11. From 50.1 ft to 60 ft.	4.0%	0.5%	1.1%	0.2%	3.5%	0.0%
12. From 60.1 to 70 ft.	1.4%	0.1%	0.2%	0.0%	0.2%	0.0%
13. From 70.1 to 80 ft.	0.3%	0.1%	0.2%	0.2%	0.6%	0.0%
14. From 80.1 to 90 ft.	0.0%	0.0%	0.9%	0.0%	0.6%	0.0%
15. From 90.1 to 100 ft.	0.2%	0.0%	0.5%	0.2%	0.0%	0.0%
16. From 100.1 to 110 ft.	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
17. From 110.1 to 120 ft.	0.0%	0.0%	0.4%	0.0%	0.0%	0.0%

Based upon the estimates above, proposal T031 would have the least visual impacts by a considerable margin, although it does use more structures than all other proposals, except proposal TO21. Proposal T031 is also removing 20 additional miles of lattice structures along Princetown Junction to New Scotland (circuit 14), which none of the other proposed projects are removing. Using the 10-foot height increase as the basis for ranking the visual impacts, proposals TO26/TO28 would have the second lowest visual impact, with about a third of the structures having a height increase of 10 feet or more. Proposal TO18 would be fourth followed by proposal TO27. Proposal TO21 would have the most visual impact with 99% of the structures having a height increase of more than 10 feet. In addition, proposal TO21 is proposing the greatest number of structures.

Proposal TO25 would have the third lowest overall visual impact based upon the table and method discussed above. However, the most significant visual impacts for proposal TO25 are due to proposed height increase for the 2.5 miles of new 765 kV transmission line structures. This will involve 16 new two and three pole structures that range in height from 130 to 165 feet. In the section of the line where there is the existing 115 kV transmission line, the four new structures will be approximately 80 feet taller than the existing structures. On other sections, the height increase will be approximately 40 feet or more.

Segment B

The following tables summarize the estimated difference in height of existing structures being removed and proposed structures for Segment B projects. The comparision demonstrates the relative height differences for the proposed projects. Green highlight indicates no visual impact due to height of the proposed structures. When structures are replaced, height increases over 10 feet are typically classified as “severe” visual impacts.

	Number of Structures				
	T019	**T022**	**T023**	**T029/T030**	**T032**
1. Less than 0 ft.	87	49	6	222	240
2. Same Ht.	3	1	2	77	6
3. From 0.1ft to 5 ft.	97	58	60	44	218
4. From 5.1 ft to 10 ft.	108	181	114	44	6
5. From 10.1 ft to 15 ft.	66	116	227	12	0
6. From 15.1 ft to 20 ft.	20	0	0	3	0
7. From 20.1 ft to 25 ft.	12	0	0	1	0
8. From 25.1 ft to 30 ft.	4	0	0	0	0
9. From 30.1 ft to 40 ft.	4	0	0	0	0
10. From 60.1 ft to 70 ft.	0	0	0	2	0
Total	401	405	409	405	470

	Percent of Structures				
	T019	**T022**	**T023**	**T029/T030**	**T032**
1. Less than 0 ft.	21.7%	12.1%	1.5%	54.8%	51.1%
2. Same Ht.	0.7%	0.2%	0.5%	19.0%	1.3%
3. From 0.1ft to 5 ft.	24.2%	14.3%	14.7%	10.9%	46.4%
4. From 5.1 ft to 10 ft.	26.9%	44.7%	27.9%	10.9%	1.3%
5. From 10.1 ft to 15 ft.	16.5%	28.6%	55.5%	3.0%	0.0%
6. From 15.1 ft to 20 ft.	5.0%	0.0%	0.0%	0.7%	0.0%
7. From 20.1 ft to 25 ft.	3.0%	0.0%	0.0%	0.2%	0.0%
8. From 25.1 ft to 30 ft.	1.0%	0.0%	0.0%	0.0%	0.0%
9. From 30.1 ft to 40 ft.	1.0%	0.0%	0.0%	0.0%	0.0%
10. From 60.1 ft to 70 ft.	0.0%	0.0%	0.0%	0.5%	0.0%

Based upon the estimates above, proposal TO32 would have the least significant visual impact, although it adds 65 (16%) more structures than any other proposed project. Proposal TO29/30 would have the second least visual impact with only 5% of the structures increasing in height by more than 10 feet. Proposals TO19 and TO22 would have comparable visual impacts, with 26% and 29% of the structures increasing in height by more than 10 feet, respectively. However, proposal T022 is proposing to remove 32.6 less miles of lattice structures along Churchtown to Pleasant Valley (circuits 12 and 13) than all the other proposed projects. Proposal TO23 would have the most significant visual impact, if only the height increase is considered, with 56% of the structures increasing in height by 10 to 15 feet.

4.9.1.5. Agricultural Impacts

Early coordination with agricultural landowners, and consideration of potential impacts to farmland will be needed for the proposed project. Siting and construction coordination will be needed to minimize impacts on prime agricultural lands and to limit loss of crop production. Site restoration of disturbed and compacted soils will be required. Herbicide use may be restricted during construction and long-term ROW maintenance operations. Transmission line siting near Certified Organic Farms may require additional planning and consideration for compliance with organic certification. If the proposed transmission line would cross properties within an Agricultural Conservation Easement Program or Land Trust, then additional agency coordination will be needed.

The estimated acreage of agricultural land that will be temporarily impacted by each proposed project within their respective segments is nearly equivalent. Assuming 20-foot-wide matting is used where the ROW is adjacent to Agricultural Districts or crop land, the estimated temporary impact to Segment A would be 94.5 acres, and the estimated temporary impact to Segment B would be 24.75 acres.

4.9.2. Substations and Switching Stations

Proposed projects do vary in the number, size and location of new or expanded substations or switching stations. Both temporary and permanent environmental impacts could result from the construction and installation of the proposed stations, including: visual, noise, tree clearing, and increased stormwater run-off (which will likely require construction of stormwater retention). Fewer or smaller stations would have less environmental impact. The table below provides the total estimated area required for the new or expanded stations, including the estimated area for stormwater retention basins, and the total number of stations.

AC TRANSMISSION PROJECT SEGMENT A: Estimated Station Area (Acres/(number))						
T018	T021	T025	T026	T027	T028	T031
2.6 (1)	24.0 (1)	40.5 (3)	7.5 (1)	11.8 (3)	10.5 (2)	10.6 (2)

AC TRANSMISSION PROJECT SEGMENT B: Estimated Station Area (Acres/(number))					
T019	T022	T023	T029	T030	T032
26.8 (3)	19.5 (2)	19.5 (2)	25.4 (2)	25.4 (2)	20.3 (2)

4.10. Replacement of Aging Infrastructure

In Appendix B of the December 17, 2015 Order Finding Transmission Needs Driven by Public Policy Requirements, the NYPSC stated: "The selection process for transmission solutions shall favor transmission solutions that result in upgrades to aging infrastructure." All of the proposed projects include upgrades to aging transmission line infrastructure.

4.10.1. The following table is a summary of the transmission line mileages to be removed for each Segment A proposal. All proposals intend to utilize existing double circuit towers for the first 12.6 miles heading east out of Edic/Porter. These structures are approximately 30 years old. They appear well maintained and in very good physical condition. It would not be prudent to replace those structures at this time. The table below shows that ITC's proposal T031 would replace about 17 more miles of existing infrastructure than the other proposals. ITC intends to rebuild the Princetown to New Scotland section of existing circuit #14.

SEGMENT A	CIRCUIT NUMBER	T018 (NGRID/NY TRANSCO)	T021 (NEXTERA)	T025 (NYPA/NAT)	T026 (NYPA/NAT)	T027 (NYPA/NAT)	T028 (NYPA/NAT)	T031 (ITC)
Marcy - New Scotland	18	0	0	2.66	0	0	0	0
Princetown Junction - New Scotland	14	0	0	0	0	0	0	20
Miles of 345kV Removed		**0**	**0**	**2.66**	**0**	**0**	**0**	**20**
Edic - Princetown Junction	30*	66.8	66.8	66.8	66.8	66.8	66.8	66.8
Edic - Princetown Junction	31**	54.2	54.2	54.2	54.2	66.8	54.2	54.2
Princetown Junction - Rotterdam	30	5	5	5	5	5	5	5
Princetown Junction - Rotterdam	31	5	5	5	5	5	5	5
Miles of 230kV Removed		**131**	**131**	**131**	**131**	**143.6**	**131**	**131**
Princetown Junction - New Scotland	13	2.5	2.5	2.5	2.5	2.5	2.5	0
Miles of 115kV Removed		**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**0**
Total Miles of Line Removed		**133.5**	**133.5**	**136.16**	**133.5**	**146.1**	**133.5**	**151**

* All developers are proposing to reuse existing double circuit poles for the first 12.6 miles east out of Edic/Porter. Therefore 12.6 miles of removal shown includes wire, insulators and hardwares only

* * T027 (NYPA/ NAT proposing to reuse existing double circuit poles for the first 12.6 miles east out of Edic/Porter. Therefore 12.6 miles of removal shown includes wire, insulators and hardwares only

4.10.2. Replacement of Aging Infrastructure – Substations

- The Segment A proposals predominately affect four existing substations: National Grid's Edic, New Scotland, Porter and Rotterdam substations. Additionally, NYPA/NAT proposal T025 also affects the NYPA's Marcy 765 kV station.
- At Edic, NAT/NYPA T025, T026, T027, and T028 are replacing two 345kV circuit breakers due to loading. At Marcy they are replacing three 345kV circuit breakers.
- At New Scotland, NGRID proposal T018 replace the existing R81 and R82 (oil) tie breakers with new SF6 units. In addition, the review team identified the need to replace these breakers for NextEra proposal T021 due to physical limitations with proposal T021. None of the remaining proposals replace any existing equipment.
- At Porter, all proposals retire 230 kV circuit breakers R300, R320 for Line #30 and breaker R310 for Line #31.
- At Rotterdam, NGRID proposal T018 and the NYPA/NAT proposals T025, T026, T027, and T028 remove the 230 kV yard from service. ITC proposal T031 does not replace any existing equipment. NextEra proposal T021 does not affect Rotterdam substation.

4.10.3. The following table summarizes the transmission line mileage to be removed by each project for each Segment B proposal. The table below shows that NextEra proposal T022 would replace about 65 less miles of existing infrastructure than the other proposals.

SEGMENT B	CIRCUIT NUMBER	T019 (NGRID/NY TRANSCO)	T022 (NEXTERA)	T023 (NEXTERA)	T029 (NYPA/NAT)	T030 (NYPA/NAT)	T032 (ITC)
Knickerbocker - Churchtown	14	21.9	21.9	21.9	21.9	21.9	21.9
Knickerbocker - Churchtown	15	21.9	21.9	21.9	21.9	21.9	21.9
Churchtown - Pleasant Valley	8	32.6	32.6	32.6	32.6	32.6	32.6
Churchtown - Pleasant Valley	10	32.6	32.6	32.6	32.6	32.6	32.6
Churchtown - Pleasant Valley	12	32.6	0	32.6	32.6	32.6	32.6
Churchtown - Pleasant Valley	13	32.6	0	32.6	32.6	32.6	32.6
Blue Stores Tap - Blue Stores	8	2.1	2.1	2.1	2.1	2.1	2.1
Total Miles of 115kV Removed		**176.3**	**111.1**	**176.3**	**176.3**	**176.3**	**176.3**

4.10.4. The Segment B proposals predominately affect NYSEG's Churchtown substation and Con Ed's Pleasant Valley substation with minor work at multiple National Grid substations.

- Churchtown Substation
  - National Grid proposal T019 and NYPA/NAT' proposals T029 and T030 will replace the existing NYSEG Churchtown substation.
  - NextEra proposals T022 and T023 and ITC' proposal T032 retain the existing equipment.
- No significant aging infrastructure is replaced by any proposal at Pleasant Valley.
- No significant aging infrastructure is replaced by any proposal in the National Grid's substations.

4.11. General Design Verifications

4.11.1. Substation Design and Arrangements

The review team compared the proposed bus arrangement for the substations proposed by the projects. Below are summary tables of the bus arrangement, number of lines, number of transformers and breakers for each substation.

Segment A

4.11.1.1. Edic 345 kV Substation

Base Proposals

Developer	# of new Lines	# of new Transformers	Total new elements	Proposed Breaker Arrangement	# of Breakers
T018 NGRID/Transco	1	0	1	Breaker & Half	16 (1 new)
T021 NextEra	1	0	1	Breaker & Half	16 (1 new)
T026 NYPA/NAT	1	0	1	Breaker & Half	16 (1 new)
T031 ITC	1	0	1	Breaker & Half	16 (1 new)

Discussion

The bus arrangements are comparable for all base proposals. A 345 kV breaker is added to Bay #3 to create a new line terminal. All proposals, except proposal T031, shift the 345 kV line to Fraser from Bay #4 to Bay #3 making Bay #4 available for a new 345 kV line. For proposals T018, T021, and T026, the new 345 kV line is to New Scotland. For proposal T031, the new 345 kV line is to the proposed Princetown substation and will terminate in Bay #3.

Expandability

None of the base proposals provide any built-in expandability.

For proposal T027, it should be noted that a potential spare terminal position at Edic (shown on the Developer's drawings) in the proposed bay north of Bay #1 is already occupied by a 345 kV capacitor bank. Therefore, there is no built-in expandability.

Replacement of Aging Infrastructure

NYPA/NAT T026 replaces two 345kV circuit breakers due to loading. At Marcy they are replacing three 345kV circuit breakers. It should be noted that National Grid has an extensive ongoing project to replace the existing control house, protection and control equipment, cabling, conduit and trench system, 345 kV breakers, and 345 kV-115 kV transformers.

Alternate Proposals

Developer	# of new Lines	# of new Transformers	Total new elements	Proposed Breaker Arrangement	# of Breakers
T025 NYPA/NAT	1	0	1	Breaker & Half	16 (1 new)
T027 NYPA/NAT	2	0	2	Breaker & Half	18 (3 new)
T028 NYPA/NAT	1	0	1	Breaker & Half	16(1 new)

Discussion

Like the base proposals, except ITC proposal T031, these alternates all shift the 345 kV line to Fraser from Bay #4 to Bay #3 making Bay #4 available for a new 345kV line. For proposal T027, the Developer adds a bay north of Bay #1 for a new 345kV line to Princetown.

Expandability

Like the base proposals, none of the alternate proposals provide any built-in expandability.

Replacement of Aging Infrastructure

At Edic, NAT/NYPA T025, T027, and T028 are replacing two 345kV circuit breakers due to loading. At Marcy they are replacing three 345kV circuit breakers.

4.11.1.2. **New Scotland 345kV Substation**

Base Proposals

Developer	# of new Lines	# of new Transformers	Total new elements	Proposed Breaker Arrangement	# of Breakers
T018 NGRID/Transco	1	0	1	Sectionalized Bus (3 sections)	16 (5 new)
T021 NextEra	1	0	1	Sectionalized Bus (3 sections)	16 (3 new)
T026 NYPA/NAT	1	0	1	Sectionalized Bus (3 sections)	16 (3 new)
T031 ITC	1	0	1	Sectionalized Bus (2 sections)	14 (1 new)

Discussion

The 345 kV yard at New Scotland has a sectionalized bus. The north main bus is the 99 Bus and the south main bus is the 77 Bus. The main bus is split by a redundant (back-to-back) tie breaker arrangement, which are breakers R81 and R82.

For all base proposals, one new 345 kV line terminal is added. The Developers place the new line terminal at various locations on the main bus. Proposals T018 and T021 place the new line terminal between tie breakers R81 and R82. Proposals T026 and T031 place the new line terminal on the south main bus (77 Bus).

Proposals T018, T021, and T026 increase reliability and operability by adding a second arrangement of redundant tie breakers to further sectionalize the bus creating a third main bus section (88 Bus). Proposals T018 and T021 create an 88 Bus by adding redundant tie breakers between R81 and R82. Proposal T026 creates an 88 Bus by adding redundant tie breakers south of the existing Leeds 93 line terminal.

For proposal T031, a new line terminal is added with no changes to the main bus.

Expandability

None of the base proposals provide any built-in expandability.

Replacement of Aging Infrastructure

Proposal T018 replaces the existing R81 and R82 (oil) tie breakers with new SF6 units. Proposal T021 has the same electrical arrangement as T018, but the Developer does not propose replacing R81 and R82. Based on the review team's field review, these breakers will have to be relocated because there is insufficient room for the proposed arrangement. Thus, from a practical standpoint, R81 and R82 need to be replaced for proposal T021.

Proposals T026 and T031 do not replace any existing equipment.

Alternate Proposals

Developer	# of new Lines	# of new Transformers	Total new elements	Proposed Breaker Arrangement	# of Breakers
T025 NYPA/NAT	0	0	0	Sectionalized Bus	13 (0 new)
T027 NYPA/NAT	2	0	2	Sectionalized Bus	17 (4 new)
T028 NYPA/NAT	1	0	1	Sectionalized Bus	16 (3 new)

Discussion

Proposal T025 does not add any new line terminals or circuit breakers. Proposals T027 and T028 create an 88 Bus by adding redundant tie breakers south of the existing Leeds 93 line terminal. For proposal T027, two new 345 kV line terminals are added to the 77 Bus. Proposal T028 adds one new line terminal to the 77 Bus.

Expandability

Proposal T025 provides some future expandability by creating one open 345 kV line terminal through the retirement of the 345 kV line to Alps. Proposals T027 and T028 do not provide any built-in expandability.

Replacement of Aging Infrastructure

None of the alternate proposals replace any existing equipment.

4.11.1.3. **Princetown Substation**

Base Proposals

Developer	**# of new Lines**	**# of new Transformers**	**Total new elements**	**Proposed Breaker Arrangement**	**# of Breakers**
T018 NGRID/Transco	No Princetown Substation proposed.				
T021 NextEra	2 – 345kV 2 – 230kV	2	6	Breaker & Half	7 – 345kV 6 – 230kV
T026 NYPA/NAT	No Princetown Substation proposed.				
T031 ITC	8	0	8	Breaker & Half	12

Discussion

For proposals T021 and T031, a breaker-and-a-half configuration is proposed. Proposal T021 has three bays and proposal T031 has four bays. Potential issues with siting the Princetown substation were discussed in the Risk Analysis section above

Expandability

Proposal T021 provides two vacant line terminal positions by adding breakers to complete the breaker-and-a-half configuration. There is also sufficient land available at their proposed site for future expansion.

Proposal T031 does not provide any built-in expandability.

Replacement of Aging Infrastructure

There is no replacement of aging infrastructure, as Princetown would be a new substation on a greenfield site.

Alternate Proposals

Developer	**# of new Lines**	**# of new Transformers**	**Total new elements**	**Proposed Breaker Arrangement**	**# of Breakers**
T025 NYPA/NAT	4	0	4	Ring Bus	4
T027 NYPA/NAT	6	0	6	Breaker & Half	6
T028 NYPA/NAT	4	0	4	Ring Bus	4

Discussion

For alternate proposals T025 and T028, a four-breaker ring-bus configuration is proposed. For alternate proposal T027, NYPA/NAT propose a gas-insulated three-bay breaker-and-a-half configuration. Potential issues with siting the Princetown substation were discussed in the Risk Analysis section above.

Expandability

None of the proposals provide any built-in expandability.

Replacement of Aging Infrastructure

There is no replacement of aging infrastructure, as Princetown would be a new substation on a greenfield site.

4.11.1.4. Rotterdam Substation

Base Proposals

Developer	# of new Lines	# of new Transformers	Total new elements	Proposed Breaker Arrangement	# of Breakers
T018 NGRID/Transco	2 – 345kV 1 – 230kV 2 – 115kV*	1 – 345kV-230kV 2 – 345kV-115kV	8	Breaker & Half (Gas-Insulated)	9 – 345kV 1 – 230kV
T021 NextEra	No changes to Rotterdam proposed.				
T026 NYPA/NAT	2 – 345kV 1 – 230kV 2 – 115kV*	1 – 345kV-230kV 2 – 345kV-115kV	8	Breaker & Half	8 – 345kV 1 – 230kV
T031 ITC	2 – 345kV	2 – 345kV-230kV	4	Sectionalized Bus	3 – 345kV 1 – 230kV

*These are tie lines to the existing 115 kV yard at Rotterdam.

Discussion

Proposals T018 and T026 propose new 345 kV breaker-and-a-half substations at Rotterdam. These proposals also add two 345 kV-115 kV transformers and one 345 kV-230 kV transformer.

Proposal T031 proposes adding a 345 kV sectionalized bus yard to the north side of the existing Rotterdam 230 kV yard.

Proposal T021 makes no changes to the existing Rotterdam bus arrangement.

It should be noted that National Grid's proposal T018 is the only one which does not impact the two existing natural gas transmission pipelines that share the National Grid electric transmission line ROW.

Expandability

Both proposals T018 and T026 provide one vacant line terminal position by adding a breaker to complete the breaker-and-a-half configuration. Proposal T031 does not provide any built-in expandability.

Replacement of Aging Infrastructure

For proposal T018, the new station replaces the existing north 230 kV yard and allows for the retirement of the south 230 kV yard. This provides an area to reconstruct the 115 kV yard as a full breaker-and-a-half station in the future.

For proposal T026, the new station removes the existing north and south 230 kV yards from service, providing an area to reconstruct the 115 kV yard as a full breaker-and-a-half station in the future.

For proposal T031, all existing 230 kV equipment remains in service. New equipment is added to the existing arrangement.

Alternate Proposals

Developer	# of new Lines	# of new Transformers	Total new elements	Proposed Breaker Arrangement	# of Breakers
T025 NYPA/NAT	Same as T026.				
T027 NYPA/NAT	Same as T026.				
T028 NYPA/NAT	Same as T026.				

Discussion

No further discussion beyond proposal T026 above.

Expandability

No further discussion beyond proposal T026 above.

Replacement of Aging Infrastructure

No further discussion beyond proposal T026 above.

4.11.1.5. **Remote Terminal Substation**s

Protection settings and minor equipment changes will be required at remote stations due to system re-configuration. Alps, Marcy, Porter, and Leeds substations are among the substations likely to be affected.

4.11.1.6. **Terminal Upgrades**

Various terminal upgrades are likely at project related substations and may result in the replacement of some equipment. The scope of work will be determined during the Facilities Study and detailed engineering.

Segment B

4.11.1.7. **Knickerbocker Substation**

Base Proposals

Developer	# of new Lines	# of new Transformers	Total new elements	Proposed Breaker Arrangement	# of Breakers
T019 NGRID/Transco	3	0	3 (also includes Series Compensation)	Ring Bus (built for future Breaker & Half)	3
T022 NextEra	3	0	3	Ring Bus (built for future Breaker & Half)	3
T029 NYPA/NAT	3	0	3	Ring Bus (built for future Breaker & Half)	3
T032 ITC	3 – 345kV 3 – 115kV	0	6	345kV - Ring Bus 115kV – Ring Bus	3 – 345kV 3 – 115kV

Discussion

All Developers propose a new Knickerbocker Substation with similar 345 kV ring bus arrangements. Proposal T019 includes Series Compensation on the line terminal to Pleasant Valley. Proposal T032 adds an independent 115 kV ring bus yard.

Expandability

Proposals T019, T022, and T029 all provide one vacant line terminal position by adding one breaker to the ring bus, or by adding breakers to complete the breaker-and-a-half configuration.

Although proposal T032 does not provide any built-in expandability, ITC's layouts for both the 345 kV and 115 kV yards could easily be modified to provide a vacant line terminal position(s).

Replacement of Aging Infrastructure

There is no replacement of aging infrastructure, as Knickerbocker would be a new substation on a greenfield site.

***Alternate Proposals*.**

Developer	# of new Lines	# of new Transformers	Total new elements	Proposed Breaker Arrangement	# of Breakers
T023 NextEra	Same as T022.				
T025 NYPA/NAT	1 – 765kV 2 – 345kV	2	5	765kV – Ring Bus 345kV – Ring Bus	3 – 765kV 4 – 345kV
T030 NYPA/NAT	Same as T029.				

Discussion

Proposal T025 proposes a 765 kV ring bus yard and a 345 kV ring bus yard with two 765kV – 345kV transformers. Proposal T025 is a Segment A alternative proposal discussed in this section to keep with other Knickerbocker substation arrangements. Proposal T025 will also require the installation of a new 765 kV breaker and associated equipment at the Marcy Substation.

Expandability

Proposal T025 does not provide any built-in expandability.

Replacement of Aging Infrastructure

There is no replacement of aging infrastructure, as Knickerbocker would be a new substation on a greenfield site.

4.11.1.8. **Churchtown Substation**

Base Proposals.

Developer	# of new Lines	# of new Transformers	Total new elements	Proposed Breaker Arrangement	# of Breakers
T019 NGRID/Transco	5	0	5	Breaker & Half	8
T022 NextEra	5	0	5	Ring Bus (built for future Breaker & Half)	5
T029 NYPA/NAT	5	0	5	Breaker & Half	8
T032 ITC	1	0	1	Straight Bus	4 (1 new)

Discussion

Except for proposal T032, all Developers propose constructing new substations at Churchtown. Proposals T019 and T029 will eliminate the existing NYSEG Churchtown substation. Proposal T022 retains and connects to the existing NYSEG Churchtown substation.

Proposal T032 adds a line terminal to the existing NYSEG substation.

Expandability

Proposals T019 and T029 provide one vacant line terminal position by adding a breaker to complete the breaker-and-a-half configuration.

Proposal T022 provides one vacant line terminal position by adding a breaker to the ring bus.

Proposal T032 does not provide any built-in expandability.

Replacement of Aging Infrastructure

National Grid proposal T019 and NYPA/NAT proposal T029 will replace the existing NYSEG Churchtown substation. NextEra proposal T022 and ITC proposal T032 retain existing equipment.

Alternate Proposals.

Developer	# of new Lines	# of new Transformers	Total new elements	Proposed Breaker Arrangement	# of Breakers
T023 NextEra	4	0	4	Ring Bus (built for future Breaker & Half)	4
T030 NYPA/NAT	Same as T029.				

Discussion

Similar to proposal T022, proposal T023 retains and connects to the existing NYSEG Churchtown substation. It differs from proposal T022 in that it eliminates one line terminal for the connection to Pleasant Valley substation.

Expandability

Proposal T023 does not provide any built-in expandability. However, there are provisions for future disconnect switches and breakers to convert the ring bus to a breaker-and-a-half configuration. This will allow a third bay to be added to the north side of the substation.

Replacement of Aging Infrastructure

NYPA/NAT proposal T030 will replace the existing NYSEG Churchtown substation. NextEra proposal T023 retains existing equipment.

4.11.1.9. **Pleasant Valley Substation**

Base Proposals.

Developer	# of new Lines	# of new Transformers	Total new elements	Proposed Breaker Arrangement	# of Breakers
T019 NGRID/Transco	1	0	1 (Also includes (2) capacitor banks)	Breaker & Half	11 (1 new)
T022 NextEra	1	0	1	Breaker & Half	11 (1 new)
T029 NYPA/NAT	1	0	1	Breaker & Half	11 (1 new)
T032 ITC	1	0	1	Breaker & Half	11 (1 new)

Discussion

Proposals T019, T022 and T029 add a 345 kV breaker to Bay #2 to complete the breaker-and-a-half configuration. This provides a new terminal for relocation of the 345 kV Long Mountain line to Bay #2. The vacant terminal in Bay #3 is then available for the proposed 345 kV line from Knickerbocker. This solution eliminates the new Knickerbocker line crossing the Long Mountain line.

Similarly, proposal T032 adds a 345 kV breaker to Bay #2 to complete the breaker-and-a-half configuration. The Bay #2 terminal is then available for the proposed 345 kV line from Knickerbocker. This solution makes it necessary for the new Knickerbocker line to cross the Long Mountain line.

Expandability

The proposals do not provide any built-in expandability.

Replacement of Aging Infrastructure

The proposal does not replace any existing equipment.

Potential Additional Upgrade Required for Proposals to Connect to Pleasant Valley Substation

As stated above, all of the proposals for Segment B propose to occupy Bay #2 at the Pleasant Valley Substation. However, based upon the current NYISO interconnection queue, the Cricket Valley Energy Center (CVEC) project—a 1,110 MW natural gas fired generator located in Dover, New York-- also proposes to interconnect at the Pleasant Valley substation by adding a breaker to Bay #2 completing the breaker-and-a-half configuration.

Currently, the CVEC project is being studied in the NYISO's 2017 Class Year. In the event that the CVEC project accepts its cost allocation from the 2017 Class Year, the proposed project selected by the NYISO will be required to expand the Pleasant Valley Substation to interconnect. Given that such potential upgrades will be similar across all of the proposals, the cost of these potential upgrades has not been included in the independent cost estimates.

Alternate Proposals.

Developer	# of new Lines	# of new Transformers	Total new elements	Proposed Breaker Arrangement	# of Breakers
T023 NextEra	Same as T022.				
T030 NYPA/NAT	Same as T029.				

Discussion, Expandability and Replacement of Aging Equipment

Refer to paragraphs under Base Proposal.

4.11.1.10. **Schodak Substation**

Proposals T019, T029 and T030 add 115 kV line breakers. The other proposals do not propose changes at the Schodak substation.

4.11.1.11. **Remote Terminal Substation**s

Protection settings and minor equipment changes will be required at remote substations due to system re-configuration. Greenbush, Milan, Lafarge, North Catskill, Hudson, and Pleasant Valley 115 kV substations are among the substations likely affected.

4.11.1.12. **Terminal Upgrades**

Various terminal upgrades are likely at project-related substations and may result in the replacement of some equipment. The scope of work will be determined during the Facilities Study and detailed engineering.

4.11.2. Transmission Line Design Comparisons

4.11.2.1. Proposed Line Design

The following tables show the Transmission Line Designs proposed by each Developer:

Segment A

PROPOSAL	DEVELOPER	SECTOR	LINE LENGTH (Miles)	VOLTAGE (KV)	NUMBER OF CIRCUIT	CONDUCTOR		TOTAL STRUCTURE TYPE			COMMENTS
						TYPE	NO/PH	STEEL MONO POLE	STEEL H-POLE	CONCRETE MONO POLE	
T018	National Grid and NYTransco	Edic SS to Princetown Jct.	66.8	345	1	954kcmil CARDINAL ACSS	2	45	316		Edic SS to 12.6 miles - 1 Ckt Reconductoring only
		Princetown Jct. to New Scotland SS	19.7	345	1	954kcmil CARDINAL ACSS	2	59	70		2.5 Miles-2 Ckts, 345kV & 115kV Line#13
		Princetown Jct. to Rotterdam SS	5.0	345/345	2	954 kcmil CARDINAL ACSS	2	85			
T021	NextEra	Edic SS to Princetown Jct.	66.8	345	1	1033.5kcmil CURLEW ACSS	2	10		515	Edic SS to 12.6 miles - 1 Ckt Reconductoring only
		Princetown Jct. to New Scotland SS	19.9	345	1	1033.5kcmil CURLEW ACSS	2	7		130	2.5 Miles-2 Ckts, 345kV & 115kV Line#13
		Princetown Jct. to Rotterdam SS	4.2	345/345	2	1033.5kcmil CURLEW ACSS	2	8		72	
		Princetown Jct. to Rotterdam SS	0.8	230/230	2	1033.5kcmil CURLEW ACSS	1	34			
T025	NYPA and NAT	Marcy to Church Rd and New Scotland Bypass	2.7	765	1	1351.5kcmil DIPPER ACSR	4	6	10		Edic SS to 12.6 miles - 1 Ckt Reconductoring only
		Edic SS to Princetown Jct.	66.8	345	1	954kcmil CARDINAL ACSS	2	62	274		2.5 Miles-2 Ckts, 345kV & 115kV Line#13
		Princetown Jct. to New Scotland SS	19.7	345	1	954kcmil CARDINAL ACSS	2	66	61		
		Princetown Jct. to Rotterdam SS	5.0	345/345	2	954kcmil CARDINAL ACSS	2	74			
T026	NYPA and NAT	Edic SS to Princetown Jct.	66.8	345	1	954kcmil CARDINAL ACSS	2	62	274		Edic SS to 12.6 miles - 1 Ckt Reconductoring only
		Princetown Jct. to New Scotland SS	19.7	345	1	954kcmil CARDINAL ACSS	2	66	61		
		Princetown Jct. to Rotterdam SS	5.0	345/345	2	954kcmil CARDINAL ACSS	2	74			
T027	NYPA and NAT	Edic SS to Princetown Jct.	78.6	345/345	2	954kcmil CARDINAL ACSS	2	391			Edic SS to 12.6 miles - 1 Ckt Reconductoring only
		Princetown Jct. to New Scotland SS	19.7	345/345	2	954kcmil CARDINAL ACSS	2	128			2.5 Miles-2 Ckts, 345kV & 115kV Line#13
		Princetown Jct. to New Scotland SS	6.3	345	1	954kcmil CARDINAL ACSS	2	38			
		Princetown Jct. to Rotterdam SS	5.0	345/345	2	954kcmil CARDINAL ACSS	2	74			
T028	NYPA and NAT	Edic SS to Princetown Jct.	66.8	345	1	954kcmil CARDINAL ACSS	2	62	274		Edic SS to 12.6 miles - 1 Ckt Reconductoring only
		Princetown Jct. to New Scotland SS	19.7	345	1	954kcmil CARDINAL ACSS	2	66	61		2.5 Miles-2 Ckts, 345kV & 115kV Line#13
		Princetown Jct. to Rotterdam SS	5.0	345/345	2	954kcmil CARDINAL ACSS	2	74			
T031	ITC	Edic SS to Princetown Jct.	67.2	345	1	954kcmil CARDINAL ACSR	2	42	403		Edic SS to 12.6 miles - 1 Ckt Reconductoring only
		Princetown Jct. to New Scotland SS	19.7	345/345	2	954kcmil CARDINAL ACSR	2	145			
		Princetown Jct. to Rotterdam SS	5.0	345/345	2	954kcmil CARDINAL ACSR	2	8	93		

Segment B

PROPOSAL	DEVELOPER	SECTOR	LINE LENGTH (Miles)	VOLTAGE (KV)	NUMBER OF CIRCUIT	CONDUCTOR		TOTAL STRUCTURE TYPE			COMMENTS
						TYPE	NO/ PH	STEEL MONO POLE	STEEL H-POLE	CONCRETE MONO POLE	
T019	National Grid and NYTransco	Knickerbocker to Churchtown SS	21.9	115/345	2	954kcmil CARDINAL ACSS	2	163	7		
		Churchtown SS to Pleasant Valley SS	32.3	115/345	2	954kcmil CARDINAL ACSS	2	231			
		Blue Stores Jct to Blue Stores SS	2.1	115	1	795kcmil DRAKE ACSR	1		24		
T022	NextEra	Knickerbocker to Churchtown SS	21.9	115/345	2	1033.5kcmil CURLEW ACSS	2	14		145	
		Churchtown SS to Pleasant Valley SS	32.3	345	1	1033.5kcmil CURLEW ACSS	2	17		229	
		Blue Stores Jct to Blue Stores SS	2.1	115	1	795kcmil DRAKE ACSR	1		24		
T023	NextEra	Knickerbocker to Churchtown SS	21.9	115/345	2	1033.5kcmil CURLEW ACSS	2	14		145	
		Churchtown SS to Pleasant Valley SS	32.3	115/345	2	1033.5kcmil CURLEW ACSS	2	21		229	
		Blue Stores Jct to Blue Stores SS	2.1	115	1	795kcmil DRAKE ACSR	1		24		
T029	NYPA and NAT	Knickerbocker to Churchtown SS	21.9	115/345	2	954kcmil CARDINAL ACSS	2	161			
		Churchtown SS to Pleasant Valley SS	32.3	115/345	2	954kcmil CARDINAL ACSS	2	244			
		Blue Stores Jct to Blue Stores SS	2.1	115	1	795kcmil DRAKE ACSR	1		24		
T030	NYPA and NAT	Knickerbocker to Churchtown SS	21.9	115/345	2	477kcmil HAWK ACSS	3	161			
		Churchtown SS to Pleasant Valley SS	32.3	115/345	2	477kcmil HAWK ACSS	3	244			
		Blue Stores Jct to Blue Stores SS	2.1	115	1	795kcmil DRAKE ACSR	1		24		
T032	ITC	Knickerbocker to Churchtown SS	21.9	115/345	2	954kcmil CARDINAL ACSR	2	158	14		
		Churchtown SS to Pleasant Valley SS	32.1	115/345	3	954kcmil CARDINAL ACSR	2	19	279		2x115 kV and 1X345kV Circuits
		Blue Stores Jct to Blue Stores SS	2.1	115	1	795kcmil DRAKE ACSR	1		24		

4.11.2.2. **Proposed ROW**

All of the transmission line proposals were evaluated to verify that they adequately fit within existing ROW corridors. The evaluation was based on conductor swingout using maximum blow out at 6 psf wind, maximum deflection and electrical clearance requirements. All proposals were found to be adequate.

4.11.2.3. **Clearances**

Electrical clearance to ground was checked to ensure compliance with NESC requirements. All proposed designs exceed NESC minimum clearances with a two to three foot margin. Including at least a two foot additional buffer in the design is good utility practice for construction tolerances and survey adjustments/errors.

4.11.2.4. **EMF**

The existing corridor (345 kV Lines #14 and #18, and 115kV Line #13) between Princetown Junction and New Scotland Substation is currently estimated to exceed NYPSC guidelines for EMF levels. The designs for proposals T018, T021, T026, and T028 improve the condition, but EMF levels are still estimated to exceed the guidelines.

Additionally, proposal T025 proposed conversion of the 345 kV line between Marcy substation and proposed Knickerbocker substation to 765 kV will likely increase EMF levels beyond NYPSC guidelines. Proposal T027 appears to mitigate the EMF exceedance.

4.11.2.5. Transmission Line Conductor Ampacity Ratings

The following tables show a summary of the proposed line lengths, conductor types and conductor ratings for each proposal. No concerns were identified with the proposed conductor types and sizes.

Segment A								SECO CALCULATED	
PROPOSAL	DEVELOPER	SECTOR	Line Length (Miles)	VOLTAGE (KV)	NUMBER OF LINE	CONDUCTOR		STEADY STATE THERMAL RATING (AMPS)	CONDUCTOR RATING (MVA)
						TYPE	NO/ PH		
T018	National Grid and NYTransco	Edic SS to Rotterdam SS	71.8	345	1	954kcmil CARDINAL ACSS	2	4072.8	2433.7
		Edic SS to New Scotland SS	86.5	345	1	954kcmil CARDINAL ACSS	2	4072.8	2433.7
		Rotterdam SS to New Scotland SS	24.7	345	1	954kcmil CARDINAL ACSS	2	4072.8	2433.7
T021	NextEra	Edic SS to Princetown SS	71.0	345	1	1033.5kcmil CURLEW ACSS	2	4293.2	2565.4
		Edic SS to New Scotland SS	86.7	345	1	1033.5kcmil CURLEW ACSS	2	4293.2	2565.4
		Princetown SS to Rotterdam SS	0.8	230	1	1033.5kcmil CURLEW ACSS	1	2147.0	855.3
		Princetown SS to Rotterdam SS #2	0.8	230	1	1033.5kcmil CURLEW ACSS	1	2147.0	855.3
T025	NYPA and NAT	Edic SS to Rotterdam SS	71.8	345	1	954kcmil CARDINAL ACSS	2	3678.2	2197.9
		Edic SS to New Scotland SS	86.5	345	1	954kcmil CARDINAL ACSS	2	3678.2	2197.9
		Rotterdam SS to New Scotland SS	24.7	345	1	954kcmil CARDINAL ACSS	2	3678.2	2197.9
		Marcy to New Scotland SS	85.7	765	1	1351.5kcmil DIPPER ACSR	4	3210.0	4253.3
T026 & T028	NYPA and NAT	Edic SS to Rotterdam SS	71.8	345	1	954kcmil CARDINAL ACSS	2	3678.2	2197.9
		Edic SS to New Scotland SS	86.5	345	1	954kcmil CARDINAL ACSS	2	3678.2	2197.9
		Rotterdam SS to New Scotland SS	24.7	345	1	954kcmil CARDINAL ACSS	2	3678.2	2197.9
T027	NYPA and NAT	Edic SS to Rotterdam SS	71.8	345	1	954kcmil CARDINAL ACSS	2	3678.2	2197.9
		Edic SS to New Scotland SS	86.5	345	1	954kcmil CARDINAL ACSS	2	3678.2	2197.9
		Edic SS to New Scotland SS #2	86.5	345	1	954kcmil CARDINAL ACSS	2	3678.2	2197.9
		Rotterdam SS to New Scotland SS	24.7	345	1	954kcmil CARDINAL ACSS	2	3678.2	2197.9
T031	ITC	Edic SS to Rotterdam SS	72.2	345	1	954kcmil CARDINAL ACSR	2	3162.0	1889.5
		Edic SS to New Scotland SS	86.9	345	1	954kcmil CARDINAL ACSR	2	3162.0	1889.5
		Rotterdam SS to New Scotland SS	24.7	345	1	954kcmil CARDINAL ACSR	2	3162.0	1889.5

Results based on Conductor Maximum temperature and Ambient temperature as shown in table above, Absorptivity and Emissivity 0.6 and Wind 3 ft/sec.

Segment B								SECO CALCULATED	
PROPOSAL	DEVELOPER	SECTOR	Line Length (Miles)	VOLTAGE (KV)	NUMBER OF LINE	CONDUCTOR TYPE	CONDUCTOR NO/ PH	STEADY STATE THERMAL RATING (AMPS)	CONDUCTOR RATING (MVA)
T019	National Grid and NYTransco	Knickerbocker to Pleasant Valley	54.2	345	1	954kcmil CARDINAL ACSS	2	3910.0	2336.4
		Knickerbocker to Pleasant Valley	54.2	115	1	954kcmil CARDINAL ACSS	1	1955.0	389.4
		Blue Stores Jct to Blue Stores SS	2.1	115	1	795kcmil DRAKE ACSR	1	1364.5	271.8
T022	NextEra	Knickerbocker to Pleasant Valley	54.2	345	1	1033.5 CURLEW ACSS	2	3440.0	2055.6
		Knickerbocker to Churchtown	21.9	115	1	795kcmil DRAKE ACSS	1	1495.0	297.8
T023	NextEra	Knickerbocker to Pleasant Valley	54.2	345	1	1033.5 CURLEW ACSS	2	3440.0	2055.6
		Knickerbocker to Pleasant Valley	54.2	115	1	795kcmil DRAKE ACSS	1	1495.0	297.8
T029	NYPA and NAT	Knickerbocker to Pleasant Valley	54.2	345	1	954kcmil CARDINAL ACSS	2	3882.8	2320.2
		Knickerbocker to Pleasant Valley	54.2	115	1	954kcmil CARDINAL ACSS	1	1941.4	386.7
T030	NYPA and NAT	Knickerbocker to Pleasant Valley	54.2	345	1	477kcmil HAWK ACSS	3	4195.8	2507.2
		Knickerbocker to Pleasant Valley	54.2	115	1	954kcmil CARDINAL ACSS	1	2126.1	423.5
T032	ITC	Knickerbocker to Pleasant Valley	54.0	345	1	954kcmil CARDINAL ACSR	2	3162.0	1889.5
		Knickerbocker to Pleasant Valley	54.0	115	1	954kcmil CARDINAL ACSR	1	1581.0	314.9
		Churchtown to Pleasant Valley	32.1	115	1	954kcmil CARDINAL ACSR	1	1581.0	314.9

Results based on Conductor Maximum temperature and Ambient temperature as shown in table above, Absorptivity and Emissivity 0.6 and Wind 3 ft/s

4.11.2.6. **Structure Heights**

In its December 17, 2015 Order, the NYPSC noted that it "will not mandate criteria to be applied by the NYISO, but all proposers of transmission solutions should be aware as they prepare their submissions that minimization of structure heights will be an important issue in the siting review process so applicants should be careful to not lock themselves into designs that could not later be approved. All applicants are encouraged to minimize the heights of the proposed structures while keeping them within the context of their 2015 proposals. In making this statement, the Commission is not in any way suggesting that it would be suitable for applicants to appropriate the structure designs of other applicants."

The following tables summarize the structure height increase for each proposal based on the percent increase in height from the existing line.

SEGMENT A	Percent of Structures					
	T018	**T021**	**T025**	**T026/T028**	**T027**	**T031**
1. Less than 0 ft.	10.8%	0.0%	48.6%	50.1%	3.0%	4.1%
2. Same Ht.	1.6%	0.0%	1.3%	1.3%	1.7%	84.1%
3. From 0.1ft to 5 ft.	5.2%	0.4%	9.2%	9.5%	12.0%	10.0%
4. From 5.1 ft to 10 ft.	9.7%	0.6%	6.0%	6.1%	0.8%	1.4%
5. From 10.1 ft to 15 ft.	12.5%	5.8%	6.3%	6.3%	7.4%	0.0%
6. From 15.1 ft to 20 ft.	16.9%	9.3%	11.8%	12.3%	6.3%	0.3%
7. From 20.1 ft to 25 ft.	12.9%	63.1%	6.9%	7.1%	10.9%	0.1%
8. From 25.1 ft to 30 ft.	11.8%	8.6%	1.6%	1.7%	32.3%	0.0%
9. From 30.1 ft to 40 ft.	9.0%	8.6%	3.3%	3.4%	15.1%	0.0%
10. From 40.1 ft to 50 ft.	3.7%	2.7%	1.8%	1.7%	5.4%	0.0%
11. From 50.1 ft to 60 ft.	4.0%	0.5%	1.1%	0.2%	3.5%	0.0%
12. From 60.1 to 70 ft.	1.4%	0.1%	0.2%	0.0%	0.2%	0.0%
13. From 70.1 to 80 ft.	0.3%	0.1%	0.2%	0.2%	0.6%	0.0%
14. From 80.1 to 90 ft.	0.0%	0.0%	0.9%	0.0%	0.6%	0.0%
15. From 90.1 to 100 ft.	0.2%	0.0%	0.5%	0.2%	0.0%	0.0%
16. From 100.1 to 110 ft.	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
17. From 110.1 to 120 ft.	0.0%	0.0%	0.4%	0.0%	0.0%	0.0%

SEGMENT B	Percent of Structures				
	T019	**T022**	**T023**	**T029/T030**	**T032**
1. Less than 0 ft.	21.7%	12.1%	1.5%	54.8%	51.1%
2. Same Ht.	0.7%	0.2%	0.5%	19.0%	1.3%
3. From 0.1ft to 5 ft.	24.2%	14.3%	14.7%	10.9%	46.4%
4. From 5.1 ft to 10 ft.	26.9%	44.7%	27.9%	10.9%	1.3%
5. From 10.1 ft to 15 ft.	16.5%	28.6%	55.5%	3.0%	0.0%
6. From 15.1 ft to 20 ft.	5.0%	0.0%	0.0%	0.7%	0.0%
7. From 20.1 ft to 25 ft.	3.0%	0.0%	0.0%	0.2%	0.0%
8. From 25.1 ft to 30 ft.	1.0%	0.0%	0.0%	0.0%	0.0%
9. From 30.1 ft to 40 ft.	1.0%	0.0%	0.0%	0.0%	0.0%
10. From 60.1 ft to 70 ft.	0.0%	0.0%	0.0%	0.5%	0.0%

There is a tradeoff between structure height and number of structures and also between structure height and use of ROW width. A discussion of how structure height relates to visual impact is contained in the Environmental section of this report.

4.11.2.7. **Structural Design Criteria**

The transmission line structural design criteria were evaluated for all of the proposals. The following table summarizes the criteria used. All proposals meet minimum standards as defined by the 2017 version of the National Electric Safety Code Section 25 for this region of the country and are within the guidelines of the Third Edition of ASCE's Manual 74 "Guidelines for Electrical Transmission Line Structural Loading".

DESIGN CRITERIA REQUIREMENT COMPARISON FOR THE TRANSMISSION LINE DESIGNS

		STANDARD REQIREMENTS				COMPARISON WITH DEVELOPER'S DESIGN CRITERIA			
Case No.	Case Description	Wind Load (mph)	Radial Thickness of ice (inches)	Temp (°F)	Standard	National Grid/ NY Transco	NextEra	NYPA/NAT	ITC
1	NESC Heavy	39.5	0.5	0	NESC – 250B	Ok	Ok	Ok	Ok
2	Extreme Wind 1	90	0	60	NESC – 250C	Ok 1	Ok 1	Exceeds (100MPH)	Exceeds (100MPH)
3	Extreme Ice and Wind	40	0.75	15	NESC – 250D	Ok	Ok	Ok	Ok
4	Extreme Ice				Not Required by NESC or ASCE Loading Guideline 74	1.5" Ice & 2psf Wind (structure overload factor of 1.1)	1.5" Ice & 0psf Wind (structure overload factor of 1.0)	1" Ice & 0psf Wind (structure overload factor of 1.0)	1" Ice & 0psf Wind (structure overload factor of 1.0)

1 Columbia County & Dutchess County are in the "Special Wind Region" as defined by the NESC. NYPA/NAT & ITC address this by exceeding the requirements of 250C. It is likely that the NESC 250D load case and/or the Extreme Ice case will control the design for National Grid & Nextera which will adequately address any special wind concerns.

The National Grid/Transco proposals T018 and T019 include noticeably heavier duty structures and foundations than other similar proposals. As stated in their proposal, their design "uses significantly heavier ice loadings than required by code and implements several techniques to mitigate cascading structure failures." Use of these more stringent design criteria does result in higher transmission line structure and foundation costs.

It was also observed that National Grid's proposal uses more concrete foundations than NYPA/NAT. To ensure that NYPA/NAT were not under designing their foundations, SECo completed a spot check of the NYPA/NAT foundation designs using the geotechnical data that they provided. SECo found that NYPA/NAT's proposed foundations to be adequate.

4.11.2.8. **Potential Issues with Conversion of Line to 765 kV**

A preliminary assessment was completed of the feasibility of the NAT/NYPA 765 KV option T025 proposal. The assessment is based on data provided in NAT/NYPA's proposal and as obtained from Developer and National Grid responses to RFIs. SECo concludes that the conversion of the line is technically feasible. However, as suggested in the NAT/NYPA's "765KV Conversion Feasibility Study" document, additional detailed engineering study, survey and field testing must be performed prior to implementation of the project. The review team also believe that the final cost of this conversion may vary widely depending on the potential remedial work recommended as the result of more detailed study. NAT/NYPA have provided rough estimates to indicate possible range of costs.

The assessment focused on the following technical criteria:

- Condition of Existing Transmission Line – The existing transmission line is approximately 40 years old and has been operated at 345KV since its construction. Based on visual observation of portions of the line it appears that the line has been well maintained and is in very good physical condition.
- Clearances - NAT/NYPA has obtained Lidar data for roughly 1/3 of the existing line length to be converted to 765KV operation. They state that they have evaluated that data and determined that their proposal will meet current day clearance standards. SECo also reviewed the Lidar data and concurs. SECo has obtained PLSCadd files for the proposed line from NYPA/NAT and found the design line to ground clearance on the line is 44ft. The minimum calculated ground clearance requirement for 765KV line based on NESC 2012- Rule 232C1a and Table 232-1 is 33.2ft. The maximum operating temperature of the line as proposed by the Developer will be less than the original design operating temperature of the line. Based on the information put forth by NAT/NYPA and our own evaluation of the partial data received from National Grid, we agree that ground clearance should not be an issue, with the exception of one span between Smith Hill Road and Newport Road. Our independent cost estimate doesn't include any dollars to correct clearance issues.
- Insulation – NAT/NYPA has evaluated the insulation of the existing line and documents their findings in their 765KV conversion feasibility study. They show that the insulation level and air gaps are adequate for 765KV operation and plan to confirm their findings by performing a system transient analysis study. Our independent cost estimate doesn't include any dollars to correct insulation issues.

- EMF – NAT/NYPA has provided an assessment regarding EMF requirements and has calculated the amount of additional easement required to address EMF needs. Our independent cost estimate includes the cost of the additional EMF easements required.
- Corona – There is concern that corona may likely be an issue with the existing line construction. SECo has contacted a major conductor hardware supplier and learned that some improvements have been made to the corona performance of transmission line hardware since the existing line was constructed. SECo doesn't have drawings that show the hardware used in the existing construction. Based on photos, taken at several locations throughout the line, it doesn't appear that the line was constructed with corona rings. Remedial work may be required to correct corona issues on the existing line. Rough cost estimates for two potential scenarios were prepared. The first is to replace hardware (not including insulators) on 96 miles of the existing line. The second is to replace hardware (not including insulators) on 83 miles of the existing line and completely rebuild 13 miles of the existing line. The rebuild of the 13 mile section might be required since that section was constructed with a bundle of three conductors per phase while the remaining line was constructed with a 4 bundle per phase. These costs were included in the independent estimate.

4.11.2.9. **Use of Concrete Poles**

NextEra proposes to use concrete poles. Due to the length and weight of concrete poles careful planning during detailed engineering will be required to develop delivery and construction plans for each pole site. NextEra has provided documentation demonstrating that they and the proposed supplier have investigated the logistics of the pole delivery and installations. This investigation includes field reviews, production schedules; as well as delivery methods and routes. In general we find that the preliminary field review process and planning has considered many of the issues/obstacles that may be confronted during delivery and construction. The Developer's plan has considered some of the concerns associated with transport, public protection and community impacts. And the option to utilize multi-piece steel poles provides a clear mitigation for problem areas. But as with all project risks, early detection, planning and mitigation are key to avoiding unexpected and untimely schedule and financial impacts. We would recommend a more detailed and robust plan and risk mitigation be developed during detailed engineering.

4.11.2.10. **Operations Concerns**

4.11.2.10.1. Transmission Line Crossings

Overhead Transmission line wire crossings could be an area of risk due to the possibility of an upper circuit failing and falling into a lower circuit (or circuits) below.

- At Edic most developers have proposed to relocate the existing Fraser line into a new bay and terminate the new line in the vacated Fraser terminal. ITC instead terminates the new line into the new terminal and crosses the Fraser line.
- A similar situation applies to the Pleasant Valley substation, where all Developers except ITC propose to relocate the existing Long Mountain line to a new bay allowing the new line to terminate without a crossing.
- At the New Scotland substation, National Grid/Transco and NextEra propose to cross the existing Blenheim Gilboa to New Scotland (Line #672) and New Scotland to Leeds (Line# 686) 345kV lines to terminate at the New Scotland substation

4.11.2.10.2. Triple Circuit Concerns

ITC's Segment B proposal T032 proposes using triple circuit structures between Churchtown Substation and Pleasant Valley Substation. The proposed structures are in a two-pole configuration with one 345 kV circuit attached horizontally to an upper crossarm and two 115 kV circuits attached side by side horizontally to a lower crossarm. The proposed compact design conserves space within the transmission corridor but creates an operational concern. Future maintenance of the transmission circuits and associated structures may depend on the outage availability of all the circuits attached. A maintenance plan must be developed prior to putting this configuration into service.

5. Attachments

5.1. Attachment A –Schedule Gantt Charts

5.2. Attachment B –Independent Estimates

5.2.1. National Grid (NGRID) – (T018)

5.2.2. NextEra Energy Transmission New York – (T021)

5.2.3. North America Transmission/New York Power Authority (NAT/NYPA) – 765kV Proposal #1 (T025)

5.2.4. North America Transmission/New York Power Authority (NAT/NYPA) – Base Proposal (T026)

5.2.5. North America Transmission/New York Power Authority (NAT/NYPA) – Double Circuit (T027)

5.2.6. North America Transmission/New York Power Authority (NAT/NYPA) – Enhanced (T028)

5.2.7. ITC – (T031)

5.2.8. National Grid (NGRID) – (T019)

5.2.9. NextEra Energy Transmission New York – (T022)

5.2.10. NextEra Energy Transmission New York Alternative – (T023)

5.2.11. North America Transmission/New York Power Authority (NAT/NYPA) – Base (T029)

5.2.12. North America Transmission/New York Power Authority (NAT/NYPA) – Enhanced (T030)

5.2.13. ITC – (T032)