

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~~Needs (AC Transmission PPTN) that the New York Public Service Commission (“NYPSC”) identified in December 2015. In its October 27, ~~2017~~2016 Viability and Sufficiency Assessment Report, the NYISO reported that the thirteen proposals were viable and sufficient 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 <u>765 kV</u> 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

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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~~Segment A and Segment B, the NYPSC also identified in the AC Transmission PPTN, upgrades to the Rock Tavern 345 kV Substation and the rebuild of the Shoemaker to Sugarloaf 138 kV line with a new double circuit 138 kV line 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;

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- 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~~Developers’ 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~~Developers’ plans for site control; and
- Evaluate the ~~Developer’s~~Developers’ 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:

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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 <u>765 kV</u>	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.

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2.2. Cost


In evaluating the construction cost of each proposal, Kenny Construction (~~"(Kenny)"~~) prepared independent cost estimates for each proposal. Kenny reviewed the Developers' proposals with the ~~costs~~Developers' cost estimates 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	\$520,156,065
T021 NextEra Energy	\$497,652,781
T025 NYPA / NAT (Base+ 765kV <u>765 kV</u>)	\$861,184,683 <u>\$862,968,398</u>
T026 NYPA / NAT (Base)	\$488,847,348 <u>\$490,654,542</u>
T027 NYPA / NAT (Double Ckt)	\$741,263,417 <u>\$749,744,787</u>
T028 NYPA / NAT (Enhanced)	\$512,174,151 <u>\$513,977,889</u>
T031 ITC	\$570,008,025

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

Developer	Independent Estimate (2018 \$)
T019 National Grid/ NY Transco	\$445,051,522
T022 NextEra Energy	\$356,825,170 <u>\$338,308,963</u>
T023 NextEra Energy (Alternate)	\$389,645,078
T029 NYPA / NAT (Base)	\$386,855,640 <u>\$387,476,622</u>
T030 NYPA / NAT (Enhanced)	\$406,320,971
T032 ITC	\$501,856,268

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


Developer	Independent Estimate (2018 \$)
T019 National Grid/ NY Transco	\$558,051,522
T022 NextEra Energy	\$469,825,170 <u>\$51,308,963</u>
T023 NextEra Energy (Alternate)	\$502,645,078
T029 NYPA / NAT (Base)	\$499,855,640 <u>\$500,476,622</u>
T030 NYPA / NAT (Enhanced)	\$519,320,971
T032 ITC	\$614,856,268

Notes:

- Independent Estimates are adjusted to 2018 U.S. Dollars.
- The estimates ~~include~~includes the contingency rate of 30% ~~included on~~referenced in the ~~DPS estimate template-PSC~~ "Order Finding Transmission Needs Driven by Public Policy Requirements" (December 17, 2015) and the Department of Public Service Staff report. The review team ~~has assumed the~~ agrees that level of contingency is sufficient to ~~include allowance~~allow for unanticipated costs and estimating accuracy to forecast a reasonable worst case cost.
- The Global ~~Addition~~Additions includes upgrades to the Rock Tavern 345 kV Substation and the rebuild of the Shoemaker to Sugarloaf 138 kV line with a new double circuit 138 kV line and related substation work at Shoemaker, Hartley, South Goshen, Chester, and Sugarloaf at the cost 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~~costs, 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:

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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~~(that has 345 kV line #14 and line #18, and 115 kV line #13) 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 (~~NAT/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. See Section 4.11.2.4 for more detail.
- For proposal T025 (~~NAT/NYPA/NAT~~ proposal to convert the existing 345 kV line to 765kV 765 kV operation) 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 cost estimate to account for the potential cost of ~~mitigation~~mitigating corona and EMF issues.

SEGMENT B

- ~~While the~~The NYPSC encouraged that new structures have minimal increase in height and concluded that height increases of less than 25 feet over existing structures will not create a significant adverse visual impact of a regional nature (December 12, 2015 Order at p. 35). All else being equal, the construction of new structures even with minimal increase in height may ~~result in~~increase the risk of public opposition due to their ~~visual impact~~potential local visual impact. The PSC determined that the local visual impacts will be addressed in the Article VII siting proceedings.

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 as described below.

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- 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~~new Edic to New Scotland ~~345kV~~345 kV line. This will provide the 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~~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~~Developers' plans and the plans are essentially the same.
- 2.6.2. For the non-incumbent Developer proposals, the following aspects are common:

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- 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~~National Grid/Transco's NYES Segment A Proposal includes the following ~~major work items~~components:

- ~~New~~A new 345 kV line of approximately 87 miles from the existing Edic 345 kV substation to the existing New Scotland 345 kV substation. The New Scotland 345 kV Substation will be upgraded and expanded
- ~~Two new 345 kV lines of approximately 5 miles single-circuit looping the existing 345 kV Edic to New Scotland #14 line into and out of a new Rotterdam 345 kV Substation (Converted from The Rotterdam 230 kV);~~ substation will be retired
- ~~Two Newnew 345/115 kV transformers;~~ New autotransformers connecting the existing Rotterdam 115 kV switchyard to the new 345 kV switchyard
- ~~One new 345/230 kV transformer;~~ New autotransformer connecting the existing 230 kV Rotterdam to Eastover Road #38 line to the new Rotterdam 345 kV switchyard
- ~~One new 135 MVAR Capacitor Bank~~MVAR capacitor bank connected to the new Rotterdam 345 kV switchyard
 - ~~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~~Decommissioning of the Porter ~~–to~~ Rotterdam 230 kV lines #30 and #31

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3.2. T021 – NextEra – Enterprise Line - Segment A


~~NextEra proposal T021~~NextEra's Enterprise Segment A Proposal includes the following ~~major work items~~components:

- ~~New 345/230kV~~ A new 345 kV line of approximately 86 miles (83.4 miles 345 kV line and 2.6 miles double circuit 345/115 kV line) from the existing Edic 345 kV substation to the existing New Scotland 345 kV substation
- Rebuild 2.6 miles of existing Rotterdam-New Scotland 115 kV line circuit #13
- A new breaker-and-a-half 345/230 kV Princetown Substation (taps, located near the existing Rotterdam 230 kV substation. The substation will include two 345/230 kV auto-transformers
 - ~~Two new 345 kV circuits each approximately 4 miles in length to loop the existing Marcy – New Scotland 345 kV line); Two New 345/230kV transformers~~
- Two New Overhead circuit #18 into Princetown – Rotterdam 345/230 kV substation
- Two new 1 mile 230 kV lines from Princetown-Rotterdam
 - ~~New Overhead Edic – New Scotland 345 kV line~~
- ~~Retire two existing Decommissioning of the~~ Porter ~~–to~~ Rotterdam 230 kV lines #30 and #31

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

~~The NAT/NYPA “Segment A +765 KV” proposal T025 includes~~ kV Proposal consists of the following ~~major work items~~components:

- ~~New Knickerbocker 765/345 kV Substation (taps~~ A new 345 kV line of approximately 86 miles from the existing Edic 345 kV substation to the existing New Scotland ~~–Alps 345 kV line); Two New 765/345 kV transformers~~substation
- ~~New~~Two new 345 kV lines of approximately 5 miles single-circuit looping the existing 345 kV Edic to New Scotland #14 line into and out of a new Rotterdam 345 kV Substation ~~(Converted from. The Rotterdam 230 kV, taps existing Edic – New Scotland 345 kV line); substation will be retired~~
- Two ~~New~~new 345/115 kV lower impedance transformers; New connecting the existing Rotterdam 115 kV switchyard to the new 345 kV switchyard. One new 345/230 kV transformer connecting the existing 230 kV Rotterdam to Eastover Road #38 line to the new Rotterdam 345 kV switchyard
 - ~~New~~A new Princetown 345 kV Switching Station (taps existing Edic – switchyard by tapping the newly proposed Edic-New Scotland 345 kV line)
- ~~New Overhead Edic – Princetown – lines and Rotterdam-New Scotland 345 kV line~~transmission lines
 - ~~Terminal Upgrades at Marcy 345 kV and Edic 345 kV~~

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- Convert ~~existing~~the Marcy – New Scotland – ~~Alps~~and New Scotland – Knickerbocker 345 kV ~~line~~transmission lines to 765 kV operation as Marcy – Knickerbocker 765 kV ~~line~~(with no connection at New Scotland)
- ~~Switching station or substation work at~~ Knickerbocker – ~~Alps section remains operated at with~~ two new 2000 MVA 765/345 kV transformers at Knickerbocker
- ~~Terminal upgrades at Edic and Marcy 345 kV). This includes the rebuild of approximately 1.5 mile of line from Marcy to Mk-B and construction of a 1 mile line bypass around New Scotland. It also includes “Network Upgrades” to modify the existing line to mitigate potential Corona Issues.~~ substations
- ~~Retire two existing~~Decommissioning of the Porter – to Rotterdam 230 kV lines #30 and #31

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


NAT/NYPA Segment A “Base” ~~proposal T025 includes~~ Proposal consists of the following ~~major work items~~components:

- ~~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~~ A new 345 kV line (double-bundle)
- ~~Loop of approximately 86 miles from the existing Edic to New Scotland 345kV line #14 to Rotterdam 345kV~~ 345 kV substation with 2 new transmission lines to the existing New Scotland 345 kV substation
- Two new 345 kV lines of approximately 5 miles single-circuit looping the existing 345 kV Edic to New Scotland #14 line into and out of a new Rotterdam 345 kV Substation. The Rotterdam 230 kV substation will be retired
- Two new 345/115 kV transformers connecting the existing Rotterdam 115 kV switchyard to the new 345 kV switchyard. One new 345/230 kV transformer connecting the existing 230 kV Rotterdam to Eastover Road #38 line to the new Rotterdam 345 kV switchyard
- Terminal upgrades at Edic and Marcy and Edie 345 kV substations
 - ~~New Scotland 345 kV Substation reconfiguration~~
- Decommissioning of the Porter to Rotterdam 230 kV lines #30 and #31

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

NAT/NYPA ~~proposal T027 includes~~ Segment A Double Circuit Proposal consists of the following ~~major work items~~components:

- ~~Retire Porter to Rotterdam 230kV lines #30 and #31~~


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- ~~New Rotterdam~~ A new 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 double circuit line of approximately 86 miles from the existing Edic to New Scotland 345kV line #14 to Rotterdam 345kV 345 kV substation with 2 new transmission lines~~
- ~~New Princetown switching station, tapping the two new Edic New Scotland lines and to the Rotterdam existing New Scotland 345kV line~~ 345 kV substation
- ~~Terminal upgrades at Marcy and~~ Two new 345 kV lines of approximately 5 miles single-circuit looping the existing 345 kV Edic to New Scotland #14 line into and out of a new Rotterdam 345 kV Substation reconfiguration. The Rotterdam 230 kV substation will be retired
- ~~Retire~~ Two new 345/115 kV lower impedance transformers connecting the existing Rotterdam 115 kV switchyard to the new 345 kV switchyard. One new 345/230 kV transformer connecting the existing 230 kV Rotterdam to Eastover Road #38 line to the new Rotterdam 345 kV switchyard
- ~~Rebuild approximately 6 miles of the Rotterdam to New Scotland 115 kV line~~ 345 kV transmission line to accommodate the new double-circuit line beginning from Princetown junction
- ~~Remove the Rotterdam to New Scotland 115 kV transmission line~~
- ~~A new Princetown 345 kV switchyard by tapping the newly proposed Edic-New Scotland lines and Rotterdam-New Scotland transmission lines~~
- ~~Terminal upgrades at Edic and Marcy 345 kV substations~~
- ~~Decommissioning of the Porter to Rotterdam 230 kV lines #30 and #31~~

3.6. T028 – NAT/NYPA Segment A - Enhanced

~~The NAT/NYPA proposal T028 includes~~ Segment A Enhanced Proposal consists of the following major work items components:

- ~~Retire Porter to Rotterdam 230kV lines #30 and #31~~
- ~~New Rotterdam~~ A new 345 kV line of approximately 86 miles from the existing Edic 345 kV substation to the existing New Scotland 345 kV substation
- ~~Two new 345 kV lines of approximately 5 miles single-circuit looping the existing 345 kV Edic to New Scotland #14 line into and out of a new Rotterdam 345 kV Substation with 2. The Rotterdam 230 kV substation will be retired~~
- ~~Two new 345/115 kV transformers (lower impedance) and 1 transformers connecting the existing Rotterdam 115 kV switchyard to the new 345 kV switchyard. One new 345/230 kV transformer connecting the existing 230 kV Rotterdam to Eastover Road #38 line to the new Rotterdam 345 kV switchyard~~

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- ~~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~~ A new Princetown ~~switching station,~~ 345 kV switchyard by tapping the ~~new-newly proposed~~ Edic – New Scotland lines and ~~the Rotterdam – New Scotland 345kV transmission~~ lines
- Terminal upgrades at Edic and Marcy and Edic 345 kV substations
 - ~~New Scotland 345 kV Substation reconfiguration~~
- Decommissioning of the Porter to Rotterdam 230 kV lines #30 and #31

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

~~ITC's "16NYPP1-1A" proposal T031 includes~~ The ITC Segment A Proposal consists of the following ~~major work items~~ components:

- ~~New~~ A new Princetown 345 kV ~~Switching Station (tap~~ switching station tapping the existing Marcy ~~to~~ to New Scotland 345 kV ~~#18 line~~ #14 line and Edic ~~to~~ to New Scotland 345 kV ~~lines~~ lines)
- ~~New~~ A new Edic – Princetown – New Scotland 345 kV line, rebuilding line #14 between Princetown and New Scotland and sharing the common tower structures with the new line
- A new Rotterdam 345 kV ~~Switching Station Expansion; Two New~~ substation with two new 345/230 kV transformers
 - ~~New Overhead Edic – Princetown 345 kV line~~
 - ~~New Overhead Princetown – New Scotland 345 kV line~~
- Two ~~New Overhead~~ new Princetown ~~to~~ to Rotterdam 345 kV lines of approximately 5.2 miles single circuit
 - ~~Rebuild Princetown – New Scotland 345 kV line (existing Edic – New Scotland 345 kV line)~~
- ~~Retire two existing~~ Decommissioning of the Porter ~~to~~ to Rotterdam 230 kV lines #30 and #31


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 138 kV line to be performed by Orange & Rockland.

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

~~NGRID/Transco's National Grid/Transco-NYES Segment B proposal T019 includes~~ consists of the following ~~major work items~~ components:

- ~~New~~ A new double-circuit 345/115 kV line from a new Knickerbocker 345 kV Switching Station ~~(tap to the existing New Scotland – Alps 345 kV line)~~


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- ~~Rebuild Pleasant Valley Substation, including a rebuild of the~~ Churchtown 115 kV Switching Station
- ~~Upgrade and an upgrade of the existing Pleasant Valley 345 kV and 115 kV substations; Two 135 MVAR Capacitor Banks at 115 kV Substation, and 50% series compensation on Knickerbocker to Pleasant Valley 345 kV line~~
- ~~Two new 135 MVAR 345 kV capacitor banks connected to the Pleasant Valley 345 kV Substation~~
- ~~Terminal Upgrades upgrades to the existing Roseton 345 kV (for Substation and Transition Station to upgrade the thermal ratings on the 345 kV Roseton to East Fishkill 345 kV #305 line)~~
 - ~~Terminal Upgrades upgrades to the existing New Scotland 345 kV Substation to upgrade the thermal ratings on the 345 kV New Scotland 345 kV (for proposed New Scotland - Knickerbocker 345 kV line)~~
- ~~New Overhead 345/115 kV double-circuit to Knickerbocker - Pleasant Valley #2A line (reconductor portions of the 115 kV line); 50% Series Compensation at Knickerbocker 345 kV~~
- ~~Multiple retirements and reconfigurations on Retirement of aging infrastructure including multiple existing 115 kV lines between Greenbush - 115 kV Substation and Pleasant Valley 115 kV Substation 345 kV~~

3.9. T022 – NextEra – Enterprise Line - Segment B

~~NextEra's NextEra Enterprise Line Segment B~~ proposal ~~T022 includes~~ consists of the following ~~major work items~~ components:

- Multiple retirements and reconfigurations on 115 kV lines between Greenbush – Pleasant Valley
- ~~New Knickerbocker 345 kV Switching Station (taps existing 345 kV Switchyard, approximately 13 miles southeast of New Scotland - along the New Scotland - Alps 345 kV line)~~
- ~~Loop New Scotland - Alps 345 kV line circuit #2 into Knickerbocker Switchyard~~
- ~~New North Churchtown 115 kV Switching Station (taps 115 kV Switchyard, just north of NYSEG's existing Churchtown - Valkin 115 kV line) switchyard~~
- ~~New overhead 345 kV A new 345 kV line from a new Knickerbocker 345 kV switching station to the existing Pleasant Valley. Line is 345 kV substation (double-circuit 345/115 kV 115 kV line between Knickerbocker and Churchtown - new 115, and single-circuit 345 kV line terminates at North between Churchtown), and Pleasant Valley)~~
 - ~~Rebuild Greenbush - North Churchtown 115 kV line~~
 - ~~Multiple retirements and reconfigurations on 115 kV lines between Greenbush - Pleasant Valley 115 kV~~

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3.10. T023 – NextEra– Enterprise Line Segment B

~~NextEra's~~NextEra Enterprise Line Segment B-Alt proposal ~~T023 build~~sconsists of the following components:


Multiple retirements and reconfigurations on T022 by adding:

- ~~Additional~~ 115 kV upgrades~~lines~~ between ~~Churchtown–Greenbush~~ – Pleasant Valley
(Retires the
- New Knickerbocker 345 kV Switchyard, approximately 13 miles southeast of New Scotland along the New Scotland - Alps 345 kV line
- Loop New Scotland - Alps 345 kV line circuit #2 into Knickerbocker Switchyard
- New North Churchtown 115 kV Switchyard, just north of NYSEG's existing Churchtown 115 kV switchyard
- A new double-circuit 345/115 kV line from Churchtown–a new Knickerbocker 345 kV switching station to the existing Pleasant Valley and extends the new 345/115 kV double circuit from Churchtown to Pleasant Valley)–345 kV substation

3.11. T029 – NAT/NYPA Segment B - Base

~~NAT/NYPA proposal T029 includes~~Segment B Base Proposal consists of the following ~~major work items~~components:

- ~~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 ~~A new~~ 345 kV Knickerbocker switchyard along the New Scotland - Alps 345 kV line
- Loop the existing 345 kV New Scotland to Alps transmission line into Knickerbocker Switchyard
- A new double-circuit 345/115 kV line from a new Knickerbocker 345 kV switching station to Pleasant Valley 345 kV Substation (double-bundled 345 kV line)
- A new Churchtown 115 kV substation
- Shoemaker – Shoemaker Tap – Middletown Tap–345/138 kV transformer and reconductor Shoemaker tap to Shoemaker 138 kV linefacilities upgrades

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3.12. T030 – NAT/NYPA Segment B - Enhanced

NAT/NYPA Segment B “Enhanced” ~~proposal T030 includes~~ Proposal consists of 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~~ components included with the Segment B Base Proposal with use of a triple bundle (instead of double-circuit bundle) conductor for the Knickerbocker – Pleasant Valley 345/~~115~~ kV transmission 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~~

~~3.16~~ 3.13. T032 – ITC Segment B - 16NYPP1-1B


ITC Segment B “~~16NYPP1-1B~~” ~~proposal T032 includes~~ Proposal consists of the following major work items components:

- ~~New~~ Multiple retirements and reconfigurations on 115 kV lines between Greenbush and Pleasant Valley
- ~~A new~~ Knickerbocker 345 kV Substation and ~~a~~ new Knickerbocker 115 kV Switching Station (~~taps Substation by tapping the existing 345 kV New Scotland – to Alps 345 kV circuit and Greenbush – to Pleasant Valley 115 kV, line respectively~~)
- ~~New Overhead~~ A new 345/115 kV double-circuit line from the Knickerbocker ~~– Pleasant Valley 345/115 kV line (triple circuit 345/115/115 kV from station to Churchtown – station on existing Greenbush to Pleasant Valley) right-of-way~~
 - ~~Terminal Upgrades at multiple~~ A new 345/115/115 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 – triple-circuit line from Churchtown to Pleasant Valley 115 kV on existing Greenbush to Pleasant Valley right-of-way~~

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

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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 the State of 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~~ In Case Nos. 12-T-0502, et al., Proceeding on Motion to Examine Alternating Current Transmission Upgrades, Order Authorizing Modification of the Process to Allow for Consideration of Alternative Proposals (February 21, 2014), the NYPSC determined that the expedited process proposed in the 2014 State of the State address was not directly applicable to its proceedings and would not be employed.¹

Accordingly, the review team’s 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:

Article VII Process Minimum Durations

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.

¹ Id. at pp 3-4 (finding that the proposed expedited process “would apply only to projects that do not require permanent expansion of the right-of-way ‘envelope’ with wider corridors or taller towers” and, thus, “is not directly applicable to this proceeding and will not be employed”).

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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~~projects' designs 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

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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.

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- 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. ~~NAT~~/NYPA/~~NAT~~ Segment A

4.1.3.1. Proposal T025 – Segment A + ~~765kv~~765 kV 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.

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- 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.

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- 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.

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- 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.

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- 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. ~~NAT~~/NYPA/~~NAT~~ Segment B Proposals

4.1.7.1. ~~NAT~~/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. ~~NAT~~/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.

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- 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:

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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 <u>765 kV</u>	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 a 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

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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.”


4.2.1. In-evaluating Estimate Methodology

Development of the ~~construction independent~~ cost of each proposal, estimates for the AC Transmission Project was an iterative process utilizing the collective expertise and experience of the review team, and augmented by vendor budgetary quotations. Kenny Construction (“Kenny”) prepared ~~independent estimates the~~ independent cost estimates. A copy of the construction costs for each proposal. In doing so, Developer’s proposals was provided to Kenny reviewed with all pricing information redacted. Kenny familiarized itself with the proposals and, in conjunction with SECo, completed field reviews of the impacted facilities.

SECo solicited budgetary quotations from vendors for major equipment including transformers, circuit breakers, GIS equipment, and Series Compensation System. Kenny Construction solicited budgetary quotations for concrete and steel poles, insulators and conductor. Kenny Construction also used historical data from projects it had completed to develop unit pricing for the material supply rates and labor and equipment rates for equipment such as switches, instrument transformers, station service transformers, transmission structures, conductors, grounding and hardware. Kenny purchases large volumes of transmission and substation materials annually.

The Preliminary designs provided by each Developer were used as the basis for the cost estimates. SECo provided engineering input as required to assist Kenny in determining specific technical requirements and verifying the Developers’ proposals with the costs redacted preliminary designs. Developers’ designs were checked for general compliance with standard industry requirements but they were not optimized.

Indirect cost percentages were derived by Kenny Construction from historical project data. Licensing and environmental cost estimates were developed for each project by SECo’s

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subcontractor GEI Consultants, Inc. ~~estimated the environmental licensing and permitting costs...~~

~~The~~The draft cost estimates from Kenny were reviewed by SECo for completeness and accuracy. SECo also compared the independent draft cost estimates for the proposals against each other for consistency across the proposals. Lastly, SECo compared each proposal's draft cost estimates against the Developer's cost estimates as a check for their reasonableness. If large differences were observed between the independent cost estimate and the Developer's cost estimate, SECo investigated and determined whether the differences were justified or they were erroneous. If the differences in the cost estimates resulted from errors, they were corrected by Kenny.


The cost 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%).

Association for the Advancement of Cost Engineering Criteria for Class 4 Accuracy

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 final cost estimates include the contingency rate of 30% ~~included on~~ referenced in the DPS estimate template. NYPSC "Order Finding Transmission Needs Driven by Public Policy Requirements" (Case No. 12-T-0502, et al.) December 17, 2015, and the Staff report.² The review team ~~assumes~~

² Item # 14 in Appendix B of the "NYPSC Order Finding Transmission Needs Driven by Public Policy Requirements" dated 12-17-2015 states: The percentage rates applied to account for contingencies and revenue requirement should all be treated uniformly across all estimates so that those factors are not manipulated by the bidders to confuse or artificially skew the results. The selection process shall not use the percentage rates

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~~the agrees that level of~~ contingency is sufficient to ~~include allowance~~ allow for unanticipated costs and estimating accuracy to forecast a reasonable worst case cost.


Segment B projects include Global Upgrades to the Rock Tavern 345 kV Substation and the rebuild of the Shoemaker to Sugarloaf 138 kV line with a new double circuit 138 kV line and related substation work at Shoemaker, Hartley, South Goshen, Chester, and Sugarloaf at the cost identified by the NYPSC in the AC Transmission Proceedings ³.

4.2.2.Potential Synergy Cost Savings

The review team calculated potential cost savings should one Developer be awarded both Segment A and Segment B projects. The savings were derived by evaluating the average cost of individual cost components of the projects to estimate potential cost savings assuming one Developer was awarded both Segment A and Segment B projects. These individual cost components included project shared cost items such as Labor & Equipment, Matting, Materials, Contractor Mobilization/Demobilization, Project Management, Field Construction Management and Inspection Staffing, Incumbent Utility Project Management and Project Oversight, Site Facilities, Material Handling & Storage, Design Engineering, Light Detection and Ranging survey (LiDAR), Geotechnical investigations, Licensing and Permitting, Testing & Commissioning of Transmission Line and Equipment, Contractor Warranties, Legal Fees, and Contractor Markup (Overhead & Profit). Each of these items were assessed for economy of scale; utilization of resources, equipment and materials; duplication of services; and replication of engineering designs to estimate the potential savings. Based on experience with prior transmission construction projects Kenny and SECo estimated a potential synergy savings of five percent (5%).

applied to account for contingencies and revenue requirement as a distinguishing factor between bids. For the purposes of bids, all developers should account for contingencies and revenue requirement at the percentage rates provided in the Trial Staff report as a placeholder for the actual rates.

³ Item # 6 in Appendix B of the December 17, 2015 NYPSC Order Finding Transmission Needs Driven by Public Policy Requirements states: "The selection process for transmission solutions for Segment B shall not use the costs of upgrades to the Rock Tavern Substation and upgrades to the Shoemaker to Sugarloaf transmission lines as a distinguishing factor between bids. The developers shall include the upgrade costs in their bids at the same level using the cost estimates for the upgrades provided in the Trial Staff report as a placeholder for the actual costs.

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4.2.3. Summary of Costs

A summary of the results are shown below:

SEGMENT A (SUMMARY OF ESTIMATE COMPARISON)


Developer	Independent Estimate (2018 \$)
T018 National Grid/ NY Transco	\$400,120,050
T021 NextEra Energy	\$382,809,831
T025 NYPA / NAT (Base+ 765kV <u>765 kV</u>)	\$662,449,756 <u>\$663,821,844</u>
T026 NYPA / NAT (Base)	\$376,036,422 <u>\$377,426,571</u>
T027 NYPA / NAT (Double Ckt)	\$570,202,629 <u>\$576,726,759</u>
T028 NYPA / NAT (Enhanced)	\$393,980,116 <u>\$395,367,607</u>
T031 ITC	\$438,467,712

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

Developer	Independent Estimate (2018 \$)
T018 National Grid/ NY Transco	\$520,156,065
T021 NextEra Energy	\$497,652,781
T025 NYPA / NAT (Base+ 765kV <u>765 kV</u>)	\$861,184,683 <u>\$862,968,398</u>
T026 NYPA / NAT (Base)	\$488,847,348 <u>\$490,654,542</u>
T027 NYPA / NAT (Double Ckt)	\$741,263,417 <u>\$749,744,787</u>
T028 NYPA / NAT (Enhanced)	\$512,174,151 <u>\$513,977,889</u>
T031 ITC	\$570,008,025

SEGMENT B (SUMMARY OF ESTIMATE COMPARISON)

Developer	Independent Estimate (2018 \$)
T019 National Grid/ NY Transco	\$342,347,324
T022 NextEra Energy	\$274,480,900 <u>\$260,237,664</u>
T023 NextEra Energy (Alternate)	\$299,726,983
T029 NYPA / NAT (Base)	\$297,581,261 <u>\$298,058,940</u>
T030 NYPA / NAT (Enhanced)	\$312,554,593
T032 ITC	\$386,043,283

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


Developer	Independent Estimate (2018 \$)
T019 National Grid/ NY Transco	\$445,051,522
T022 NextEra Energy	\$356,825,170 <u>338,308,963</u>
T023 NextEra Energy (Alternate)	\$389,645,078
T029 NYPA / NAT (Base)	\$386,855,640 <u>387,476,622</u>
T030 NYPA / NAT (Enhanced)	\$406,320,971
T032 ITC	\$501,856,268

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

Developer	Independent Estimate (2018 \$)
T019 National Grid/ NY Transco	\$558,051,522
T022 NextEra Energy	\$469,825,170 <u>451,308,963</u>
T023 NextEra Energy (Alternate)	\$502,645,078
T029 NYPA / NAT (Base)	\$499,855,640 <u>500,476,622</u>
T030 NYPA / NAT (Enhanced)	\$519,320,971
T032 ITC	\$614,856,268


Notes:

- Independent Estimates are adjusted to 2018 U.S. Dollars.
- The estimates include the contingency rate of 30% ~~included on the DPS estimate template. We have assumed the contingency to include allowance~~ referenced in the PSC "Order Finding Transmission Needs Driven by Public Policy Requirements" (December 17, 2015) and the Department of Public Service Staff report.. The review team agrees that level of the contingency is sufficient to allow for unanticipated costs and estimating accuracy to forecast a reasonable worst case cost.
- The Global Addition includes upgrades to the Rock Tavern 345 kV Substation and the rebuild of the Shoemaker to Sugarloaf 138 kV Substation with a new double circuit 138 kV line and related substation work at Shoemaker, Hartley, South Goshen, Chester, and Sugarloaf at the cost identified by the NYPSC in the AC Transmission Proceedings.

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The following tables highlight the significant technical differences between the proposals that drive the differences in estimated costs. Items shown in red would tend to increase costs while those shown in green tend to lower costs.

Segment A Comparison of Significant Technical Differences Between Proposals for 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 <u>345 kV</u> Capacitor	Proposed heavier structures than NAT/NYPA/NAT , which has a similar design. Concrete foundations on all structures other than H-pole tangent 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 required . Concrete Poles	
NAT/NYPA/NAT	T025 765kV	Yes	Rebuilds, no capacitor	Direct embedded tangent structures	765kV 765 kV line (converted from 345 kV) and new Knickerbocker 765kV <u>765 kV</u> Substation
	T026 Base	No	Rebuilds, no capacitor		
	T027 Dbl Ckt <u>circuit</u>	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 <u>New Scotland</u> . Has approx. 30 <u>15</u> % more	

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				transmission structures	
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Segment B Comparison of Significant Technical Differences Between Proposals for 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 NAT/NYPA/NAT . Concrete foundations on all structures	
NextEra	T022 Base	New "North" Churchtown and retains existing Churchtown SS.		Monopole Design - less ROW required . Concrete Poles. Does not include replacement of 32 miles of Ckts Circuits 12 and 13.	
	T023	Similar to T022 but has one less line terminal		Includes replacement of 32 miles of 115kV 115 kV Churchtown to PV	
NAT/NYPA/NA ±	T029 Base	Complete Rebuild	Breakers at Schodak		
	T030	Complete Rebuild	Breakers at Schodak	Same as T029 but triple bundled 345kV 345 kV conductor	
ITC	T032 Base	Adds breaker at existing station, and builds new Knickerbocker 115kV 115 kV		Has approx. 30 15% more transmission structures	


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A summary of the independent estimate cost estimates (raw costs - not including contingency or Global Additions - in \$1,000's) for each Developer's proposal follows:

Segment A Proposals


4.2.4. 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 Hardwares	\$10,840
	Subtotal (1)		\$204,039
	2	Substations	
	2.1	Rotterdam Substation	\$48,141
	2.2	Edic Substation	\$2,117
	2.3	Princeton 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	\$8,459
	Subtotal (2)		\$66,301
	Total (1+2)		\$270,340
	Contractors Mark up (15% of Total 1+2)		\$40,551
	Total Direct Cost (A)		\$310,891
Indirect Cost	3	Technical Services Costs	
	3.1	Contractor Mobilization / Demobilization	\$2,711
	3.2	Project Management, Material Handling & Amenities	\$18,402
	3.3	Engineering	\$18,121
	3.4	Testing & Commissioning	\$1,559
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs	\$20,144
	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)		\$77,575
Subtotal Project Cost (B=A+3) 2017 \$			\$388,466
	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 \$			\$388,466

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Total Project Cost 2018 \$	\$400,120
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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 Optical Ground Wire	\$35,990
	1.5	Insulators, Fitting and Hardware	\$10,840
		Subtotal (1)	\$204,039
	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	\$8,459
		Subtotal (2)	\$66,301
		Total (1+2)	\$270,340
		Contractors Mark-up (15% of Total 1+2)	\$40,551
		Total Direct Cost (A)	\$310,891
Indirect Cost	3	Technical Services Costs	
	3.1	Contractor Mobilization / Demobilization	\$2,711
	3.2	Project Management, Material Handling & Amenities	\$18,402
	3.3	Engineering	\$18,121
	3.4	Testing & Commissioning	\$1,559
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs	\$20,144
	3.6	Compensation for use of NYPA Structures (1 Circuit)	\$8,919
	3.7	Legal, Environmental Licensing & Permitting and Environmental Mitigation	\$7,719
		Total Indirect Cost (3)	\$77,575
		Subtotal Project Cost (B=A+3) 2017 \$	\$388,466
	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 \$	\$388,466
		Total Project Cost 2018 \$	\$400,120

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4.2.5 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	\$74,701
	1.4	Conductor, Shiedwire and OPGW	\$38,661
	1.5	Insulators, Fitting and Hardwares	\$18,280
	Subtotal (1)		\$205,239
	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	\$4,378
Subtotal (2)		\$55,107	
Total (1+2)		\$260,346	
Contractors Mark-up (15% of Total 1+2)		\$39,052	
Total Direct Cost (A)		\$299,398	
Indirect Cost	3	Technical Services Costs	
	3.1	Contractor Mobilization / Demobilization	\$2,603
	3.2	Project Management, Material Handling & Amenities	\$18,440
	3.3	Engineering	\$17,327
	3.4	Testing & Commissioning	\$1,435
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs	\$15,672
	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)		\$72,262
Subtotal Project Cost (B=A+3) 2017 \$			\$371,660
	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 \$			\$371,660
Total Project Cost 2018 \$			\$382,810


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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	\$74,701
	1.4	Conductor, Shiedwire and Optical Ground Wire	\$38,661
	1.5	Insulators, Fitting and Hardwares	\$18,280
	Subtotal (1)		\$205,239
	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	\$4,378
	Subtotal (2)		\$55,107
	Total (1+2)		\$260,346
	Contractors Mark-up (15% of Total 1+2)		\$39,052
	Total Direct Cost (A)		\$299,398
Indirect Cost	3	Technical Services Costs	
	3.1	Contractor Mobilization / Demobilization	\$2,603
	3.2	Project Management, Material Handling & Amenities	\$18,440
	3.3	Engineering	\$17,327
	3.4	Testing & Commissioning	\$1,435
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs	\$15,672
	3.6	Compensation for use of NYPA Structures (1 Circuit)	\$8,919
	3.7	Legal, Environmental Licensing & Permitting and Environmental Mitigation	\$7,865
	Total Indirect Cost (3)		\$72,262
Subtotal Project Cost (B=A+3) 2017 \$			\$371,660
	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 \$			\$371,660
Total Project Cost 2018 \$			\$382,810

4.2.6 T025 NAT/NYPA Segment A + ~~765kV~~ 765 kV


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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	\$13,068
	Subtotal (1)		\$208,887
	2	Substations	
	2.1	Rotterdam Substation	\$46,629
	2.2	Edic Substation	\$2,153
	2.3	Princeton 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	\$8,301
	Subtotal (2)		\$155,062
	Total (1+2)		\$363,949
Indirect Cost	Contractors Mark-up (15% of Total 1+2)		\$54,592
	Total Direct Cost (A)		\$418,541
	3	Technical Services Costs	
	3.1	Contractor Mobilization / Demobilization	\$3,639
	3.2	Project Management, Material Handling & Amenities	\$20,427
	3.3	Engineering	\$26,178
	3.4	Testing & Commissioning	\$3,826
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs	\$28,303
	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)		\$100,882
	Subtotal Project Cost (B=A+3) 2017 \$		\$519,424
	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 \$			\$643,155
Total Project Cost 2018 \$			\$662,450


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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, Shiedwire and Optical Ground Wire	\$37,454
	1.5	Insulators, Fitting and Hardwares	\$13,068
	Subtotal (1)		\$208,887
	2	Substations	
	2.1	Rotterdam Substation	\$47,629
	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	\$8,301
	Subtotal (2)		\$156,062
	Total (1+2)		\$364,949
	Contractors Mark-up (15% of Total 1+2)		\$54,742
Total Direct Cost (A)		\$419,691	
Indirect Cost	3	Technical Services Costs	
	3.1	Contractor Mobilization / Demobilization	\$3,649
	3.2	Project Management, Material Handling & Amenities	\$20,483
	3.3	Engineering	\$26,265
	3.4	Testing & Commissioning	\$3,851
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs	\$28,307
	3.6	Compensation for use of NYPA Structures (1 Circuit)	\$8,919
	3.7	Legal, Environmental Licensing & Permitting and Environmental Mitigation	\$9,589
	Total Indirect Cost (3)		\$101,064
Subtotal Project Cost (B=A+3) 2017 \$			\$520,756
	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 \$			\$644,487
Total Project Cost 2018 \$			\$663,822

4.2.7 T026 NAT/NYPA Segment A Base

Client:	NYISO		
Project:	AC Transmission Project Evaluation		
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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 Hardwares	\$11,907
	Subtotal (1)		\$181,777
	2	Substations	
	2.1	Rotterdam Substation	\$47,340
	2.2	Edie 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	\$8,301
	Subtotal (2)		\$63,603
	Total (1+2)		\$245,381
Indirect Cost	Contractors Mark-up (15% of Total 1+2)		\$36,807
	Total Direct Cost (A)		\$282,188
	3	Technical Services Costs	
	3.1	Contractor Mobilization / Demobilization	\$2,454
	3.2	Project Management, Material Handling & Amenities	\$18,075
	3.3	Engineering	\$16,556
	3.4	Testing & Commissioning	\$1,498
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs	\$19,749
	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)		\$75,169
	Subtotal Project Cost (B=A+3) 2017 \$		\$357,357
	4	Network Upgrade Facilities (NUF)	
	4.1	NUF proposed as element of the Project (Marcy and Edie Terminals)	\$7,727
	4.2	NUF identified during Evaluation	\$0
Subtotal - NUF Cost - (C)			\$7,727
Total Project Cost (B+C) 2017 \$			\$365,084
Total Project Cost 2018 \$			\$376,036

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Client:	NYISO		
Project:	AC Transmission Project Evaluation		
Subject:	Report Draft		
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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, Shiedwire and Optical Ground Wire	\$35,492
	1.5	Insulators, Fitting and Hardwares	\$11,907
	Subtotal (1)		\$181,777
	2	Substations	
	2.1	Rotterdam Substation	\$48,340
	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	\$8,301
	Subtotal (2)		\$64,603
	Total (1+2)		\$246,381
Contractors Mark-up (15% of Total 1+2)		\$36,957	
Total Direct Cost (A)		\$283,338	
Indirect Cost	3	Technical Services Costs	
	3.1	Contractor Mobilization / Demobilization	\$2,464
	3.2	Project Management, Material Handling & Amenities	\$18,148
	3.3	Engineering	\$16,643
	3.4	Testing & Commissioning	\$1,523
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs	\$19,753
	3.6	Compensation for use of NYPA Structures (1 Circuit)	\$8,919
	3.7	Legal, Environmental Licensing & Permitting and Environmental Mitigation	\$7,920
	Total Indirect Cost (3)		\$75,369
Subtotal Project Cost (B=A+3) 2017 \$		\$358,707	
	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 \$		\$366,434	
Total Project Cost 2018 \$		\$377,427	


4.2.8.T027 NAT/NYPA Segment A Double Circuit

Client:	NYISO		
Project:	AC Transmission Project Evaluation		
Subject:	Report Draft		
Document No.:	AC Transmission Report 04-2305 25 18	Revision:	46

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, Shiedwire and OPGW	\$62,279
	1.5	Insulators, Fitting and Hardwares	\$26,553
	Subtotal (1)		\$282,915
	2	Substations	
	2.1	Rotterdam Substation	\$47,340
	2.2	Edie Substation	\$5,333
	2.3	Princeton 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	\$8,301
Subtotal (2)		\$99,109	
Total (1+2)		\$382,023	
Contractors Mark-up (15% of Total 1+2)		\$57,303	
Total Direct Cost (A)		\$439,327	
Indirect Cost	3	Technical Services Costs	
	3.1	Contractor Mobilization / Demobilization	\$3,820
	3.2	Project Management, Material Handling & Amenities	\$22,160
	3.3	Engineering	\$25,712
	3.4	Testing & Commissioning	\$2,532
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs	\$26,200
	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)		\$106,541	
Subtotal Project Cost (B=A+3) 2017 \$		\$545,867	
	4	Network Upgrade Facilities (NUF)	
	4.1	NUF proposed as element of the Project (Marcy and Edie Terminals)	\$7,727
	4.2	NUF identified during Evaluation	\$0
Subtotal - NUF Cost - (C)		\$7,727	
Total Project Cost (B+C) 2017 \$		\$553,594	
Total Project Cost 2018 \$		\$570,202	


Client:	NYISO		
Project:	AC Transmission Project Evaluation		
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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, Shiedwire and Optical Ground Wire	\$62,279
	1.5	Insulators, Fitting and Hardwares	\$26,553
	Subtotal (1)		\$282,915
	2	Substations	
	2.1	Rotterdam Substation	\$48,340
	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	\$8,301
	Subtotal (2)		\$100,109
		Total (1+2)	
	Contractors Mark-up (15% of Total 1+2)		\$57,453
	Total Direct Cost (A)		\$440,477
Indirect Cost	3	Technical Services Costs	
	3.1	Contractor Mobilization / Demobilization	\$3,830
	3.2	Project Management, Material Handling & Amenities	\$22,218
	3.3	Engineering	\$25,799
	3.4	Testing & Commissioning	\$2,557
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs	\$26,204
	3.6	Compensation for use of NYPA Structures (2 Circuit)	\$17,838
	3.7	Legal, Environmental Licensing & Permitting and Environmental Mitigation	\$8,278
	Total Indirect Cost (3)		\$106,725
Subtotal Project Cost (B=A+3) 2017 \$			\$547,201
	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 (Everett - Wolf Road 115kV Upgrade)	\$5,000
Subtotal NUF Cost (C)			\$12,727
Total Project Cost (B+C) 2017 \$			\$559,928
Total Project Cost 2018 \$			\$576,726


Client:	NYISO		
Project:	AC Transmission Project Evaluation		
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4.2.9. 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	
	1.2	Foundations	
	1.3	Structures	
	1.4	Conductor, Shiedwire and OPGW	
	1.5	Insulators, Fitting and Hardwares	
	Subtotal (1)		\$181,780
	2	Substations	
	2.1	Rotterdam Substation	
	2.2	Edie Substation	
	2.3	Princetown Substation	
	2.4	New Scotland Substation	
	2.5	Porter Substation	
	2.6	Knickerbocker Substation	
	2.7	Marcy Substation	
	2.8	Substation Interconnections	
	Subtotal (2)		\$76,322
Total (1+2)		\$258,101	
Contractors Mark-up (15% of Total 1+2)		\$38,715	
Total Direct Cost (A)		\$296,817	
Indirect Cost	3	Technical Services Costs	
	3.1	Contractor Mobilization / Demobilization	
	3.2	Project Management, Material Handling & Amenities	
	3.3	Engineering	
	3.4	Testing & Commissioning	
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs	
	3.6	Compensation for use of NYPA Structures (1 Ckt.)	
	3.7	Legal, Env. Lisc. & Permit and Env. Mitigation	
	Total Indirect Cost (3)		\$77,961
Subtotal Project Cost (B=A+3) 2017 \$			\$374,778
	4	Network Upgrade Facilities (NUF)	
	4.1	NUF proposed as element of the Project (Marcy and Edie Terminals)	
	4.2	NUF identified during Evaluation	
Subtotal NUF Cost (C)			\$7,727
Total Project Cost (B+C) 2017 \$			\$382,505
Total Project Cost 2018 \$			\$393,980


Client:	NYISO		
Project:	AC Transmission Project Evaluation		
Subject:	Report Draft		
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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, Shiedwire and Optical Ground Wire	\$35,494
	1.5	Insulators, Fitting and Hardwares	\$11,907
	Subtotal (1)		\$181,780
	2	Substations	
	2.1	Rotterdam Substation	\$48,340
	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	\$8,301
	Subtotal (2)		\$77,322
Total (1+2)		\$259,101	
Contractors Mark-up (15% of Total 1+2)		\$38,865	
Total Direct Cost (A)		\$297,967	
Indirect Cost	3	Technical Services Costs	
	3.1	Contractor Mobilization / Demobilization	\$2,591
	3.2	Project Management, Material Handling & Amenities	\$18,417
	3.3	Engineering	\$17,763
	3.4	Testing & Commissioning	\$1,840
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs	\$20,533
	3.6	Compensation for use of NYPA Structures (1 Circuit)	\$8,919
	3.7	Legal, Environmental Licensing & Permitting and Environmental Mitigation	\$8,096
	Total Indirect Cost (3)		\$78,159
Subtotal Project Cost (B=A+3) 2017 \$		\$376,125	
	4	Network Upgrade Facilities (NUF)	
	4.1	Network upgrade facility proposed as element of the Project (Marcy and Edic Terminals)	\$7,727
	4.2	Network upgrade facility identified during Evaluation	\$0
Subtotal NUF Cost (C)		\$7,727	
Total Project Cost (B+C) 2017 \$		\$383,852	
Total Project Cost 2018 \$		\$395,368	

Client:	NYISO		
Project:	AC Transmission Project Evaluation		
Subject:	Report Draft		
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4.2.10. T031 ITC Segment A

ITC (T031)			
Description			Total Amount (In thousand \$)
Direct Cost	1	Transmission Lines	
	1.1	Clearing & Access	
	1.2	Foundations	
	1.3	Structures	
	1.4	Conductor, Shiedwire and OPGW	
	1.5	Insulators, Fitting and Hardwares	
	Subtotal (1)		\$237,347
	2	Substations	
	2.1	Rotterdam Substation	
	2.2	Edie Substation	
	2.3	Princetown Substation	
	2.4	New Scotland Substation	
	2.5	Porter Substation	
	2.6	Knickerbocker Substation	
	2.7	Marcy Substation	
	2.8	Substation Interconnections	
	Subtotal (2)		\$62,507
Total (1+2)		\$299,855	
Contractors Mark-up (15% of Total 1+2)		\$44,978	
Total Direct Cost (A)		\$344,833	
Indirect Cost	3	Technical Services Costs	
	3.1	Contractor Mobilization / Demobilization	
	3.2	Project Management, Material Handling & Amenities	
	3.3	Engineering	
	3.4	Testing & Commissioning	
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs	
	3.6	Compensation for use of NYPA Structures (1 Ckt.)	
	3.7	Legal, Env. Lisc. & Permit and Env. Mitigation	
	Total Indirect Cost (3)		\$80,864
Subtotal Project Cost (B=A+3) 2017 \$		\$425,697	
	4	Network Upgrade Facilities (NUF)	
	4.1	NUF proposed as element of the Project	
	4.2	NUF identified during Evaluation	
Subtotal NUF Cost (C)		\$0	
Total Project Cost (B+C) 2017 \$			\$425,697
Total Project Cost 2018 \$			\$438,468

Client:	NYISO	
Project:	AC Transmission Project Evaluation	
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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, Shiedwire and Optical Ground Wire	\$41,525
	1.5	Insulators, Fitting and Hardwares	\$18,615
	Subtotal (1)		\$237,347
	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	\$8,383
	Subtotal (2)		\$62,507
	Total (1+2)		\$299,855
	Contractors Mark-up (15% of Total 1+2)		\$44,978
	Total Direct Cost (A)		\$344,833
Indirect Cost	3	Technical Services Costs	
	3.1	Contractor Mobilization / Demobilization	\$2,999
	3.2	Project Management, Material Handling & Amenities	\$18,925
	3.3	Engineering	\$19,832
	3.4	Testing & Commissioning	\$1,560
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs	\$20,688
	3.6	Compensation for use of NYPA Structures (1 Circuit)	\$8,919
	3.7	Legal, Environmental Licensing & Permitting and Environmental Mitigation	\$7,941
	Total Indirect Cost (3)		\$80,864
Subtotal Project Cost (B=A+3) 2017 \$			\$425,697
	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 \$			\$425,697
Total Project Cost 2018 \$			\$438,468

Segment B Proposals

Client:	NYISO		
Project:	AC Transmission Project Evaluation		
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4.2.11. 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	
	1.2	Foundations	
	1.3	Structures	
	1.4	Conductor, Shiedwire and OPGW	
	1.5	Insulators, Fitting and Hardwares	
	Subtotal (1)		\$176,595
	2	Substations	
	2.1	Knickerbocker Substation	
	2.2	East Greenbush Substation	
	2.3	Schodack Substation	
	2.4	Churchtown Substation	
	2.5	Pleasant Valley Substation	
	2.6	Substation Interconnections	
Subtotal (2)		\$55,682	
Total (1+2)		\$232,277	
Contractors Mark-up (15% of Total 1+2)		\$34,842	
Total Direct Cost (A)		\$267,118	
Indirect Cost	3	Technical Services Costs	
	3.1	Contractor Mobilization / Demobilization	
	3.2	Project Management, Material Handling & Amenities	
	3.3	Engineering	
	3.4	Testing & Commissioning	
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs	
	3.6	Legal, Env. Lisc. & Permit and Env. Mitigation	
	Total Indirect Cost (3)		\$59,755
Subtotal Project Cost (B=A+3) 2017 \$		\$326,874	
	4	Network Upgrade Facilities (NUF)	
	4.1	NUF proposed as element of the Project (Fishkill and New Scotland Terminals)	
	4.2	NUF identified by System Impact Study (Cricket Valley Line Upgrade)	
Subtotal NUF Cost (C)		\$5,502	
Total Project Cost (B+C) 2017 \$		\$332,376	
Total Project Cost 2018 \$		\$342,347	

Client:	NYISO			
Project:	AC Transmission Project Evaluation			
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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 Optical Ground Wire		\$30,070
	1.5	Insulators, Fitting and Hardware		\$11,200
	Subtotal (1)			\$176,595
	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		\$5,534
	Subtotal (2)			\$55,682
Indirect Cost	Total (1+2)			\$232,277
	Contractors Mark-up (15% of Total 1+2)			\$34,842
	Total Direct Cost (A)			\$267,118
	3	Technical Services Costs		
	3.1	Contractor Mobilization / Demobilization		\$2,323
	3.2	Project Management, Material Handling & Amenities		\$16,172
	3.3	Engineering		\$15,527
	3.4	Testing & Commissioning		\$1,324
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs		\$16,982
	3.6	Legal, Environmental Licensing & Permitting and Environmental Mitigation		\$7,428
	Total Indirect Cost (3)			\$59,755
	Subtotal Project Cost (B=A+3) 2017 \$			\$326,874
	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 \$			\$332,376
	Total Project Cost 2018 \$			\$342,347

4.2.12. T022 NextEra Segment B


NextEra Energy (T022)

Client:	NYISO	
Project:	AC Transmission Project Evaluation	
Subject:	Report Draft	
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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, Shiedwire and OPGW	\$25,925
	1.5	Insulators, Fitting and Hardware	\$9,609
	Subtotal (1)		\$145,550
	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	\$7,272
	Subtotal (2)		\$40,138
Total (1+2)		\$185,688	
Contractors Mark up (15% of Total 1+2)		\$27,853	
Total Direct Cost (A)		\$213,542	
Indirect Cost	3	Technical Services Costs	
	3.1	Contractor Mobilization / Demobilization	\$1,857
	3.2	Project Management, Material Handling & Amenities	\$15,258
	3.3	Engineering	\$12,281
	3.4	Testing & Commissioning	\$920
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs	\$10,584
	3.6	Legal, Env. Lisc. & Permit and Env. Mitigation	\$7,628
	Total Indirect Cost (3)		\$48,528
Subtotal Project Cost (B=A+3) 2017 \$		\$262,069	
	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 \$		\$266,486	
Total Project Cost 2018 \$		\$274,481	


Client:	NYISO	
Project:	AC Transmission Project Evaluation	
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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 \$49,013
	1.4	Conductor, Shieldwire and Optical Ground Wire \$25,925
	1.5	Insulators, Fitting and Hardwares \$9,609
	Subtotal (1)	
	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 \$6,769
	Subtotal (2)	
	Total (1+2)	
	Contractors Mark-up (15% of Total 1+2)	
	Total Direct Cost (A)	
Indirect Cost	3	Technical Services Costs
	3.1	Contractor Mobilization / Demobilization \$1,752
	3.2	Project Management, Material Handling & Amenities \$14,399
	3.3	Engineering \$11,654
	3.4	Testing & Commissioning \$920
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs \$10,365
	3.6	Mitigation \$7,628
	Total Indirect Cost (3)	
Subtotal Project Cost (B=A+3) 2017 \$		\$248,241
	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 \$		\$252,658
Total Project Cost 2018 \$		\$260,238


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4.2.13. 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, Shiedwire and OPGW	\$30,529
	1.5	Insulators, Fitting and Hardwares	\$11,349
	Subtotal (1)		\$165,255
	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	\$6,473
Subtotal (2)		\$37,482	
Total (1+2)		\$202,736	
Contractors Mark-up (15% of Total 1+2)		\$30,410	
Total Direct Cost (A)		\$233,147	
Indirect Cost	3	Technical Services Costs	
	3.1	Contractor Mobilization / Demobilization	\$2,027
	3.2	Project Management, Material Handling & Amenities	\$16,697
	3.3	Engineering	\$13,253
	3.4	Testing & Commissioning	\$874
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs	\$12,954
	3.6	Legal, Env. Lisc. & Permit and Env. Mitigation	\$7,628
	Total Indirect Cost (3)		\$53,433
Subtotal Project Cost (B=A+3) 2017 \$			\$286,580
	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 \$			\$290,997
Total Project Cost 2018 \$			\$299,727


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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 Optical Ground Wire	\$30,529
	1.5 Insulators, Fitting and Hardwares	\$11,349
	Subtotal (1)	\$165,255
	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	\$6,473
	Subtotal (2)	\$37,482
	Total (1+2)	\$202,736
	Contractors Mark-up (15% of Total 1+2)	\$30,410
	Total Direct Cost (A)	\$233,147
Indirect Cost	3 Technical Services Costs	
	3.1 Contractor Mobilization / Demobilization	\$2,027
	3.2 Project Management, Material Handling & Amenities	\$16,697
	3.3 Engineering	\$13,253
	3.4 Testing & Commissioning	\$874
	3.5 Permitting, Real Estate, Sales Tax and Additional Costs	\$12,954
	3.6 Legal, Environmental Licensing & Permitting and Environmental Mitigation	\$7,628
	Total Indirect Cost (3)	\$53,433
Subtotal Project Cost (B=A+3) 2017 \$		\$286,580
	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 \$		\$290,997
Total Project Cost 2018 \$		\$299,727


Client:	NYISO	
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4.2.14. 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, Shiedwire and OPGW	\$30,069
	1.5	Insulators, Fitting and Hardwares	\$11,442
	Subtotal (1)		\$146,154
	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	\$5,495
	Subtotal (2)		\$41,487
Total (1+2)		\$187,641	
Contractors Mark-up (15% of Total 1+2)		\$28,146	
Total Direct Cost (A)		\$215,787	
Indirect Cost	3	Technical Services Costs	
	3.1	Contractor Mobilization / Demobilization	\$1,876
	3.2	Project Management, Material Handling & Amenities	\$15,334
	3.3	Engineering	\$12,503
	3.4	Testing & Commissioning	\$973
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs	\$14,135
	3.6	Legal, Env. Lisc. & Permit and Env. Mitigation	\$7,628
	Total Indirect Cost (3)		\$52,449
Subtotal Project Cost (B=A+3) 2017 \$			\$268,236
	4	Network Upgrade Facilities (NUF)	
	4.1	NUF proposed as element of the Project (Middletown Line and Terminal)	\$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 \$			\$288,914
Total Project Cost 2018 \$			\$297,581


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Project:	AC Transmission Project Evaluation			
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NY Power Authority and North American Transmission (T029)				
Description			Total Amount (In thousand \$)	
Direct Cost	1	Transmission Lines		
	1.1	Clearing & Access		\$34,313
	1.2	Foundations		\$17,769
	1.3	Structures		\$52,916
	1.4	Conductor, Shieldwire and Optical Ground Wire		\$30,069
	1.5	Insulators, Fitting and Hardwares		\$11,442
	Subtotal (1)			\$146,509
	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		\$5,495
	Subtotal (2)			\$41,487
Indirect Cost	Total (1+2)			\$187,996
	Contractors Mark-up (15% of Total 1+2)			\$28,199
	Total Direct Cost (A)			\$216,196
	3	Technical Services Costs		
	3.1	Contractor Mobilization / Demobilization		\$1,880
Indirect Cost	3.2	Project Management, Material Handling & Amenities		\$15,363
	3.3	Engineering		\$12,524
	3.4	Testing & Commissioning		\$973
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs		\$14,136
	3.6	Legal, Environmental Licensing & Permitting and Environmental Mitigation		\$7,628
Indirect Cost	Total Indirect Cost (3)			\$52,504
	Subtotal Project Cost (B=A+3) 2017 \$			\$268,700
	4	Network Upgrade Facilities (NUF)		
	4.1	NUF proposed as element of the Project (Middletown Line and Terminal)		\$16,261
	4.2	NUF identified by System Impact Study (Cricket Valley Line Upgrade)		\$4,417
Indirect Cost	Subtotal NUF Cost (C)			\$20,678
	Total Project Cost (B+C) 2017 \$			\$289,378
	Total Project Cost 2018 \$			\$298,059

Client:	NYISO		
Project:	AC Transmission Project Evaluation		
Subject:	Report Draft		
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4.2.15. 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, Shiedwire and OPGW	\$35,969
	1.5	Insulators, Fitting and Hardwares	\$11,553
	Subtotal (1)		\$156,807
	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	\$6,312
	Subtotal (2)		\$42,369
Total (1+2)		\$199,176	
Contractors Mark-up (15% of Total 1+2)		\$29,876	
Total Direct Cost (A)		\$229,052	
Indirect Cost	3	Technical Services Costs	
	3.1	Contractor Mobilization / Demobilization	\$1,992
	3.2	Project Management, Material Handling & Amenities	\$15,576
	3.3	Engineering	\$13,164
	3.4	Testing & Commissioning	\$972
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs	\$14,389
	3.6	Legal, Env. Lisc. & Permit and Env. Mitigation	\$7,628
	Total Indirect Cost (3)		\$53,721
Subtotal Project Cost (B=A+3) 2017 \$			\$282,773
	4	Network Upgrade Facilities (NUF)	
	4.1	NUF proposed as element of the Project (Middletown Line and Terminal)	\$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 \$			\$303,451
Total Project Cost 2018 \$			\$312,555

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Project:	AC Transmission Project Evaluation	
Subject:	Report Draft	
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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 Optical Ground Wire	\$35,969
	1.5 Insulators, Fitting and Hardwares	\$11,553
	Subtotal (1)	\$156,807
	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	\$6,312
	Subtotal (2)	\$42,369
	Total (1+2)	\$199,176
	Contractors Mark-up (15% of Total 1+2)	\$29,876
	Total Direct Cost (A)	\$229,052
Indirect Cost	3 Technical Services Costs	
	3.1 Contractor Mobilization / Demobilization	\$1,992
	3.2 Project Management, Material Handling & Amenities	\$15,576
	3.3 Engineering	\$13,164
	3.4 Testing & Commissioning	\$972
	3.5 Permitting, Real Estate, Sales Tax and Additional Costs	\$14,389
	3.6 Legal, Environmental Licensing & Permitting and Environmental Mitigation	\$7,628
	Total Indirect Cost (3)	\$53,721
Subtotal Project Cost (B=A+3) 2017 \$		\$282,773
	4 Network Upgrade Facilities (NUF)	
	4.1 NUF proposed as element of the Project (Middletown Line and Terminal)	\$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 \$		\$303,451
Total Project Cost 2018 \$		\$312,555

4.2.16. T032 ITC Segment B


ITC (T032)

Client:	NYISO	
Project:	AC Transmission Project Evaluation	
Subject:	Report Draft	
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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, Shiedwire and OPGW	\$33,769
	1.5	Insulators, Fitting and Hardwares	\$16,154
	Subtotal (1)		\$235,269
	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	\$5,764
	Subtotal (2)		\$31,954
Total (1+2)		\$267,224	
Contractors Mark-up (15% of Total 1+2)		\$40,084	
Total Direct Cost (A)		\$307,307	
Indirect Cost	3	Technical Services Costs	
	3.1	Contractor Mobilization / Demobilization	\$2,672
	3.2	Project Management, Material Handling & Amenities	\$18,202
	3.3	Engineering	\$16,986
	3.4	Testing & Commissioning	\$755
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs	\$16,833
	3.6	Legal, Env. Lisc. & Permit and Env. Mitigation	\$7,628
	Total Indirect Cost (3)		\$63,075
Subtotal Project Cost (B=A+3) 2017 \$		\$370,382	
	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 \$			\$374,799
Total Project Cost 2018 \$			\$386,043

Client:	NYISO	 ISECO <small>SUBSTATION ENGINEERING COMPANY</small>		
Project:	AC Transmission Project Evaluation			
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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, Shiedwire and Optical Ground Wire	\$33,769
	1.5	Insulators, Fitting and Hardwares	\$16,154
	Subtotal (1)		\$235,269
	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	\$5,764
	Subtotal (2)		\$31,954
	Total (1+2)		\$267,224
	Contractors Mark-up (15% of Total 1+2)		\$40,084
	Total Direct Cost (A)		\$307,307
Indirect Cost	3	Technical Services Costs	
	3.1	Contractor Mobilization / Demobilization	\$2,672
	3.2	Project Management, Material Handling & Amenities	\$18,202
	3.3	Engineering	\$16,986
	3.4	Testing & Commissioning	\$755
	3.5	Permitting, Real Estate, Sales Tax and Additional Costs	\$16,833
	3.6	Legal, Environmental Licensing & Permitting and Environmental Mitigation	\$7,628
	Total Indirect Cost (3)		\$63,075
Subtotal Project Cost (B=A+3) 2017 \$			\$370,382
	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 \$			\$374,799
Total Project Cost 2018 \$			\$386,043

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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.

Common Risks to all Proposals


#	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>i.e.</i> , 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.

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2	Other environmental approvals	Federal agency and other approvals could take longer than the state Article VII process. This could become more likely if cutbacks of funding to regulatory agencies affect employee staffing.	Developer needs early outreach with Federal agencies and others to prepare 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	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.

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		design or construction modifications.	
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	<p>Crossing of other transmission and distribution lines:</p> <p>creates additional schedule risk, to the extent an outage needs to be scheduled;</p> <p>creates additional operating risk, to the extent a single</p>	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

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		<p>event could remove both elements from services; and</p> <p>creates cost risk to the extent unexpected costs such as raising, lowering, or relocating an existing line is required.</p>	<p>netting and other protection prior to pulling sock line and conductor. This risk can be 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.</p>
10	Highway, Rail Road & Navigable Waterway crossings	<p>Crossing of Highways, Rail Roads, and Navigable Waterways creates additional risk to the project schedule and cost, depending on the requirements imposed during construction.</p>	<p>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.</p>

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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

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			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.


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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 of the projects.

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 <u>345 kV</u> 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 <u>is</u> located. <i>(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.)</i>
2	Obtaining Site Control and Property Acquisition	National Grid owns all property required for new facilities. <i>De minimis</i> 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 <u>345 kV</u> Lines #14 and #18, and 115kV <u>115 kV</u> Line #13) between Princetown Junction and New Scotland Substation is currently estimated to exceed NPSC guidelines for EMF levels. The	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

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		proposed design improves the condition, but EMF levels are still estimated to exceed the guidelines.	and New Scotland. <i>(The review team's independent cost estimate includes the cost for additional EMF easements.)</i> This is considered a critical risk for all Segment A proposals with <u>the</u> exception of T027 (<u>NAT/NYPA double circuit proposal</u>) <u>due to the elctromagnitic fields from the new circuit configuration interacting with the existing circuits which is anticipated to reduce the EMF levels at the edge of the ROW due to the EMF cancelling effect of that design.</u>
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 <u>230 kV line # 30</u> 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

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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 <u>345 kV</u> 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 <u>is</u> located. <i>(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.)</i>
2	Obtaining Site Control and Property Acquisition	<p>Proposal utilizes existing ROW owned by National Grid.</p> <p><i>De minimis</i> property may need to be acquired for access and construction marshalling yards.</p> <p>Additionally, Developer must procure property for Princetown substation.</p>	<p>Negotiations with the incumbent utility could result in potential cost and schedule implications.</p> <p>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.</p> <p>For Princetown substation<u>Substation</u>, Developer has already obtained a purchase option on property for its proposed location.</p>

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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 <u>345 kV</u> Lines #14 and #18, and 115kV <u>115 kV</u> 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. <i>(The review team’s independent cost estimate includes the cost for additional EMF easements.)</i> This is considered a critical risk for all Segment A proposals with <u>the</u> exception of T027 (NAT/NYPA double circuit proposal). <u>due to the elctromagnitic fields from the new circuit configuration interacting with the existing circuits which is anticipated to reduce the EMF levels at the edge of the ROW due to the</u>

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			<u>EMF cancelling effect of that design.</u>
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 230 kV line #30 beginning at Edic/Porter and continuing east for 12.6 miles. A cursory visual inspection indicate indicates 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 (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 necessary and the review team's analysis indicates that the lines could require relocating the be relocated within the National Grid property. There is a risk that the new substation and may need to be moved to an alternate location within the existing National Grid property or purchasing de minimis additional property. (easement be acquired.) (The review team's independent cost estimate

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			<i>includes the cost for relocating these gas transmission lines.)</i>
2	Property Acquisition Concern - Princetown Substation	NAT/NYPA's proposed design for Princetown Substation appears to just fit within the existing National Grid ROW.	<p>If the final design requires purchasing additional property it will likely be difficult and increase cost. <i>(The review team's independent cost estimate does not include the cost for additional property/easements.)</i></p> <p>This is considered <u>one of</u> the highest risk<u>risks</u> for this proposal</p>
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. Construction on ROW with existing lines will require coordination with incumbent utility to maintain clearances.	<p>Public opposition to this site may result in delays associated with obtaining regulatory approvals and increased costs.</p> <p>As <u>The risks include: 1. the potential need for an</u> alternative design such as GIS or <u>alternative</u> site may need to be identified, such as NextEra proposed<u>a</u> 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 <u>possible</u> opposition. Short<u>2. short</u> term outages and/or temporary bypasses of existing lines may be required during construction.</p>

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4	Design Concern - Marcy 765kV <u>765 kV</u> Substation (NYPA Owned)	As proposed, the Developer's layout has a single span of conductors crossing the bus between the new 765kV <u>765 kV</u> breaker and the south main bus, and between the new breaker and breaker 7202.	A dropped conductor will <u>could</u> trip out the south main bus as well as the bus 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 <u>345 kV</u> 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. <i>(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.)</i>
6	Obtaining Site Control and Property Acquisition	Proposal utilizes existing ROW owned by National Grid. <i>De minimis</i> 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

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			increased costs which is considered a low probability.
7	Design Concern - EMF	<p>The existing corridor (345kV<u>345 kV</u> Lines #14 and #18, and 115kV<u>115 kV</u> Line #13) between Princetown Junction and New Scotland Substation is currently estimated to exceed NYS PSC guidelines for EMF levels. Additionally, conversion of the 345kV<u>345 kV</u> line between Marcy substation and proposed Knickerbocker substation to 765kV<u>765 kV</u> is estimated to likely increase EMF levels beyond NYPSC guidelines.</p>	<p>EMF levels will have to be addressed during detailed engineering and may result in purchasing EMF easements totaling approximately 76 acres from property owners along the ROW between Marcy and New Scotland. <i>(The review team's independent cost estimate includes the cost for additional EMF easements.)</i> This is considered a critical risk for all Segment A proposals with <u>the</u> exception of T027 (NAT/NYPA double circuit proposal<u>)-) due to the elctromagnitic fields from the new circuit configuration interacting with the existing circuits which is anticipated to reduce the EMF levels at the edge of the ROW due to the EMF cancelling effect of that design.</u></p>
8	Public Opposition - 765 kV Transmission Line	<p>New York State's only 765kV<u>765 kV</u> transmission line between Massena and Marcy was completed in 1975 amidst heavy public opposition. As such, it is highly likely that converting the 345kV<u>345 kV</u> line between Marcy substation and the proposed</p>	<p>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</p>

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		Knickerbocker substation will be controversial due to 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. <u>New structures in the 2.5 mile section of 765 kV line 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.</u>	obtain required EMF easements.
9	Design Concern - 765 kV Transmission Line	The 345kV <u>345 kV</u> line between Marcy substation and the proposed Knickerbocker substation was designed and constructed to 765kV <u>765 kV</u> 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. <i>(The review team's independent cost estimate includes an allowance for potential remedial work that may be identified.)</i>
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	The Developer proposes re-using 92 structures on the double circuit Edic/Fraser and 230kV Line <u>230 kV line #30</u>

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		inadequate and require repair or replacement.	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.
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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 <u>necessary, and the review team's analysis indicates that the lines could require relocating the-be relocated within the National Grid property. There is a risk that the new substation and/ may need to be moved to an alternate location within the existing National Grid property or purchasingde minimis additional property. (easement be acquired.)</u> <i>(The review team's independent cost estimate includes the cost for relocating these gas transmission lines.)</i>
2	Design Concern - New Scotland Substation	A significant issue is the lack of space in Control House #3 —i.e.,	To keep the new 345kV <u>345 kV</u> panels with the existing panel line up will likely require expanding the building to the


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	(National Grid Owned)	the most up-to-date building of the three existing control houses.	east where the cable trench entrances and a communication tower are located. <i>(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.)</i>
3	Obtaining Site Control and Property Acquisition	<p>Proposal utilizes existing ROW owned by National Grid.</p> <p><i>De minimis</i> property may need to be acquired for access and construction marshalling yards.</p>	<p>Negotiations with the incumbent utility could result in potential cost and schedule implications.</p> <p>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.</p>
4	Design Concern - EMF	The existing corridor (345kV <u>345 kV</u> Lines #14 and #18, and 115kV <u>Line 115 kV line</u> #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	<p>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. <i>(The review team's independent cost estimate includes the cost for additional EMF easements.)</i></p>


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		estimated to exceed the guidelines.	This is considered a critical risk for all Segment A proposals with <u>the</u> exception of T027 (<u>NAT/NYPA</u> double circuit proposal).) <u>due to the elctromagnitic fields from the new circuit configuration interacting with the existing circuits which is anticipated to reduce the EMF levels at the edge of the ROW due to the EMF cancelling effect of that design.</u>
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 230 kV 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 <u>necessary, and the review team’s analysis indicates that the lines could require relocating</u> be relocated within

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			<p><u>the National Grid property. There is a risk that the substation and/may need to be moved to an alternate location within the existing National Grid property or purchasingde minimis additional property-easement be acquired.</u> (The review team's independent cost estimate includes the cost for relocating these gas transmission lines.)</p>
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 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)	<p>Proposed <u>GIS</u> 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.</p> <p>Construction on ROW with existing lines will require coordination with incumbent utility to maintain clearances.</p>	<p>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-proposeda 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.</p>


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			<u>The risk for this proposal is somewhat minimized by the proposed GIS design which has a smaller footprint and less visual impact.</u> Short term outages and/or temporary bypasses of existing lines may be required to during construction.
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 <u>345 kV</u> 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. <i>(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.)</i>
<u>5</u>	<u>Obtaining Site Control and Property Acquisition</u>	<u>Proposal utilizes existing ROW owned by National Grid.</u> <u>De minimis property may need to be acquired for access and construction marshalling yards.</u>	<u>Negotiations with the incumbent utility could result in potential cost and schedule implications.</u> <u>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</u>


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			<u>increased costs which is considered a low probability.</u>
<u>6</u>	<u>Design Concern - EMF</u>	<u>Based on preliminary calculations provided by the Developer, it is possible that EMF design levels will be within NYPSC guidelines.</u>	<u>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. There is a risk that the EMF levels will exceed NYS PSC levels after final studies and may result in purchasing EMF easements from property owners along the right-of-way between Princetown and New Scotland</u>
<u>7</u>	<u>Re-use of existing structures</u>	<u>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.</u>	<u>The Developer proposes re-using 92 structures on the double circuit Edic/Fraser and 230 kV 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.</u>


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

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#	<u>Risk Title</u>	<u>Description</u>	<u>Comment</u>
<u>1</u>	<u>Design Concern - Rotterdam Substation (National Grid Owned)</u>	<u>Proposed substation layout is directly over two existing gas transmission lines and is likely to be resisted by the owner of that facility.</u>	<u>Relocation of the existing gas transmission lines is likely, and the review team's analysis indicates that the lines could be relocated within the National Grid property. There is a risk that the substation may need to be moved to an alternate location within the existing National Grid property or de minimis additional easement be acquired. (The review team's independent cost estimate includes the cost for relocating these gas transmission lines.)</u>
<u>2</u>	<u>Property Acquisition Concern - Princetown Substation</u>	<u>NAT/NYPA's proposed design for Princetown Substation appears to just fit within the existing National Grid rights-of-way.</u>	<u>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.)</u>
<u>3</u>	<u>Design Concern – Princetown Substation location (on National Grid Owned ROW)</u>	<u>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.</u> <u>Construction on ROW with existing lines will require</u>	<u>Public opposition to this site may result in delays associated with obtaining regulatory approvals and increased costs. An alternative design such as GIS or an alternative site may need to be identified such as a location midway between the Junction and Rotterdam, which</u>

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		<u>coordination with incumbent utility to maintain clearances.</u>	<u>has adequate space and would not be as close to existing buildings or roads minimizing the visual impact and possible opposition.</u> <u>Short term outages and/or temporary bypasses of existing lines may be required during construction.</u>
<u>4</u>	<u>Design Concern - New Scotland Substation (National Grid Owned)</u>	<u>A significant issue is the lack of space in Control House #3, the most up-to-date building of the three existing control houses.</u>	<u>To keep the new 345 kV 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 will include this scope of work.)</u>
5	Obtaining Site Control and Property Acquisition	Proposal utilizes existing ROW owned by National Grid. <i>De minimis</i> 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

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			increased costs which is considered a low probability.
6	Design Concern - EMF	<p><u>The existing corridor (which has 345 kV lines #14 and #18, and 115 kV 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. Based on preliminary calculations provided by the Developer, it is possible that EMF design levels will be within NYPSC guidelines.</u></p>	<p>EMF levels will have to be confirmed<u>addressed</u> during detailed engineering. It and <u>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.)</u></p> <p><u>This is considered a critical risk for all Segment A proposals with the exception of T027 (NAT/NYPA double circuit proposal) due to the elctromagnetic fields from the new circuit configuration interacting with the existing circuits which is anticipated that the double circuit alternative will to reduce the EMF levels to below NYS PSC guideline levels on the Princetown Junction to New Scotland corridor at the edge of the ROW due to the EMF cancelling effect of that design.</u></p>
7	Re-use of existing structures	During construction the Developer could discover that structures originally planned for re-use are in worse condition	<p>The Developer proposes re-using 92 structures on the double circuit Edic/Fraser and 230kV Line <u>230 kV line #30</u></p>


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		than expected or inadequate and require repair or replacement.	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.
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T031 – 16NYPP1-1A AC Transmission – ITC

~~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	Proposed substation is located close to existing homes and	Public opposition to this site may result in delays associated

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	Substation location (on National Grid Owned ROW)	<p>buildings. These property owners may oppose the siting of a substation near their property due to concerns with visual impact, noise, security lights, etc.</p> <p>Construction on ROW with existing lines will require coordination with incumbent utility to maintain clearances.</p>	<p>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.</p> <p>Short term outages and/or temporary bypasses of existing lines may be required to during construction.</p>
4	Design Concern- New Scotland Substation (National Grid Owned)	<p>A significant issue is the lack of space in Control House #3, the most up-to-date building of the three existing control houses.</p>	<p>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 will include this scope of work.)</p>
5	Obtaining Site Control and Property Acquisition	<p>Proposal utilizes existing ROW owned by National Grid.</p> <p>De minimis property may need to be acquired for access and construction marshalling yards.</p>	<p>Negotiations with the incumbent utility could result in potential cost and schedule implications.</p> <p>The review team's schedule provides two years for negotiation and procurement of</p>

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			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. <i>(The review team's independent cost estimate includes the cost for additional EMF easements.)</i> 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.

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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 <u>345 kV</u> transmission line into New Scotland by adding a 345kV <u>345 kV</u> 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 <u>345 kV</u> line to Princetown 345kV <u>345 kV</u> Line to Princetown (formally line14 to Edic), 345kV <u>345 kV</u> Line 93 to Leeds, 345kV <u>345 kV</u> 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 <u>345 kV</u> 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. <i>(While the Developer</i>

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			<i>did not include expanding the control house in its estimate, the review team's independent cost estimate includes this scope of work.)</i>
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 <u>the review team's analysis indicates that the lines could require relocating be relocated within the National Grid property.</u> There is a risk that the substation <u>and/location may need to be moved within the existing National Grid property</u> or <u>purchasing de minimis</u> additional <u>property-easement be acquired.</u> (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 <u>345 kV</u> T-line terminals with circuit breakers, disconnect switches, a 345kV <u>345 kV</u> tie breaker, and two 345kV – 230kV <u>345 kV – 230 kV</u> transformers. Each transformer will have a 230kV <u>230 kV</u> circuit breaker connected to the 230kV <u>230 kV</u> main bus.	With this configuration, and because the 230kV Lines <u>230 kV lines #30 and #31</u> are eliminated, a failed 230kV <u>230 kV</u> breaker or a 230kV <u>230 kV</u> bus fault will cause a loss of the entire 230kV <u>230 kV</u> yard.

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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. <i>(The review team's independent cost estimate includes the cost for additional property/easements.)</i>
6	Design Concern – Princetown Substation location (on National Grid Owned ROW)	<p>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.</p> <p>Construction on ROW with existing lines will require coordination with incumbent utility to maintain clearances.</p>	<p>Public opposition to this site may result in delays associated with obtaining regulatory approvals and increased costs. An alternative design such as GIS or <u>alternative</u> 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. <u>Outages</u> Short term outages and/or temporary bypasses of existing lines will be required to during construction.</p>
7	Obtaining Site Control and Property Acquisition	<p>Proposal utilizes existing ROW owned by National Grid.</p> <p><i>De minimis</i> property may need to be acquired for access and construction marshalling yards.</p>	<p>Negotiations with the incumbent utility could result in potential cost and schedule implications.</p> <p>The review team's schedule provides two years for negotiation and procurement of ROW beginning with the notice to proceed. This should</p>

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			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.	<p>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. <i>(The review team's independent cost estimate includes the cost for additional EMF easements.)</i></p> <p>This is considered a critical risk for all Segment A proposals with <u>the</u> exception of T027 (<u>NAT/NYPA double circuit proposal</u>) <u>due to the elctromagnetic fields from the new circuit configuration interacting with the existing circuits which is anticipated to reduce the EMF levels at the edge of the ROW due to the EMF cancelling effect of that design.</u></p>


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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 230 kV 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.
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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 <u>345kV345 kV</u> 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 <u>345kV345 kV</u> 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. <u>Additionally Depending on the outcome of the 2017 Class Year Study</u> , the substation yard <u>will may</u> have to be expanded to the southwest to accommodate one of the proposed <u>345kV345 kV</u> capacitor banks. <i>(This additional work is not included in the independent estimates.)</i>
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. <i>(Expansion of the</i>

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			<i>control house is included in the independent estimates.)</i>
4	Construction Concern - Churchtown Substation (NYSEG Owned)	Developer proposes constructing a new 115kV <u>115 kV</u> , 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 <u>115 kV</u> 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 <u>increases</u> the highest <u>siting</u> risk for <u>of</u> this proposal.
6	Obtaining Site Control and Property Acquisition	National Grid owns all property required for new facilities. <i>De minimis</i> 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.

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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 <u>345 kV</u> 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 <u>345 kV</u> 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. <i>(This additional work is not included in the independent estimates.)</i>
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


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			Valley Project. <i>(Expansion of the control house is included in the independent estimates.)</i>
5	Construction Concern - Churchtown Substation (NYSEG Owned)	Developer proposes constructing a new 115kV <u>115 kV</u> , 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 <u>considered</u> <u>increases</u> the <u>highest</u> <u>siting</u> risk for <u>of</u> this proposal.
7	Obtaining Site Control and Property Acquisition	Proposal utilizes existing ROW owned by National Grid. <i>De minimis</i> 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


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			increased costs which is considered a low probability.
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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 <u>345 kV</u> 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 <u>345 kV</u> 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. <i>(This additional work is not included in the independent estimates.)</i>


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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. <i>(Expansion of the control house is included in the independent estimates.)</i>
5	Construction Concern - Churchtown Substation (NYSEG Owned)	Developer proposes constructing a new 115kV <u>115 kV</u> , 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 <u>considered increases</u> the highest <u>siting</u> risk for <u>of</u> this proposal.
7	Obtaining Site Control and Property Acquisition	Proposal utilizes existing ROW owned by National Grid. <i>De minimis</i> 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


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			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.
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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 <u>345kV345 kV</u> 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 <u>345kV345 kV</u> 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. <i>(This additional work is not included in the independent estimates.)</i>
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. <i>(Expansion of</i>

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			<i>the control house is included in the independent estimates.)</i>
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. <u>This increases the siting risk of this proposal.</u>
5	Obtaining Site Control and Property Acquisition	Proposal utilizes existing ROW owned by National Grid. <i>De minimis</i> 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.


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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 345 kV 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 345 kV 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. <i>(This additional work is not included in the independent estimates.)</i>
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. <i>(Expansion of the control house is included in the independent estimates.)</i>
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-


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			ft. and 20-ft. This is <u>considered</u> <u>increases</u> the <u>highest</u> <u>siting</u> risk for <u>of</u> this proposal.
5	Obtaining Site Control and Property Acquisition	<p>Proposal utilizes existing ROW owned by National Grid.</p> <p><i>De minimis</i> property may need to be acquired for access and construction marshalling yards.</p>	<p>Negotiations with the incumbent utility could result in potential cost and schedule implications.</p> <p>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.</p>

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 <u>345 kV</u> line from Knickerbocker Substation in Bay #2 of Pleasant	This will likely require adding two 345kV <u>345 kV</u> breakers with disconnect switches to Bay #1. The Cricket Valley line

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		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.	will be moved from Bay #2 to Bay #1. Bay #2 will then be available for the new line from Knickerbocker. <i>(This additional work is not included in the independent estimates.)</i>
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. <i>(Expansion of the control house is included in the independent estimates.)</i>
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%. <u>The increase in the total number of structures could increase the risk of adverse impact on visual and agricultural resources.</u> Impact of structure placement will have to be determined during detailed engineering. This is considered <u>one of the highest riskrisks</u> for this proposal.

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5	Obtaining Site Control and Property Acquisition	<p>Proposal utilizes existing ROW owned by National Grid.</p> <p><i>De minimis</i> property may need to be acquired for access and construction marshalling yards.</p>	<p>Negotiations with the incumbent utility could result in potential cost and schedule implications.</p> <p>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.</p>
6	Operation Concern – Triple Circuit Transmission Design	<p>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<u>345 kV</u> circuit attached horizontally to an upper crossarm and two 115kV<u>115 kV</u> circuits attached side by side horizontally to a lower crossarm.</p>	<p>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.</p> <p>A maintenance plan must be developed prior to putting this configuration into service.</p>

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

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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, line #30 and line #31, with a single Edic to New Scotland ~~345kV~~ 345 kV 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~~ 345 kV line. However, a compact transmission line configuration may be required to fit a future ~~345kV~~ 345 kV 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.


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<u>Segment-A Summary of ROW Requirements for Segment-A Projects From Edic to Princetown Junction</u>							
Sector	Corridor Width (ft.)	Developer	Proposal	Proposed Structure Configuration	ROW Req'd. (ft.)	ROW Corridor Remaining (ft.)	Remarks
Edic SS to Prince-town Jct	200	NGRID/Transco	T018	1 Ckt – 345kV 345 kV H-pole Horizontal	120	80	Sufficient reserved ROW for expansion utilizing Compact Vertical Configuration
		NextEra	T021	1 Ckt – 345kV 345 kV Single Pole Delta	80	120	Sufficient reserved ROW for expansion utilizing H-pole Horizontal Configuration
		NAT/NYPA/ NAT	T026 & T028	1 Ckt – 345kV 345 kV H-pole Horizontal	140 (a)	60 (a)	Sufficient reserved ROW for expansion utilizing Compact Vertical Configuration
		NAT/NYPA/ NAT	T027	2 Ckt – 345kV 345 kV 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 345 kV 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-conducted in the future.
- Most proposals provide for future expansion of substations or could be ~~modified~~ expanded to provide for additional line terminals and transformers in the new substations.

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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:~~

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Significant items specific to each developer: Potential Transmission Expansion for Segment A				
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 <u>345 kV</u> gas-insulated substation design provides one open 345kV <u>345 kV</u> bay position and room for additional 345kV <u>345 kV</u> bays. Design also provides ability to connect one additional 345kV/115kV <u>345 kV/115 kV</u> transformer to support the local transmission system. Lastly, the design allows for the rebuilding of the 115kV <u>115 kV</u> 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 <u>345 kV</u> bay positions and room on the property for adding bays. NextEra's proposal maintains the existing and aging Rotterdam 230kV <u>230 kV</u> yard intact.

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T025 - Segment A + 765kV <u>765 kV</u> Proposal	A	NYPA/North American Transmission	Including the common items above, the Developer states that converting the Marcy-New Scotland-Knickerbocker 345kV <u>345 kV</u> transmission lines to 765kV <u>765 kV</u> could significantly increase Central East transfer capability. (Note that T025 includes this conversion.)	At Rotterdam, rebuilding and relocating the 345kV <u>345 kV</u> substation allows for the rebuilding of the 115kV <u>115 kV</u> straight bus configuration into a breaker-and-a-half configuration. A new Princetown Substation is proposed at the junction of the 345kV <u>345 kV</u> Edic-New Scotland line and the 230kV <u>230 kV</u> Porter to Rotterdam lines. Due to the proximity to the neighboring properties, constructing or expanding the substation will be difficult. At New Scotland, proposal T025 eliminates the 345kV <u>345 kV</u> line to Alps thus creating an open line terminal position.
T026 - Segment A Base Proposal	A	NYPA/North American Transmission	No significant expandability to NYPA/NAT's <u>NAT/NYPA's</u> proposal beyond the common items mentioned above.	At Rotterdam, rebuilding and relocating the 345kV <u>345 kV</u> substation allows for the rebuilding of the 115kV <u>115 kV</u> straight bus configuration into a breaker-and-a-half configuration.

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T027 - Segment A Double Circuit Proposal	A	NYPA/North American Transmission	No significant expandability to NYPA/NAT's <u>NAT/NYPA's</u> proposal beyond the common items mentioned above.	<p>At Rotterdam, rebuilding and relocating the 345kV<u>345 kV</u> substation allows for the rebuilding of the 115kV<u>115 kV</u> straight bus configuration into a breaker-and-a-half configuration. A new Princetown Substation is proposed at the junction of the 345kV<u>345 kV</u> Edic-New Scotland line and the 230kV<u>230 kV</u> Porter to Rotterdam lines. Due to the proximity to the neighboring properties, constructing or expanding the substation will be difficult.</p> <p><i>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<u>345 kV</u> capacitor bank.</i></p>
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T028 - Segment A Enhanced Proposal	A	NYPA/North American Transmission	No significant expandability to NYPA/NAT's <u>NAT/NYPA's</u> proposal beyond the common items mentioned above.	<p>At Rotterdam, rebuilding and relocating the 345kV<u>345 kV</u> substation allows for the rebuilding of the 115kV<u>115 kV</u> straight bus configuration into a breaker-and-a-half configuration.</p> <p>A new Princetown Substation is proposed at the junction of the 345kV<u>345 kV</u> Edic-New Scotland line and the 230kV<u>230 kV</u> Porter to Rotterdam lines. Due to the proximity to the neighboring properties, constructing or, if constructed, expanding the substation will be difficult.</p>
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 <u>230 kV</u> yard intact. Additionally, physical limitations at these properties may preclude future expansions without purchasing additional property.
Proposal	Segment	Developer	Transmission Line Expandability	Substation Expandability

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T019 - New York Energy Solution Segment B	B	National Grid/Transco	No significant expandability to NGRID's proposal beyond the common items mentioned above.	At Knickerbocker Substation, the proposed design provides one open 345kV <u>345 kV</u> bay position. The Knickerbocker design also allows the 345kV <u>345 kV</u> 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 <u>115 kV</u> bay position. Additional breaker-and-a-half bays can be added in the future.
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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 <u>115 kV</u> 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 <u>345 kV</u> bay position. The Knickerbocker design also allows the 345kV <u>345 kV</u> 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.

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T029 - Segment B Base Proposal	B	NYPA/North American Transmission	No significant expandability to NYPA/NAT's <u>NAT/NYPA's</u> proposal beyond the common items mentioned above.	The Developer proposes a new 115kV <u>115 kV</u> breaker-and-a-half substation and eliminates the existing NYSEG Churchtown substation. The three-bay substation is proposed for south of the existing substation and north of Orchard Road. This location will permit future expansion of the proposed substation to the north. At Knickerbocker, the Developer's design allows the 345kV <u>345 kV</u> ring bus configuration to be converted to a breaker- and-a-half configuration with room on the property for adding bays.
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T030 - Segment B Enhanced Proposal	B	NYPA/North American Transmission	No significant expandability to NYPA/NAT's <u>NAT/NYPA's</u> proposal beyond the common items mentioned above.	<p>The Developer proposes a new 115kV<u>115 kV</u> breaker-and-a-half substation and eliminates the existing NYSEG Churchtown substation. The three-bay substation is proposed for south of the existing substation and north of Orchard Road. This location will permit future expansion of the substation to the north.</p> <p>At Knickerbocker, the Developer's design allows the 345kV<u>345 kV</u> ring bus configuration to be converted to a breaker-and-a-half configuration with room on the property for adding bays.</p>
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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 <u>345 kV</u> bay position and one open 115kV <u>115 kV</u> bay position. The Knickerbocker design also allows the 345kV <u>345 kV</u> and 115kV <u>115 kV</u> 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 <u>345 kV – 115 kV</u> transformers to support the local transmission system could be provided.
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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.”

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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~~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~~"Order Finding Transmission proceeding (Case Nos. 12-T-0502, et al.)Needs Driven by Public Policy Requirements" 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."*

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- 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	<p>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.</p> <p>NGRID will transfer ownership <u>of</u> all assets to the Transco.</p>
T025 T026 T027 T028 T029 T030	NYPA/North American Transmission	<p>The proposed project's route would use existing ROW owned by the incumbent utility (National Grid).</p> <p><u>NAT</u>/NYPA/NAT lays out a plan in their proposal (Attachment C.2A Property 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.</p> <p><u>NAT</u>/NYPA/NAT does not yet possess the required ROWs. However, they have a documented plan to obtain the real property.</p>
T021 T022 T023	NextEra	<p>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).</p> <p>NextEra does not yet possess the required ROWs. However, it has a documented plan to obtain the necessary real property.</p>

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T031 T032	ITC	<p>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.</p> <p>ITC lays out a plan for obtaining site control in their proposal (Attachment C.2A)</p> <p>ITC does not yet possess the required ROWs. However, they have a documented plan to obtain the real property.</p>
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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~~Cost 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~~NAT/NYPA's T025 ~~765kv~~765 kV 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.

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- 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	

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Substation Property Requirements for Segment A

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	Princeton Substation (New)	Schenectady		24.0
T025	NYPA / NAT	Knickerbocker Substation (New)	Rensselaer	30.00	
		Princeton 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	
		Princeton Substation (New)	Schenectady	3.00	
		Rotterdam Substation (New)	Schenectady	7.50	
T028	NYPA / NAT	Princeton Substation (New)	Schenectady	3.00	
		Rotterdam Substation (New)	Schenectady	7.50	
T031	ITC	Princeton 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' O&M plans. With the exception of ITC, all Developers propose to operate their facilities from an in-state control center.

Summary Proposed of O&M Plans

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#	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 T023	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 1,400 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,

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		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.
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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~~qualified 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 ~~of the engineering work.~~
- 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.

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- 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-proposal. 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.

<p align="center">AC TRANSMISSION PROJECT SEGMENT A: Estimate of Heavy Clearing (Acres)</p>
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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).

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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~~United States Army Corps of Engineers (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


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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. Many factors affect the visibility and visual impact of the proposed lines, including surrounding vegetation, presence of existing lines, topography, land use, structure design and the number of structures. 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- during final design to reduce the visual impact. The type of structure will affect its visibility with lattice type towers having the highest potential visual 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 its December 17, 2015 Order, the NYPSC encouraged Developers to minimize structure heights. Since all of the proposed projects are essentially using the same existing ROW, with the exception of the 765 kV portion of T025 proposal, the remaining variable for evaluating potential visual impact is the structure height and number of structures.~~


Segment A

~~The height of the structure will~~ 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 minimizing 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 NYPSC concluded that height increases of less than 25 feet over existing structures will not create a significant adverse visual impact of a regional nature (December 12, 2015 Order at p. 35). The construction of new structures even with minimal increase in height may result in public opposition due to their potential local visual impact. The PSC determined that the local visual impacts will be addressed in the Article VII siting proceedings.

Segment A


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The height of the structure may 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~~765 kV operation and has structures ranging in height from 135 feet to 195 feet ~~and~~where the proposed structures range in height from 60- ~~to~~ 145 ft. This may reduce the visual impact of the proposed line. Green ~~highlight~~highlights in the table below 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, absent a viewshed analysis.

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	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%


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Based upon the height increase comparison estimates above, proposal T031 would have the least potential visual impacts by a considerable margin, although it does use more structures than all other proposals, except proposal ~~T021~~T021. 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- except for 6.3 mile being removed by T027. Using the 10-foot height increase as the basis for ranking the potential visual impacts, proposals ~~T026/T028~~T026 and T028 would have the second lowest visual impact, with about a third of the structures having a height increase of 10 feet or more. Proposal ~~T018~~T018 would be fourth followed by proposal ~~T027~~T027. Proposal ~~T021~~T021 would have the most potential visual impact with 99% of the structures having a height increase of more than 10 feet. In addition, proposal ~~T021~~T021 is proposing the greatest number of structures.

Proposal ~~T025~~T025 would have the third lowest overall potential visual impact based upon the table and method discussed above. However, the most significant potential visual impacts for proposal ~~T025~~T025 are due to the 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 the 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 comparison demonstrates the relative height differences for the proposed projects. Green ~~highlight~~highlights in the table below 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, absent a viewshed analysis.

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	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 0.1 ft 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 0.1 ft 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 and criteria described above, proposal T032 would have the least significant potential visual impact due to height increase; however, it adds ~~65-1661~~ (15%) more structures than any other proposed project which could have additional potential visual impacts. Proposal ~~T029/30~~T029 and T030 would have the second least potential visual impact with only 5% of the structures increasing in height by more than 10 feet. Proposals ~~T019~~T019 and ~~T022~~T022 would have comparable potential 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.~~63~~ less miles of lattice structures along Churchtown to Pleasant Valley (circuits 12 and 13) than all the other proposed projects. Proposal ~~T023~~T023 would have the most significant potential visual impact, if only the height increase is considered, with 56% of the structures increasing in height by 10 to 15 feet.

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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	24.0	40.5	7.5	11.8	10.5	10.6
(1)	(1)	(3)	(1)	(3)	(2)	(2)

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AC TRANSMISSION PROJECT SEGMENT B: Estimated Station Area (Acres/(number))					
T019	T022	T023	T029	T030	T032
26.8	19.5	19.5	25.4	25.4	20.3
(3)	(2)	(2)	(2)	(2)	(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. Replacement of Aging Infrastructure – Transmission Lines (Segment A)

The following table is a summary of the transmission line mileages to be ~~removed~~replaced for each Segment A proposal. All proposals intend to utilize existing double circuit structures 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 and ~~NYPA/NAT's~~NAT/NYPA's proposal T027 would replace more miles of existing infrastructure than the other proposals. ITC intends to rebuild the Princetown to New Scotland section of existing circuit #14. ~~NAT/NYPA/NAT~~ (T027) proposes ~~that line# 14 be rebuilt for only~~to rebuild 6.3 miles of line# 14 from Princetown Junction where the ROW is only ~~370ft.~~370 feet wide. The replacement of 6.3 miles of lattice structures with single steel pole vertical structure is to accommodate the proposed double circuit ~~345kV~~345 kV line.


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Replacement of Aging Transmission Line Infrastructure –Segment A

SEGMENT A	CIRCUIT NUMBER	T018 (NGRI D/NY TRAN SCO)	T021 (NEXT ERA)	T025 (NAT/N YPA/NA T)	T026 (NAT/ NYPA/ NAT)	T027 (NAT/N YPA/NA T)	T028 (NAT/ NYPA/ NAT)	T031 (ITC)
Marcy - New Scotland	18	0	0	2.66	0	0	0	0
Princetown Junction - New Scotland	14 ¹ 14	0	0	0	0	6.3	0	20
Miles of 345kV345 kV Removed		0	0	2.66	0	6.3	0	20
Edic - Princetown Junction	30 ² 30	66.8	66.8	66.8	66.8	66.8	66.8	66.8
Edic - Princetown Junction	31 ³ 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 230kV230 kV Removed		131	131	131	131	143.6	131	131
Princetown Junction - New Scotland	4 ⁴ 13	2.5	2.5	2.5	2.5	2.5 13.4	2.5	0
Miles of 115kV115 kV Removed		2.5	2.5	2.5	2.5	2.5 13.4	2.5	0
Total Miles of Line Removed		133.5	133.5	136.16	133.5	152.4 ³ 16 3.3	133.5	151
<u>1 T027 (NAT/NYPA) proposing to replace 6.3 miles of lattice structure with single pole structure and T031 (ITC) proposing to replace entire 20 miles of lattice structure with single pole double circuit lines.</u>								
<u>*2 All developers are proposing to reuse existing double circuit poles of line #30 to replace existing 230 kV for the first 12.6 miles east out of Edic/Porter. Therefore 12.6 miles of removal shown includes wire, insulators and hardwares only. Removal total 66.8 miles is sum of 12.6miles from NYPA Structures and 54.2 miles of NG Line.</u>								
<u>*3 T027 (NAT/NYPA/ NAT), double circuit proposal, proposing to reuse existing double circuit poles of line #31 to replace 230 kV for the first 12.6 miles east out of Edic/Porter. Therefore 12.6 miles of removal shown includes wire, insulators and hardwares only. Removal total 66.8 miles is sum from 12.6miles on NYPA Structures and 54.2 miles of NG Line. For rest of the proposals, line#31 from Porter to 12.6 miles is being de-energized, retired in place.</u>								
<u>4 T027 (NYPA/ NAT), double circuit proposal, 115 kV line#13 from a point 6.3miles South of Princetown Jct. to Rotterdam Substation, approximately 4.5 miles is being de-energized, retired in place.</u>								

4.10.1.4.10.2. Replacement of Aging Infrastructure – Substations (Segment A)

- The Segment A proposals predominately affect four existing substations: National Grid's Edic, New Scotland, Porter and Rotterdam substations. Additionally, ~~NAT/NYPA/NAT~~ proposal T025 also affects the NYPA's Marcy 765 kV station.


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- At Edic, NAT/NYPA T025, T026, T027, and T028 are replacing two ~~345kV~~345 kV circuit breakers due to loading. At Marcy they are replacing three ~~345kV~~345 kV circuit breakers.
- At New Scotland, ~~NGRID~~NGrid proposal T018 proposes to 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 ~~Lineline~~ #30 and breaker R310 for ~~Lineline~~ #31.
- At Rotterdam, ~~NGRID~~NGrid proposal T018 and the ~~NAT~~/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 or replace any existing equipment at Rotterdam substation.

4.10.3. Replacement of Aging Infrastructure – Transmission Lines (Segment B)

The following table summarizes the transmission line mileage to be ~~removed~~replaced 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

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Transmission Line Replaced For Segment B

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. Replacement of Aging Infrastructure – Substations (Segment A)

The Segment B proposals ~~predominately~~predominantly 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 ~~NAT/NYPA/NAT'~~ proposals T029 and T030 will replace the existing NYSEG Churchtown ~~substation~~115 kV Substation.
 - NextEra proposals T022 and T023 and ITC' proposal T032 retain the existing ~~equipment~~Churchtown 115 kV Substation.
- 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

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

~~NAT/NYPA~~ T026 replaces two ~~345kV~~345 kV circuit breakers at Edic due to loading. At Marcy they are replacing three ~~345kV~~345 kV 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
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T025 NAT /NYPA/ NAT	1	0	1	Breaker & Half	16 (1 new)
T027 NAT /NYPA/ NAT	2	0	2	Breaker & Half	18 (3 new)
T028 NAT /NYPA/ NAT	1	0	1	Breaker & Half	16(1 new)

Discussion


Like the base proposals, except for ITC proposal T031, ~~these alternates all~~ the alternate proposals shift the 345 kV line to Fraser from Bay #4 to Bay #3 making Bay #4 available for a new ~~345kV~~345 kV line. For proposal T027, the Developer adds a bay north of Bay #1 for a new ~~345kV~~345 kV 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~~345 kV circuit breakers due to loading. At Marcy they are replacing three ~~345kV~~345 kV circuit breakers.

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4.11.1.2. New Scotland ~~345kV~~345 kV Substation

Base Proposals

Developer	# of new Lines	# of new Transformers	Total new elements	Proposed Breaker Arrangement	# of Breakers
T018 NGRID <u>Grid</u> /Transco	1	0	1	Sectionalized Bus (3 sections)	16 (5 new)
T021 NextEra	1	0	1	Sectionalized Bus (3 sections)	16 (3 new)
T026 NAT /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 ~~Busbus~~ and the south main bus is the 77 ~~Busbus~~. 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 ~~Busbus~~).

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 ~~Busbus~~). Proposals T018 and T021 create an 88 ~~Busbus~~ by adding redundant tie breakers between R81 and R82. Proposal T026 creates an 88 ~~Busbus~~ 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.

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Replacement of Aging Infrastructure

Proposal T018 replaces the existing R81 and R82 (oil) tie circuit breakers with new SF6 units breakers. 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 <u>NAT/NYPA/NAT</u>	0	0	0	Sectionalized Bus	13 (0 new)
T027 <u>NAT/NYPA/NAT</u>	2	0	2	Sectionalized Bus	17 (4 new)
T028 <u>NAT/NYPA/NAT</u>	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 Busbus 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 Busbus. Proposal T028 adds one new line terminal to the 77 Busbus.

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.

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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 Grid/Transco	No Princetown Substation proposed.				
T021 NextEra	2 – 345kV <u>345 kV</u> 2 – 230kV <u>230 kV</u>	2	6	Breaker & Half	7 – 345kV <u>345 kV</u> 6 – 230kV <u>230 kV</u>
T026 NAT /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~~Refer to Risk Analysis section of the report for discussions on the potential issues with siting and constructing 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~~the 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
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T025 NAT/NYPA/NAT	4	0	4	Ring Bus	4
T027 NAT/NYPA/NAT	6	0	6	Breaker & Half	9
T028 NAT/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, ~~NAT/NYPA/NAT~~ propose a gas-insulated three-bay breaker-and-a-half configuration. ~~Potential~~Refer to Risk Analysis section of the report for discussions on the potential issues with siting and constructing 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

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


*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.

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It should be noted that ~~National Grid's~~NGrid'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 potentially 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 potentially 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 NAT/NYPA/NAT	Same as T026.				
T027 NAT/NYPA/NAT	Same as T026.				
T028 NAT/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

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No further discussion beyond proposal T026 above.

4.11.1.5. Remote Terminal Substations

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.

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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 <u>NGrid</u> /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 <u>NAT</u> /NYPA /NAT	3	0	3	Ring Bus (built for future Breaker & Half)	3
T032 ITC	3 – 345kV <u>345 kV</u> 3 – 115kV <u>115 kV</u>	0	6	345kV <u>345 kV</u> - Ring Bus 115kV <u>115 kV</u> - Ring Bus	3 – 345kV <u>345 kV</u> 3 – 115kV <u>115 kV</u>

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.

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Alternate Proposals.

Developer	# of new Lines	# of new Transformers	Total new elements	Proposed Breaker Arrangement	# of Breakers
T023 NextEra	Same as T022.				
T025 NAT /NYPA/ NAT	1 – 765kV <u>765 kV</u> 2 – 345kV <u>345 kV</u>	2	5	765kV <u>765 kV</u> – Ring Bus 345kV <u>345 kV</u> – Ring Bus	3 – 765kV <u>765 kV</u> 4 – 345kV <u>345 kV</u>
T030 NAT /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~~765 kV – 345 kV 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 <u>NGrid</u> /Transco	5	0	5	Breaker & Half	8
T022 NextEra	5	0	5	Ring Bus (built for future Breaker & Half)	5

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T029 NAT/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~~115 kV substation at Churchtown. Proposals T019 and T029 will ~~eliminate~~replace the existing NYSEG 115 kV 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 ~~NAT/NYPA/NAT~~ proposal T029 will replace the existing NYSEG Churchtown ~~substation.~~115 kV Substation. NextEra proposal T022 and ITC proposal T032 ~~retain~~retains the existing ~~equipment~~Churchtown Substation.


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 NAT/NYPA/NAT	Same as T029.				

Discussion

Similar to proposal T022, proposal T023 retains and connects to the existing NYSEG Churchtown 115 kV substation. It differs from proposal T022 in that ~~it eliminates~~it removes one line terminal for the connection to Pleasant Valley substation.

Expandability

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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

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

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 <u>Grid</u> /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 NAT/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.

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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—~~aan over 1,110~~over 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 NAT/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.

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4.11.1.11. Remote Terminal Substations

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:

Transmission Line Design Information for Segment A

Client:	NYISO		
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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		

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Transmission Line Design Information for 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	NYP&A 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	NYP&A 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

NY State Public Service Commission policy limits the electrical and magnetic fields produced by a transmission line. The maximum limits at the edge of the right of way for the electrical field is 1.6

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kilovolts per meter (kV/m)⁴ and for the magnetic field is 200 milligauss (mG)⁵. The existing transmission line corridor (345 kV Lines #14 and #18, and ~~115kV~~ 115 kV Line #13 are located on that corridor) between Princetown Junction and New Scotland Substation is currently estimated to exceed NYPSC ~~guidelines~~ standards for EMF levels. The designs for proposals T018, T021, T026, and T028 improve the EMF exceedance condition, but EMF levels are still estimated to exceed the ~~guidelines~~ standards. Although the proposed designs may actually improve existing levels on this transmission corridor, current NYPSC Article VII regulations will require that any project proposing upgrades on the corridor need to correct the exceedance to comply with current standards. Calculations provided by the Developers are preliminary in nature and will have to be confirmed during detailed engineering design. The findings might result in purchasing of new EMF easements from property owners along the ROW between Princetown and New Scotland.

Additionally, proposal T025 proposed conversion of the 345 kV line between Marcy substation and the proposed Knickerbocker substation to 765 kV will likely increase EMF levels beyond NYPSC ~~guidelines~~ standards and would also require acquisition of additional easements.


The double circuit 345 kV line construction for Proposal T027 appears to mitigate the EMF exceedance. The physical configuration and phasing of this new line may have the effect of interacting with the electric fields from the existing line #14 to reduce the net EMF effect to acceptable levels.

It should be noted that SECo did not perform independent EMF calculations. Developers provided calculations that were checked for their reasonableness within the context of the PSC EMF standards. The calculations provided by all Developers have a reasonable correlation to one another for similar arrangements and appear to be a good preliminary indication of the potential EMF levels. The additional ROW requirements shown in this report are estimates based on information provided by the Developers and subject to round off and preliminary nature of the design. The exact ROW requirements will need to be determined once the final design is complete. An allowance was included in the independent cost estimate to allow for the purchase of additional easements associated with EMF mitigation.

The following table ~~summarises~~ summarizes the EMF results provided by the developers and the estimated additional ROW that is likely to be required to mitigate the EMF levels.


⁴ The applicable electric field strength standards established by the PSC are set forth in Opinion No. 78-13 (issued June 19, 1978).

⁵ The magnetic field standards established by the PSC are set forth in the PSC's Interim Policy Statement on Magnetic Fields, issued September 11, 1990. This statement also reaffirmed the electric field strength standards set in Opinion No. 78-13.

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PROPOSAL	Developer	LINE				EMF			
		Sector	Voltage (kV)	Length (miles)	Corridor Width (ft.)	Estimated @ Edge of ROW		Estimated Additional ROW Requirement	
						Max. Electric Field (kV/m)	Max. Magnetic Field (mG)	Width (ft.)	Area (Acres)
T018	National Grid and NYTransco	Princeton Jct to New Scotland SS	345	6.3	370	1.9	94.6	10	7.6
			345	4.3	590	1.9	59.2	10	5.2
			345/115	2.5	450	1.9	83.4	10	3.0
			345	6.6	590	1.9	59.2	10	8.0
				19.7					23.9
T021	NextEra Energy	Princeton Jct. to New Scotland SS	345	6.5	370	1.7	140.0	10	7.9
			345	4.3	590	1.8	150.0	10	5.2
			345/115	2.5	450	1.8	150.0	10	3.0
			345	6.6	590	1.8	170.0	10	8.0
				19.9					24.1
T025	NYPA / NAT	Marcy SS to Knickerbocker	765	0.4	470	0.3	50.0		0.0
			765	1.3	675	2.7	125.0	25	4.0
			765	33.7	360-380	-	-	23	93.8
			765	2.0	570	2.6	161.0	23	5.5
			765	27.7	345-380	-	-	23	77.2
			765	6.3	370	2.7	212.0	25	19.1
			765	4.3	590	2.6	148.0	23	11.9
			765	2.5	450	2.7	188.0	25	7.6
			765	6.1	590	2.6	148.0	23	17.1
			765	1.0	615	1.4	119.0		0.0
			765	1.9	615	0.2	27.0		0.0
			765	1.1	400	0.5	232.0		0.0
			765	1.5	400	1.9	100.0	9	1.6
			765	5.1	250	1.7	92.0	8	5.0
			765	3.0	750	0.4	187.0		0.0
				97.9					242.9
T026 & T028	NYPA / NAT	Princeton Jct. to New Scotland SS	345	6.3	370	1.8	208.0	10	7.6
			345	4.3	590	1.9	150.0	10	5.2
			345/115	2.5	450	1.9	188.0	10	3.0
			345	6.6	590	1.8	185.0	10	8.0
				19.7					23.9
T027	NYPA / NAT	Princeton Jct to New Scotland SS	345	6.3	370	1.3	123.0		0.0
			345	4.3	590	1.2	122.0		0.0
			345/115	2.5	450	1.2	124.0		0.0
			345	6.6	590	1.2	122.0		0.0
				19.7					0.0
T031	ITC	Princeton Jct to New Scotland SS	345	6.3	370	<1.0	<100	10	7.6
			345	4.3	590	-	-	10	5.2
			345/115	2.5	450	-	-	10	3.0
			345	6.6	590	-	-	10	8.0
				19.7					23.9


EMF Results Provided by the Developers and Estimated Additional ROW

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PROPOSAL	Developer	LINE				EMF			
		Sector	Voltage (kV)	Length (miles)	Corridor Width (ft.)	Estimated @ Edge of ROW		Estimated Additional ROW Requirement	
						Max. Electric Field (kV/m)	Max. Magnetic Field (mG)	Width (ft.)	Area (Acres)
T018	National Grid and NYTransco	Princeton Jct. to New Scotland SS	345	6.3	370	1.9	94.6	10	7.6
			345	4.3	590	1.9	59.2	10	5.2
			345/115	2.5	450	1.9	83.4	10	3.0
			345	6.6	590	1.9	59.2	10	8.0
				19.7					23.9
T021	NextEra Energy	Princeton Jct. to New Scotland SS	345	6.5	370	1.7	140.0	10	7.9
			345	4.3	590	1.8	150.0	10	5.2
			345/115	2.5	450	1.8	150.0	10	3.0
			345	6.6	590	1.8	170.0	10	8.0
				19.9					24.1
T025	NYPA / NAT	Marcy SS to Knickerbocker	765	0.4	470	0.3	50.0		0.0
			765	1.3	675	2.7	125.0	25	4.0
			765	33.7	360-380	-	-	23	93.8
			765	2.0	570	2.6	161.0	23	5.5
			765	27.7	345-380	-	-	23	77.2
			765	6.3	370	2.7	212.0	25	19.1
			765	4.3	590	2.6	148.0	23	11.9
			765	2.5	450	2.7	188.0	25	7.6
			765	6.1	590	2.6	148.0	23	17.1
			765	1.0	615	1.4	119.0		0.0
			765	1.9	615	0.2	27.0		0.0
			765	1.1	400	0.5	232.0		0.0
			765	1.5	400	1.9	100.0	9	1.6
			765	5.1	250	1.7	92.0	8	5.0
			765	3.0	750	0.4	187.0		0.0
				97.9					242.9
T026 & T028	NYPA / NAT	Princeton Jct. to New Scotland SS	345	6.3	370	1.8	208.0	10	7.6
			345	4.3	590	1.9	150.0	10	5.2
			345/115	2.5	450	1.9	188.0	10	3.0
			345	6.6	590	1.8	185.0	10	8.0
				19.7					23.9
T027	NYPA / NAT	Princeton Jct. to New Scotland SS	345	6.3	370	1.3	123.0		0.0
			345	4.3	590	1.2	122.0		0.0
			345	2.5	450	1.2	124.0		0.0
			345	6.6	590	1.2	122.0		0.0
				19.7					0.0
T031	ITC	Princeton Jct. to New Scotland SS	345	6.3	370	<1.0	<100	10	7.6
			345	4.3	590	-	-	10	5.2
			345/115	2.5	450	-	-	10	3.0
			345	6.6	590	-	-	10	8.0
				19.7					23.9


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.

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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	NYP&A 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	NYP&A 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	NYP&A 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.

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Segment B								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		
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

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Segment A Transmission Line Conductor Ampacity Ratings

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.

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Segment B Transmission Line Conductor Ampacity Ratings

Segment B						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		
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.”~~


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The following tables summarize Tables summarizing 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 is shown in the Environmental section of this report Section 4.9. The heights were derived from each Developers proposed designs and PLSCadd models provided.

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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


Case No.	Case Description	STANDARD REQUIREMENTS				COMPARISON WITH DEVELOPER'S DESIGN CRITERIA			
		Wind Load (mph)	Radial Thickness of ice (inches)	Temp (°F)	Standard	National Grid/ NY Transco	NextEra	NYP/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. NYP/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 as~~ compared to NAT/NYP/NAT proposals. To ensure that NAT/NYP/NAT were not under designing their foundations, SECo completed a spot check of the NAT/NYP/NAT foundation designs using the geotechnical data that they provided. SECo found that NYP/NAT's/NAT/NYP's proposed foundations ~~to be were~~ adequate.


4.11.2.8. Potential Issues with Conversion of Line to 765 kV

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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~~765 kV 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~~345 kV 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 Light Detection and Ranging survey (Lidar) data for roughly 1/3 of the existing line length to be converted to ~~765KV~~765 kV 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 with NAT/NYPA's conclusion. SECo has obtained PLSCadd files for the proposed line from ~~NAT/NYPA/NAT~~ and found the design line to ground clearance on the line is 44ft. The minimum calculated ground clearance requirement for ~~765KV~~765 kV line based on NESC 2012- Rule 232C1a and Table 232-1 is 33.~~2ft~~2 feet. 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~~does not include any ~~dollars~~costs to correct clearance issues.
- Insulation – NAT/NYPA has evaluated the insulation of the existing line and ~~documents~~documented their findings in their ~~765KV~~765 kV conversion feasibility study report. They show that the insulation level and air gaps are adequate for ~~765KV~~765 kV 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

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independent cost estimate includes the cost of the additional ~~EMF~~ easements required to mitigate EMF.

- 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~~does not have drawings that show the hardware used in the existing construction. Based on photos, taken at several locations throughout the line, it ~~doesn't~~does not appear that the line was constructed with corona rings. Remedial work may be required to correct corona issues on the existing line. A Rough rough cost estimate ~~was completed~~needed to potentially mitigate corona issues if detailed engineering study confirms the need~~---~~, was included in the cost estimates. The additional cost estimate is to replace hardware (not including insulators) on 83 miles of the existing line and completely rebuild approximately 13 ~~miles-mile~~ of the existing line ~~between Mk J and~~north of Knickerbocker. The rebuild of the 13 mile section might be required since that section was originally constructed with a bundle of three conductors per phase while the remaining line was constructed with a 4 bundle per phase. These costs have been included as a ~~network~~ upgradeNetwork Upgrade Facilities costs in the independent cost 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,~~ the review team determined 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~~The review team recommends that a more detailed and robust plan and risk mitigation be developed during detailed engineering.

Additionally, the installation of full length concrete poles as opposed to multi-piece steel poles requires significantly more equipment and labor to install. The concrete poles range in length up

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to 135 feet and weigh up to 62,000 pounds vs. steel pole sections (steel poles typically include three sections) up to 50 feet long and 16,000 pounds. Larger capacity cranes for offloading and setting the poles, heavy duty trucks to move poles on the right of way, larger work pad areas a with additional and thicker matting, heavier duty construction access roads with wider turning radius, and additional labor to rig and maneuver the poles is required. These incremental installation costs were considered in the estimates.

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~~all Developers, except for ITC, have proposed to relocate the existing Fraser line into a new bay and terminate the new line in the vacated Fraser terminal. ITC (T031) 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~~345 kV 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.

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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~~765 kV
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)