AC Transmission PPTN: Preliminary Results

Dawei Fan
Manager, Public Policy and Interregional Planning

ESPWG/TPAS
April 30, 2018, KCC

NEW YORK INDEPENDENT SYSTEM OPERATOR

DRAFT – FOR DISCUSSION PURPOSES ONLY

Review Process

- March 30, 2018: posted draft SECO report and preliminary evaluation results. Written comments welcomed throughout the review process.
- April 5, 2018: ESPWG/TPAS, summary of the review schedule
- April 6, 2018: review results with all developers in the same meeting
- April 19, 2018: review results with all developers in the same meeting
- April 23, 2018: preliminary stakeholder written comments due
- April 30, 2018: ESPWG/TPAS
- May 10, 2018: ESPWG/TPAS (added)
- May 22, 2018: ESPWG/TPAS
- June 20, 2018: Business Issue Committee (advisory vote)
- June 21, 2018: Operating Committee (for information, not required by Tariff)
- June 26, 2018: Special Management Committee (advisory vote)
- July 2018: draft report delivered to NYISO Board

Topics

- Public Policy Transmission Planning Process
- AC Transmission Public Policy Transmission Need
- Viable and Sufficient Projects
- Comparative Evaluation Assumptions
- Comparative Evaluation Results
- Next Steps

Public Policy Transmission Planning Process

Overview

- Section 31.4 of Attachment Y of the NYISO Open Access Transmission Tariff (OATT) describes the planning process that the NYISO, and all interested parties, shall follow to consider needs for new transmission projects on the Bulk Power Transmission Facilities (BPTF) that are driven by Public Policy Requirements.
- A Public Policy Requirement is a federal or New York State statute or regulation, including a New York State Public Service Commission (PSC) order adopting a rule or regulation subject to and in accordance with the State Administrative Procedure Act, any successor statute, or any duly enacted law or regulation passed by a local governmental entity in New York State, that may relate to transmission planning on the BPTF.

Public Policy Planning Process

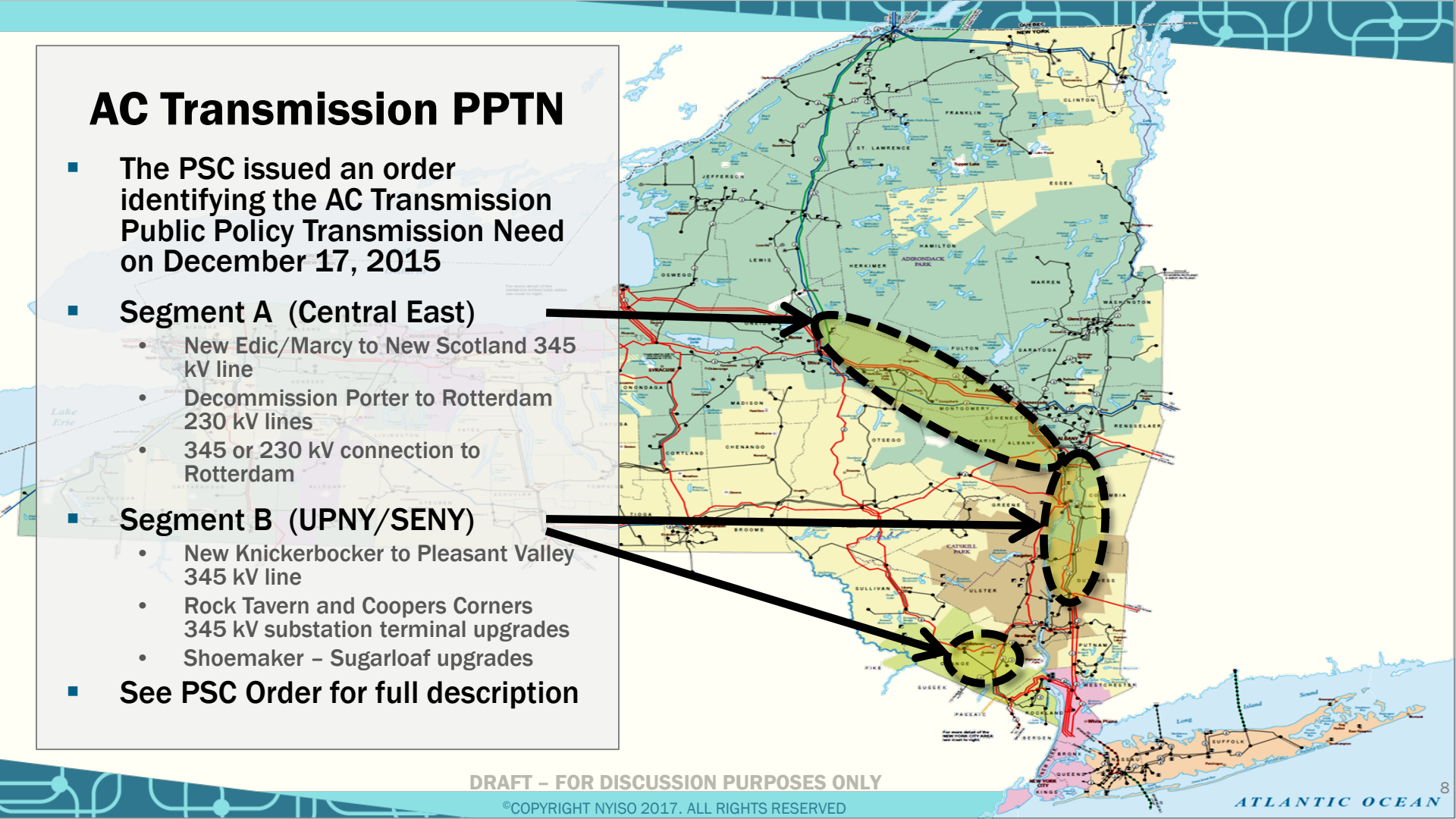
- **Phase I: Identify Needs and Assess Solutions**
  - NYISO solicits transmission needs driven by Public Policy Requirements
  - PSC identifies transmission needs and defines additional evaluation criteria
  - NYISO solicits solutions (transmission, generation, or EE/DR)
  - NYISO performs Viability and Sufficiency Assessment (VSA)
  - PSC reviews assessment and confirms continued transmission need
- **Phase II: Transmission Evaluation and Selection**
  - NYISO staff evaluates viable and sufficient transmission solutions and recommends the more efficient or cost-effective solution
  - Stakeholder review and advisory votes at BIC and MC
  - NYISO Board may select a transmission solution for purposes of cost allocation and recovery under the NYISO OATT

NEW YORK INDEPENDENT SYSTEM OPERATOR

AC Transmission Public Policy Transmission Need

AC Transmission PPTN

- The PSC issued an order identifying the AC Transmission Public Policy Transmission Need on December 17, 2015
- Segment A (Central East)
  - New Edic/Marcy to New Scotland 345 kV line
  - Decommission Porter to Rotterdam 230 kV lines
  - 345 or 230 kV connection to Rotterdam
- Segment B (UPNY/SENY)
  - New Knickerbocker to Pleasant Valley 345 kV line
  - Rock Tavern and Coopers Corners 345 kV substation terminal upgrades
  - Shoemaker – Sugarloaf upgrades
- See PSC Order for full description



Solicitation for Solutions

- The NYISO established the power flow study cases, reviewed the sufficiency and evaluation criteria at the February 5, 2016 ESPWG/TPAS meeting, and made the study cases available to facilitate development of the solutions
- On February 29, 2016, the NYISO issued a solicitation for solutions
- On April 29, 2016, developers submitted 16 project proposals

Viability and Sufficiency Assessment

- In October 2016, the NYISO determined that 13 projects are viable and sufficient

Segment	Project ID	Developer Name	Project Name
A	T018	National Grid / Transco	New York Energy Solution Seg. A
	T021	NextEra Energy Transmission New York	Enterprise Line: Segment A
	T025	North America Transmission / NYPA	Segment A + 765 kV
	T026	North America Transmission / NYPA	Segment A Base
	T027	North America Transmission / NYPA	Segment A Double Circuits
	T028	North America Transmission / NYPA	Segment A Enhanced
	T031	ITC New York Development	16NYPP1-1A AC Transmission
B	T019	National Grid / Transco	New York Energy Solution Seg. B
	T022	NextEra Energy Transmission New York	Enterprise Line: Segment B
	T023	NextEra Energy Transmission New York	Enterprise Line: Segment B-Alt
	T029	North America Transmission / NYPA	Segment B Base
	T030	North America Transmission / NYPA	Segment B Enhanced
	T032	ITC New York Development	16NYPP1-1B AC Transmission

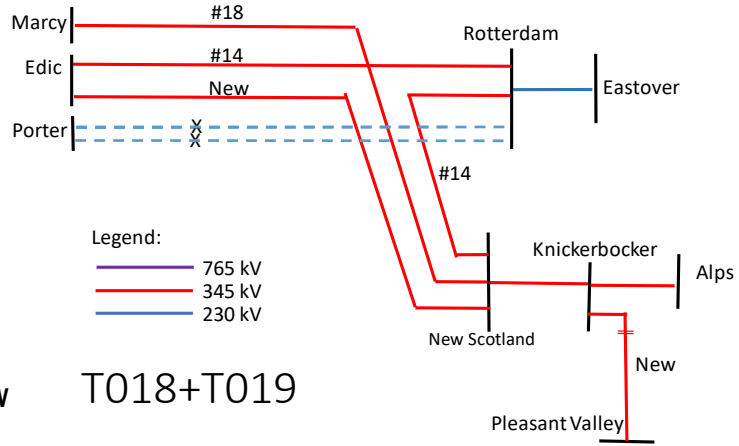
- On January 24, 2017, PSC issued an order confirming the AC Transmission PPTN

NEW YORK INDEPENDENT SYSTEM OPERATOR

Viable and Sufficient Projects

T018: National Grid/Transco - NYES Segment A

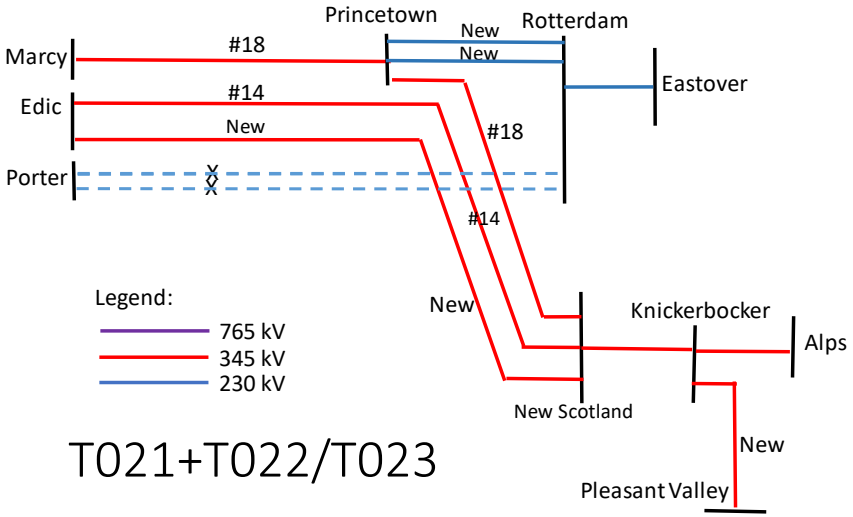
- A new 345 kV line from the existing Edic 345 kV substation to the existing New Scotland 345 kV substation;
- Two new 345 kV compact monopole structure lines looping the existing 345 kV Edic to New Scotland #14 line into and out of a new Rotterdam 345 kV substation. The Rotterdam 230 kV substation will be retired;
- Two new 345/115 kV autotransformers connecting the existing Rotterdam 115 kV switchyard to the new 345 kV switchyard. One new 345/230 kV 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 connected to the new Rotterdam 345 kV switchyard; and
- Decommission of the Porter to Rotterdam 230 kV lines #30 and #31.



T018+T019

T021: NextEra - Enterprise Line Segment A

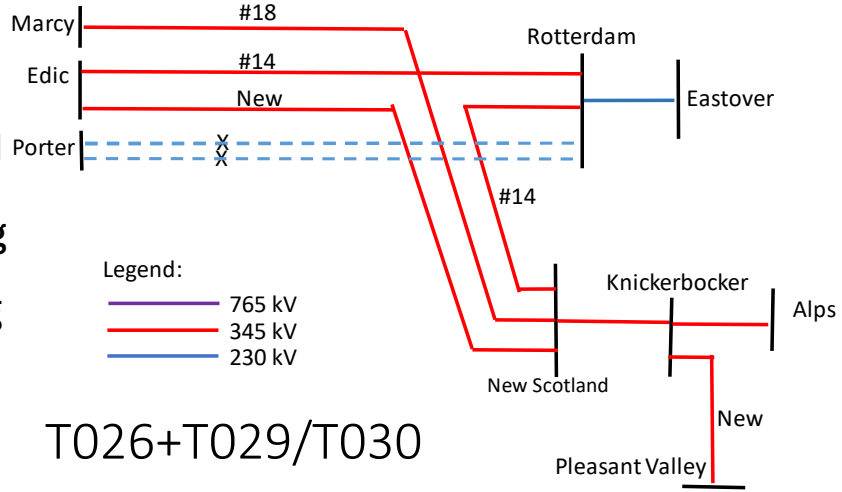
- A new 345 kV line from the existing Edic 345 kV substation to the existing New Scotland 345 kV substation;
- New Princetown substation with two new 345/230 kV transformers;
- Two new 345 kV lines looping the existing Marcy – New Scotland line #18 into and out of the new Princetown substation;
- Two new Princetown – Rotterdam 230 kV lines; and
- Decommission of the Porter to Rotterdam 230 kV lines #30 and #31.



T021+T022/T023

T026: NAT/NYPA - Segment A Base

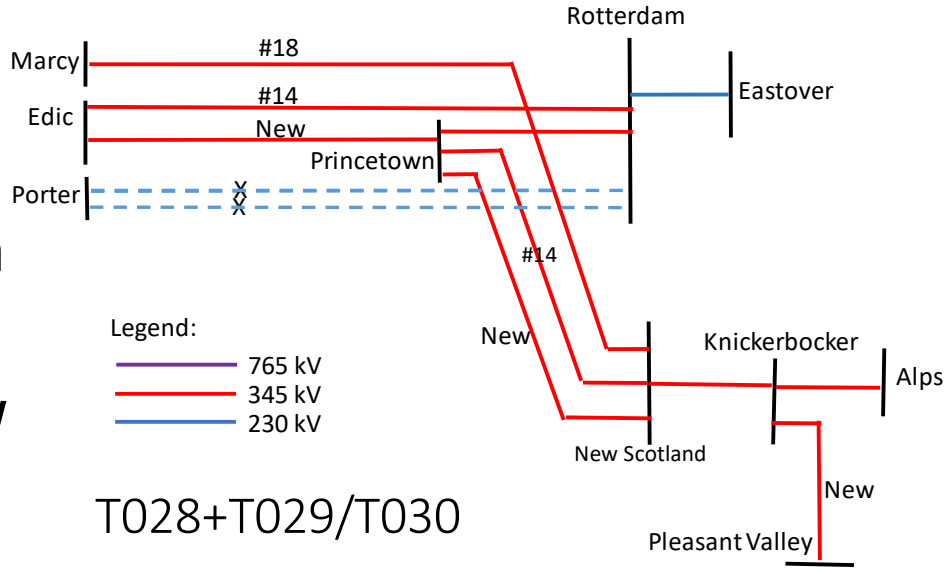
- A new 345 kV line from the existing Edic 345 kV substation to the existing New Scotland 345 kV substation.
- Two new 345 kV lines looping the existing 345 kV Edic to New Scotland #14 line into and out of a new Rotterdam 345 kV substation. The Rotterdam 230 kV substation will be retired;
- Two new 345/115 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 Marcy and Edic substations; and
- Decommission of the Porter to Rotterdam 230 kV lines #30 and #31.



T026+T029/T030

T028: NAT/NYPA - Segment A Enhanced

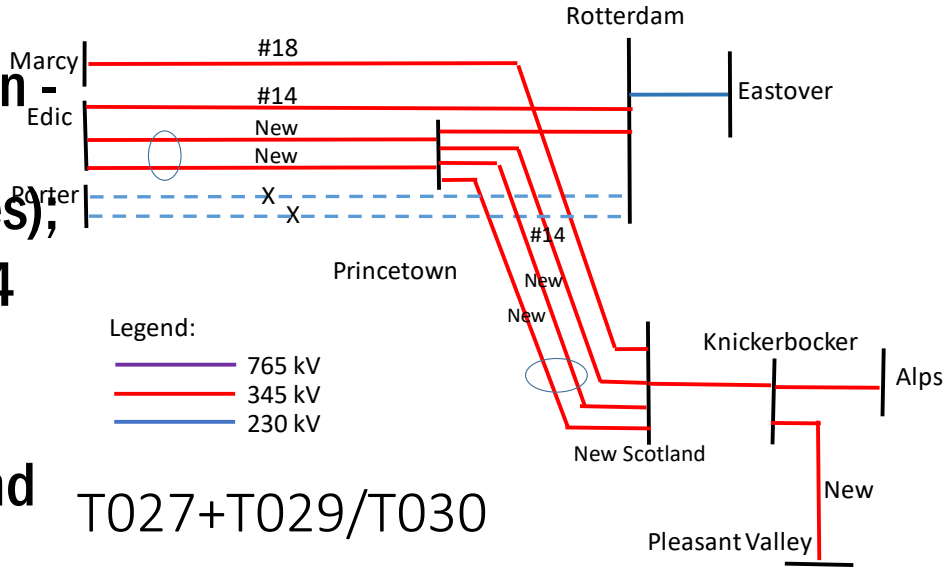
- T026 components;
- Two new 345/115 kV transformers at Rotterdam replaced with lower impedance transformers; and
- A new Princetown switching station tapping the new Edic to New Scotland 345 kV line and the Rotterdam to New Scotland 345 kV line



T028+T029/T030

T027: NAT/NYPA - Segment A Double-Circuit

- T028 components;
- One additional Edic - Princetown - New Scotland 345 kV line (two new lines on the same structures);
- Rebuilding 6.3 miles of line #14 south of Princetown; and
- Removal of the existing 115 kV line #13 between Rotterdam and New Scotland

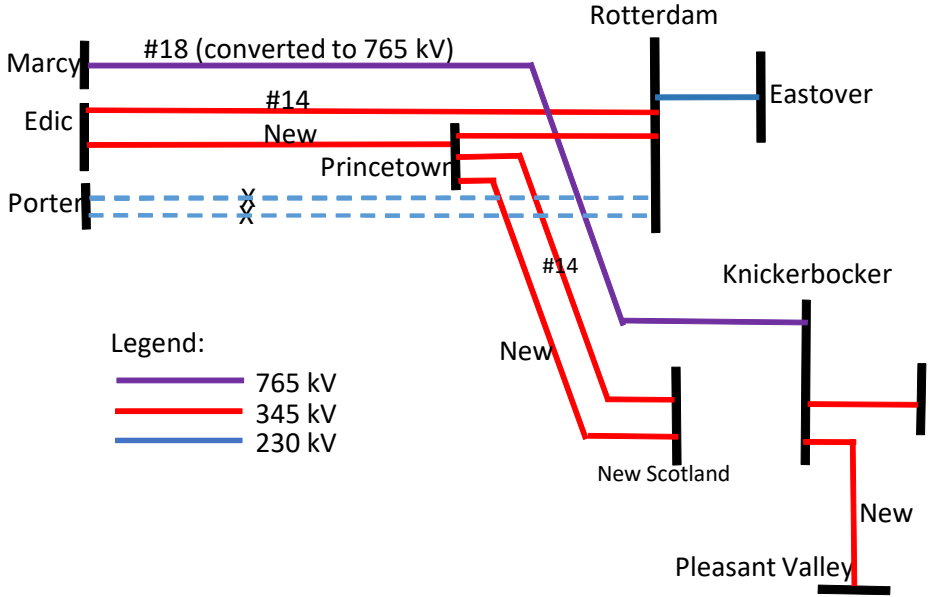


T027+T029/T030

DRAFT – FOR DISCUSSION PURPOSES ONLY

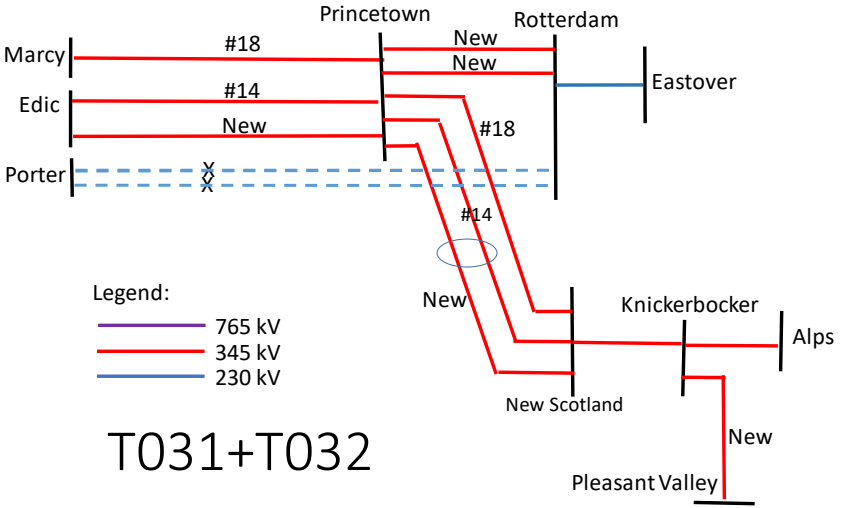
T025: NAT/NYPA - Segment A + 765 kV

- T028 components;
- A new Knickerbocker substation with two new 765/345 kV transformers; and
- Converting the existing 345 kV line between Marcy and Knickerbocker to 765 kV line (bypassing the New Scotland 345 kV substation)



T031: ITC - 16NYPP1-1A AC Transmission Segment A

- A new Princetown 345 kV switching station tapping the existing Marcy to New Scotland 345 kV #18 line and Edic to New Scotland 345 kV #14 line;
- 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 substation with two new 345/230 kV transformers'
- Two new Princetown to Rotterdam 345 kV lines; and
- Decommission of the Porter to Rotterdam 230 kV lines #30 and #31.



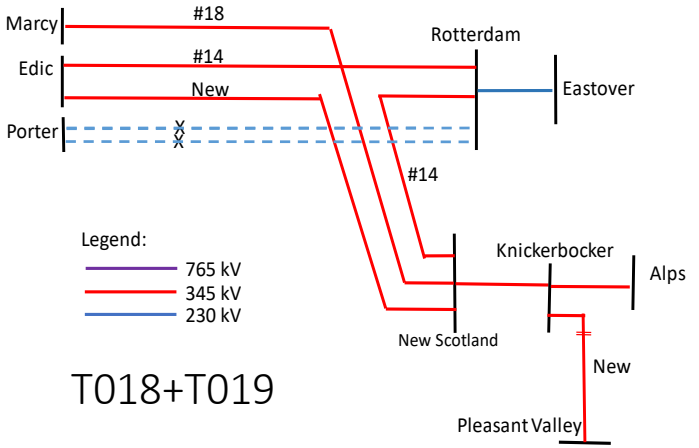
T031+T032

Segment B Projects

- **Per the PSC order, all Segment B projects include:**
  - Rock Tavern and Coopers Corners 345 kV substation terminal upgrades to be performed by Central Hudson
  - Shoemaker – Sugarloaf upgrades to be performed by Orange & Rockland

T019: National Grid/Transco - NYES Segment B

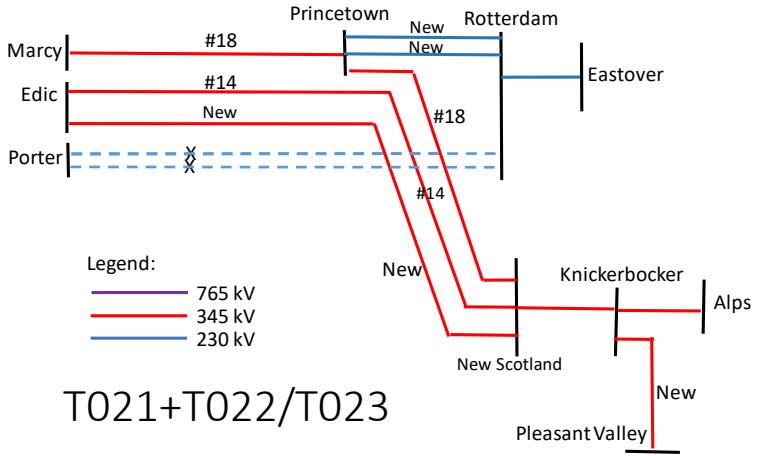
- A new double-circuit 345/115 kV line from a new Knickerbocker 345 kV switching station to the existing Pleasant Valley substation, and 50% series compensation on Knickerbocker to Pleasant Valley 345 kV line;
- Two new 135 MVAR capacitor banks at the Pleasant Valley 345 kV substation;
- Terminal upgrades at Roseton 345 kV substation to increase the thermal ratings on the 345 kV Roseton to East Fishkill #305 line;
- Terminal upgrades to the existing New Scotland 345 kV substation to upgrade the thermal ratings on the 345 kV New Scotland to Knickerbocker #2A line;
- Retirement of aging infrastructure including multiple existing 115 kV lines between Greenbush 115 kV substation and Pleasant Valley 115 kV substation.



T018+T019

T022: NextEra - Enterprise Line Segment B

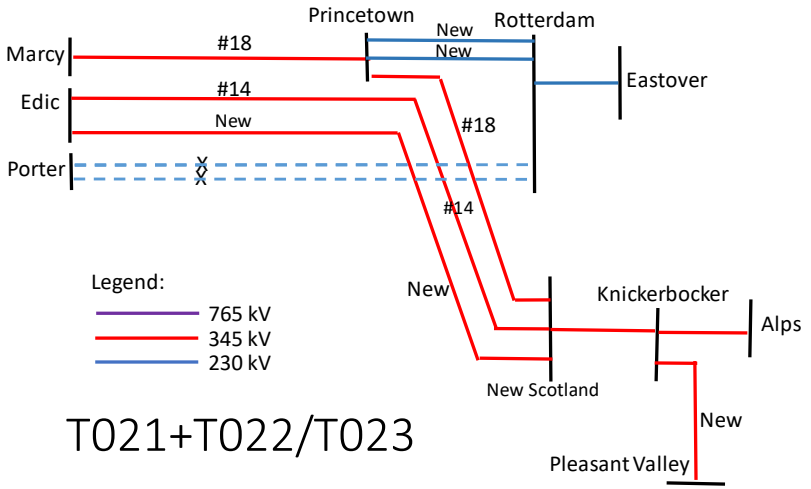
- A new 345 kV line from a new Knickerbocker 345 kV switching station to the existing Pleasant Valley 345 kV substation (double-circuit 345/115 kV line between Knickerbocker and Churchtown, and single–circuit 345 kV line between Churchtown and Pleasant Valley);
- A new North Churchtown 115 kV switch yard just north of the existing Churchtown 115 kV substation; and
- Multiple retirements and reconfigurations on 115 kV lines between Greenbush – Pleasant Valley



T021+T022/T023

T023: NextEra - Enterprise Line Segment B-Alt

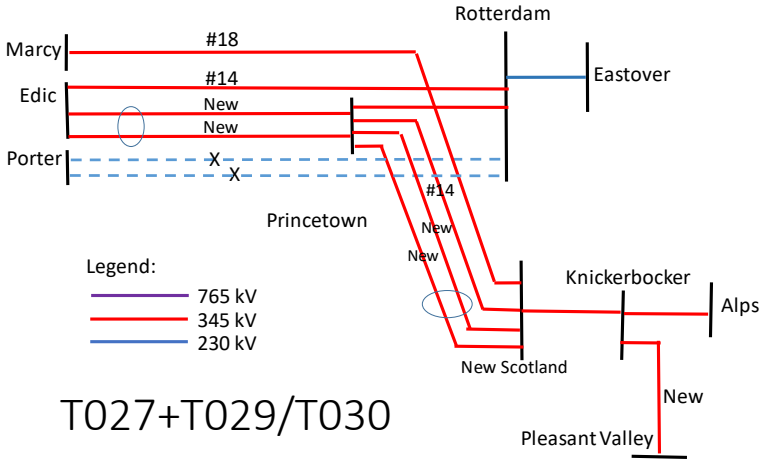
- A new double-circuit 345/115 kV line from a new Knickerbocker 345 kV switching station to the existing Pleasant Valley 345 kV substation;
- A new North Churchtown 115 kV switch yard just north of the existing Churchtown 115 kV substation; and
- Multiple retirements and reconfigurations on 115 kV lines between Greenbush – Pleasant Valley



T021+T022/T023

T029: NAT/NYPA - Segment B Base

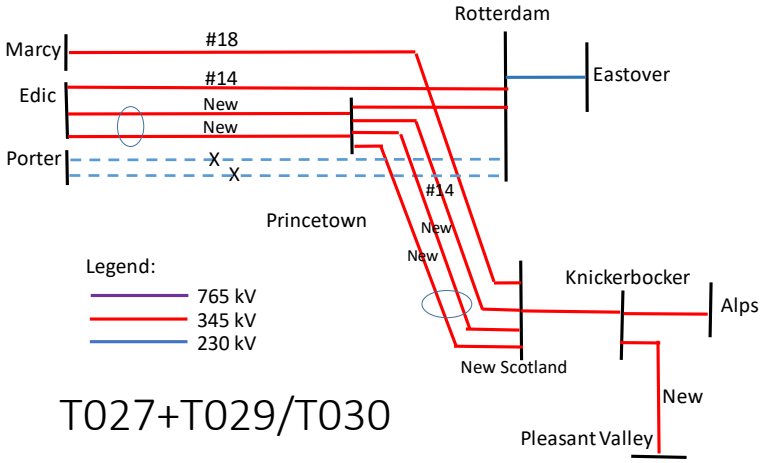
- A new double-circuit 345/115 kV line from a new Knickerbocker 345 kV switching station to Pleasant Valley 345 kV substation (double-bundled 345 kV line);
- Middletown – Shoemaker Tap – Shoemaker upgrades; and
- Multiple retirements and reconfigurations on 115 kV lines between Greenbush – Pleasant Valley.



T027+T029/T030

T030: NAT/NYPA - Segment B Enhanced

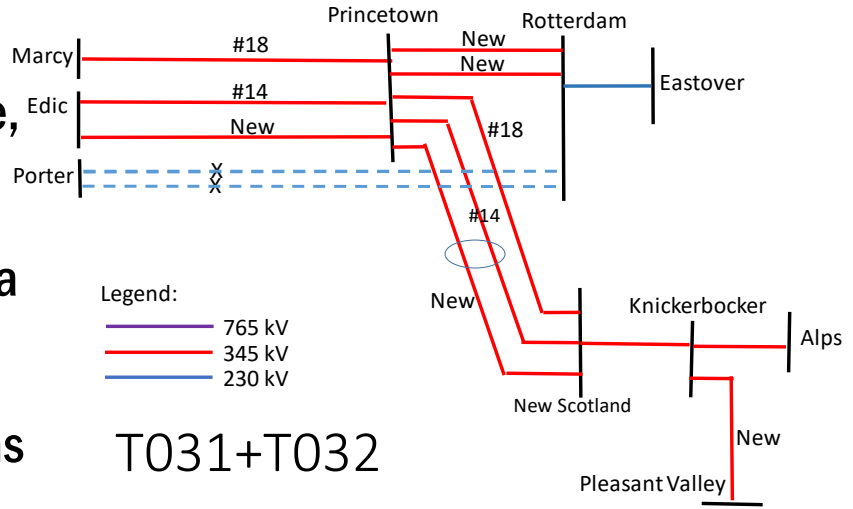
- A new double-circuit 345/115 kV line from a new Knickerbocker 345 kV switching station to Pleasant Valley 345 kV substation (triple-bundled 345 kV line);
- Middletown – Shoemaker Tap – Shoemaker upgrades; and
- Multiple retirements and reconfigurations on 115 kV lines between Greenbush and Pleasant Valley.



T027+T029/T030

T032: ITC - 16NYPP1-1A AC Transmission Segment B

- A new Knickerbocker 345/115 kV substation (tapping existing New Scotland to Alps 345 kV line and Greenbush to Pleasant Valley 115 kV line, respectively);
- A new double-circuit 345/115 kV line from Knickerbocker to Churchtown, and a new triple-circuit 345/115/115 kV line from Churchtown to Pleasant Valley;
- Multiple retirements and reconfigurations on 115 kV lines between Greenbush and Pleasant Valley.



T031+T032

Comparative Evaluation Assumptions

Overview

- At the November 7, 2017 ESPWG/TPAS meeting, the NYISO presented assumptions used for selection evaluation, and also solicited comments
- The evaluation of Public Policy Transmission Projects differs from other planning processes because it can give varying levels of consideration to the baseline and the scenarios

Databases for Comparative Evaluation

- Power flow: used in metrics such as transfer limits, cost per MW, and operability
- Resource adequacy: used to maintain enough resource for MAPS database and analyze ICAP benefit
- Production cost: used in metrics such as production cost savings, emission, LBMP, load payment, and performance
- SECO databases: used in metrics such as overnight capital cost, schedules, property rights, and expandability

Major Assumptions: Transfer Analysis

- **Baseline power flow case**
  - Started with the 2016 RPP base case representation of 2026 summer peak load
  - Updates based on 2017 Gold Book
    - Generation modeled in service: Ginna, FitzPatrick, Cayuga, CPV Valley Energy Center, Cricket Valley Energy Center, Bayonne Energy Center II, Bethlehem Energy Center Uprate
  - Generation modeled out of service: Indian Point Energy Center (IPEC) Units No. 2 & 3
  - Hudson Transmission Project scheduled at 0 MW
  - ABCJK PARs modeled based on PJM/NYISO JOA
  - Selected Western NY transmission project modeled as in service

Major Assumptions: Transfer Analysis

- **VSA power flow case: used in Viability and Sufficiency Assessment performed in 2016**
  - 2014 Reliability Planning Process (RPP) base case representation of 2019 summer peak load
  - Updated to include CPV Valley Energy Center and associated System Deliverability Upgrades

Production Cost Database

- **Baseline**
  - Started with draft 2017 CARIS Phase 1 Base Case (2017–2026)
  - Updated with the same assumptions as used in power flow baseline
  - UPNY-ConEd pre-project voltage limit increased to 6250 MW due to updates such as IPEC retirement and Cricket Valley addition
  - Impacts of projects on NYCA transmission security modeled based on transfer analysis
  - National CO_2 program assumed to start in 2027
  - 30-year database (2017 – 2046) after updates and extension
  - Compensatory MW added to maintain LOLE criterion for MAPS purpose only

Production Cost Database

- **Scenarios:**
  - No National CO2 program
  - High and low Natural gas price
  - Clean Energy Standard (CES) combined with retirement of aging generation
    - **Approximately 16 GW renewables added across the NYCA to achieve the 50 x 30 goal**
    - **Coal plants (Cayuga and Somerset) assumed to retire by 2020**
    - **Approximately 3,500 MW of old GTs in NYC and Long Island assumed to retire by 2022**
    - **Compensatory MW added to maintain LOLE criterion for MAPS purpose only**

Resource Adequacy Analysis

- **Baseline:**
  - Started with 2016 RPP base case
  - Updated with the same assumptions as used in in power flow and MAPS baselines
  - UPNY-SENY and UPNY-ConEd topology consistent with what's proposed for RNA 2018
  - Impact of AC Transmission projects captured in MARS topology
  - Compensatory MW added to maintain resource adequacy
- **Scenario: Clean Energy Standard combined with retirement of aging generation**
  - Assumptions are the same as in the MAPS CES + Retirement scenario
  - Compensatory MW added to maintain resource adequacy

Comparative Evaluation Results

Challenges in Comparative Evaluation

- Rights-of-way (ROW) and pole attachment usage: proposed projects use ROW owned by National Grid and poles owned by the NYPA. Analysis revealed that developers have viable options to obtain property rights or pole attachment rights from current Transmission Owners at commercially reasonable rates. The cost of acquiring the ROW, easements, and/or pole usage was included in the cost estimates and project schedules.
- Electromagnetic Field (EMF) concerns: All Segment A projects, except for T027, require the acquisition of additional easement to meet EMF guidelines. Higher voltage could result in higher EMF. EMF mitigation was included in the cost estimates.

Challenges in Comparative Evaluation

- Substation, transmission line, and tower design: the design may result in better performance in one evaluation metric but worse in another. The complexity of selecting a design feature may be further increased when the difference cannot be easily quantified, such as visual impact.
- Network Upgrade Facilities (NUF): all projects are currently being evaluated in the Transmission Interconnection Procedures (TIP). Current estimates include the cost to mitigate the identified potential violations, such as the transfer limit degradation from NYISO to ISO-NE. Additional upgrades may be identified and considered.

Challenges in Comparative Evaluation

- **ICAP Methodology:**
  - Implementing a new methodology to measure the ICAP savings attributable to a proposed transmission project. This new methodology utilizes the optimization technique recently developed for the "Alternative Methods for Developing LCR", and reflects the principles by which the markets are designed.

Challenges in Comparative Evaluation

- **Complexity of combining Segment A projects (7) and Segment B projects (6):**
  - Combined Segment A and B projects from the same developers exhaustively, and considered synergies in accordance with the criterion in the PSC order
  - Combinations of Segment A and B projects from different developers were evaluated by grouping projects that had similar electrical characteristics:

    Segment A Groupings with Similar Electrical Characteristics:
    - Segment A projects: T018, T021, T026, T028, T031
    - Segment A: T025
    - Segment A: T027

    Segment B Groupings with Similar Electrical Characteristics:
    - Segment B projects: T022, T023, T029, T030, T032
    - Segment B: T019

Representative Results

Combination ID	Representative Combination
1	T018+T019
2	T021+T022
3	T021+T023
4	T025+T019
5	T025+T029
6	T025+T030
7	T026+T029
8	T026+T030
9	T027+T019
10	T027+T029
11	T027+T030
12	T028+T029
13	T028+T030
14	T031+T032

Representative Results for Central East Voltage Transfer and Production Cost Analysis

Grouping ID	T018	T021	T025	T026	T027	T028	T031
T019	1	3	4	7	9	12	14
T022	1	2	5	7	10	12	14
T023	1	3	5	7	10	12	14
T029	1	3	5	7	10	12	14
T030	1	3	6	8	11	13	14
T032	1	3	5	7	10	12	14

Representative Results for UPNY-SENY Thermal Transfer

Grouping ID	T018	T021	T025	T026	T027	T028	T031
T019	1	1	4	1	9	1	1
T022	2	2	5	2	10	2	2
T023	3	3	5	3	10	3	3
T029	7	7	5	7	10	12	12
T030	8	8	6	8	11	13	13
T032	14	14	5	14	10	14	14

Draft SECO Report

- **Significant amount of evaluation assumptions and results are documented in the draft SECO report. Specific sections of the report are listed below for reference:**
  - Schedule (Section 4.1)
  - Cost (Section 4.2)
  - Risk (Section 4.3)
  - Expandability (Section 4.4)
  - Proper Rights (Section 4.5)
  - Operational Plan (Section 4.6)
  - Field Reviews (Section 4.7)
  - Work Plans (Section 4.8)
  - Environmental (Section 4.9)
  - Replacement of Aging Infrastructure (Section 4.10)
  - General Design Verification (Section 4.11)
  - Schedule Gantt Charts (Attachment A)
  - Detailed Independent Cost Estimates (Attachment B)

PSC Criteria

- Section 31.4.8.1.8 of Attachment Y: The NYISO shall apply any criteria specified by the Public Policy Requirement or provided by the NYPSC and perform the analyses requested by the NYPSC, to the extent compliance with such criteria and analyses are feasible.
- The following criteria from the PSC order, as stated in the February 29, 2016 solicitation letter, were considered in the comparative evaluation.

PSC Criteria and Evaluation

PSC Criteria	Evaluation
In lieu of establishing an intended in-service year against which project schedules would be evaluated, the NYISO will consider the proposed project schedule for each Public Policy Transmission Project in the evaluation of impacts to congestion and other applicable criteria over the study period. The NYISO will assume that project schedules begin January 1 of a given year following the NYISO's selection and NYPSC Article VII siting approval (*i.e.,* project schedules need not account for the timing of the NYISO or NYPSC processes).	Considered in the Schedule metric
The selection process will favor Public Policy Transmission Projects that minimize the acquisition of property rights for new substations and substation expansions. For the purpose 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.	Considered in the Property Rights metric
No Public Policy Transmission Project shall be selected for Segment B that does not incorporate certain specified add-ons that would be constructed (*i.e.,* as specified in the NYPSC Order the upgrades to the Rock Tavern Substation and the upgrades to the Shoemaker to Sugarloaf transmission lines), unless the NYISO determines that such add-ons, jointly or severally, are not material to the accomplishment of the purpose a solution for Segment B.	Considered in the selection process
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 Public Policy Transmission Projects.	Reflected in the overnight Capital cost

PSC Criteria and Evaluation

PSC Criteria	Evaluation
No Public Policy Transmission Project shall be selected for Segment A unless a Public Policy Transmission Project is selected for Segment B.	Considered in the selection process
No Public Policy Transmission Project shall be selected for Segment A except on condition that the Public Policy Transmission Project selected for Segment A shall not be implemented until there is reasonable certainty established in a manner to be determined by the NYISO that the Public Policy Transmission Project selected for Segment B will be implemented.	Considered in the selection process
The selection process shall favor Public Policy Transmission Projects that result in upgrades to aging infrastructure.	Evaluated as a separate metric
Project selection will be competitive by Segment (Segment A and Segment B), but synergies produced by selecting a single Developer to provide both segments may be considered.	Considered in the selection process
The selection process shall not use the percentage rates applied to account for contingencies and revenue requirement as a distinguishing factor between Public Policy Transmission Projects. The NYISO will evaluate costs based on raw construction costs to ensure that all of the proposed Public Policy Transmission Projects are evaluated on a comparable basis as to the scope of costs.	Reflected in the capital cost

NEW YORK INDEPENDENT SYSTEM OPERATOR

Upgrades to Aging Infrastructure

SEGMENT A	CIRCUIT NUMBER	T018 (NGRID/ NY TRANSCO)	T021 (NEXTERA)	T025 (NYPA/NAT)	T026 (NYPA/NAT)	T027 (NYPA/NAT)	T028 (NYPA/NAT)	T031 (ITC)
Marcy - New Scotland	18	0	0	2.66	0	0	0	0
Princetown Junction - New Scotland	14	0	0	0	0	6.3	0	20
Miles of 345kV Removed		**0**	**0**	**2.66**	**0**	**6.3**	**0**	**20**
Edic - Princetown Junction	30*	66.8	66.8	66.8	66.8	66.8	66.8	66.8
Edic - Princetown Junction	31**	54.2	54.2	54.2	54.2	66.8	54.2	54.2
Princetown Junction - Rotterdam	30	5	5	5	5	5	5	5
Princetown Junction - Rotterdam	31	5	5	5	5	5	5	5
Miles of 230kV Removed		**131**	**131**	**131**	**131**	**143.6**	**131**	**131**
Princetown Junction - New Scotland	13	2.5	2.5	2.5	2.5	13.4	2.5	0
Miles of 115kV Removed		**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**0**
Total Miles of Line Removed		**133.5**	**133.5**	**136.16**	**133.5**	**152.4**	**133.5**	**151**

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

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

NEW YORK INDEPENDENT SYSTEM OPERATOR

Upgrades to Aging Infrastructure

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**

NEW YORK INDEPENDENT SYSTEM OPERATOR

Independent Overnight Cost Estimates

- SECO developed the independent cost estimates considering material and labor cost by equipment, engineering and design work, permitting, site acquisition, procurement and construction work, and commissioning needed for the proposed project
- Common upgrades for Shoemaker – Sugarloaf lines and Rock Tavern/Coopers Corners 345 kV substation terminals not included in the cost estimates
- See the draft SECO report Section 4.2 for more details

Segment	Project ID	Independent Cost Estimate: 2018 $M (w/ 30% contingency rate)	Independent Cost Estimate: 2018 $M (w/o 30% contingency rate)
A	T018	520	400
	T021	498	383
	T025	861	662
	T026	489	376
	T027	741	570
	T028	512	394
	T031	570	438
B	T019	445	342
	T022	357	274
	T023	390	300
	T029	387	298
	T030	406	313
	T032	502	386

Independent Overnight Cost Estimates

- 5% synergies applied if the same developer constructs both segments

	Same Developers											
Independent Cost Estimate: 2018 $M (w/ 30% contingency rate)	T018+T019	T021+T022	T021+T023	T025+T029	T025+T030	T026+T029	T026+T030	T027+T029	T027+T030	T028+T029	T028+T030	T031+T032
With 5% synergies	917	812	843	1159	1177	832	850	1072	1090	854	873	1018

	Different Developers																															
Independent Cost Estimate: 2018 $M (w/ 30% contingency rate)	T021+T019	T025+T019	T026+T019	T027+T019	T028+T019	T031+T019	T018+T022	T025+T022	T026+T022	T027+T022	T028+T022	T031+T022	T018+T023	T025+T023	T026+T023	T027+T023	T028+T023	T031+T023	T018+T029	T021+T029	T031+T029	T018+T030	T021+T030	T031+T030	T018+T032	T021+T032	T025+T032	T026+T032	T027+T032	T028+T032
Without 5% synergies	943	1273	934	1186	957	1015	877	1189	846	1098	869	927	910	1222	878	1131	902	960	907	885	957	926	904	976	1022	1000	1323	991	1243	1014

Transfer: VSA Power Flow Cases

UPNY-SENY Thermal Transfer (N-1 Normal Transfer Criteria)

Project ID	Limit	Delta
Pre-Project	5113	-
T018+T019	6682	1569
T021+T022	6199	1086
T021+T023	6155	1042
T028+T029	6083	970
T028+T030	6200	1087
T031+T032	6171	1058

Central East Voltage Transfer (N-1)

Project ID	Limit	Delta
Pre-Project	2725	-
T018+T019	3170	445
T021+T022	3087	362
T025+T030	3755	1030
T026+T029	3107	382
T027+T029	3627	902
T028+T029	3141	416
T031+T032	3156	431

Transfer: Baseline

UPNY-SENY Thermal N-1 NTC: Roseton Dispatched at 100%

Project ID	Thermal Limit	Limiting Elelment	Limiting Contingency	Incremental
Pre-Project w/o Athens SPS	4,775	137451 LEEDS 3 345 126294 PLTVLLEY 345 2	TE44:L/O ATHENS-PV 345 91	-
T018+T019	6,375	146754 MDTN TAP 345 146772 SHOEMTAP 138 1	T:77&76	1,600
T021+T022	5,975	125002 ROSETON 345 126281 E FISHKILL 345 1	T:77&76	1,200
T021+T023	5,975	125002 ROSETON 345 126281 E FISHKILL 345 1	T:77&76	1,200
T025+T019	5,825	146143 KNICK_SCAP 345 126294 PLTVLLEY 345 1	T:34&44_CE18/UC30	1,050
T025+T029	6,600	125002 ROSETON 345 126281 E FISHKILL 345 1	T:77&76	1,825
T025+T030	6,700	125002 ROSETON 345 126281 E FISHKILL 345 1	T:77&76	1,925
T026+T029	5925	125002 ROSETON 345 126281 E FISHKILL 345 1	T:77&76	1,150
T026+T030	5,975	125002 ROSETON 345 126281 E FISHKILL 345 1	T:77&76	1,200
T027+T019	6,525	146772 SHOEMTAP 138 146771 SHOEM138 138 1	T:77&76	1,750
T027+T029	6,125	125002 ROSETON 345 126281 E FISHKILL 345 1	T:77&76	1,350
T027+T030	6,175	125002 ROSETON 345 126281 E FISHKILL 345 1	T:77&76	1,400
T028+T029	5,950	125002 ROSETON 345 126281 E FISHKILL 345 1	T:77&76	1,175
T028+T030	6,025	125002 ROSETON 345 126281 E FISHKILL 345 1	T:77&76	1,250
T031+T032	6,000	125002 ROSETON 345 126281 E FISHKILL 345 1	T:77&76	1,225

NEW YORK INDEPENDENT SYSTEM OPERATOR

Transfer: Baseline

UPNY-SENY Thermal N-1 NTC: Roseton Dispatched at 85%

Project ID	Thermal Limit	Limiting Elelment	Limiting Contingency	Incremental
Pre-Project w/o Athens SPS	4,825	137451 LEEDS 3 345 126294 PLTVLLEY 345 2	TE44:L/O ATHENS-PV 345 91	-
T018+T019	6,500	146754 MDTN TAP 345 146772 SHOEMTAP 138 1	T:77&76	1,675
T021+T022	6,350	137451 LEEDS 3 345 126294 PLTVLLEY 345 2	TE44:L/O ATHENS-PV 345 91	1,525
T021+T023	6,300	137451 LEEDS 3 345 126294 PLTVLLEY 345 2	TE44:L/O ATHENS-PV 345 91	1,475
T025+T019	5,825	146143 KNICK_SCAP 345 126294 PLTVLLEY 345 1	T:34&44_CE18/UC30	1,000
T025+T029	6,950	137451 LEEDS 3 345 126294 PLTVLLEY 345 2	TE44:L/O ATHENS-PV 345 91	2,125
T025+T030	7,100	137451 LEEDS 3 345 126294 PLTVLLEY 345 2	TE44:L/O ATHENS-PV 345 91	2,275
T026+T029	6,225	137451 LEEDS 3 345 126294 PLTVLLEY 345 2	TE44:L/O ATHENS-PV 345 91	1,400
T026+T030	6,350	137451 LEEDS 3 345 126294 PLTVLLEY 345 2	TE44:L/O ATHENS-PV 345 91	1,525
T027+T019	6,700	146754 MDTN TAP 345 146772 SHOEMTAP 138 1	T:77&76	1,875
T027+T029	6,150	137451 LEEDS 3 345 126294 PLTVLLEY 345 2	TE44:L/O ATHENS-PV 345 91	1,325
T027+T030	6,300	137451 LEEDS 3 345 126294 PLTVLLEY 345 2	TE44:L/O ATHENS-PV 345 91	1,475
T028+T029	6,250	137451 LEEDS 3 345 126294 PLTVLLEY 345 2	TE44:L/O ATHENS-PV 345 91	1,425
T028+T030	6,400	137451 LEEDS 3 345 126294 PLTVLLEY 345 2	TE44:L/O ATHENS-PV 345 91	1,575
T031+T032	6,325	137451 LEEDS 3 345 126294 PLTVLLEY 345 2	TE44:L/O ATHENS-PV 345 91	1,500

Transfer: Baseline

UPNY-SENY Thermal N-1 NTC: Optimized Transfer

Project ID	Limit	Constraint	Incremental
Pre-Project	5025	(1)	
T018+T019	7023	(2)	1998
T021+T022	6543	(1)	1519
T021+T023	6490	(1)	1466
T025+T019	6187	(3)	1163
T025+T029	7251	(1)	2226
T025+T030	7367	(1)	2342
T026+T029	6426	(1)	1401
T026+T030	6560	(1)	1535
T027+T019	7128	(2)	2103
T027+T029	6351	(1)	1326
T027+T030	6495	(1)	1470
T028+T029	6452	(1)	1427
T028+T030	6594	(1)	1569
T031+T032	6501	(1)	1476

(1) Leeds - Pleasant Valley at 1538 MW LTE rating for TE44:L/O ATHENS-PV 345 91
(2) Middletown Transformer at 707 MW STE rating for T:77&76
(3) Knickerbocker Series Comp at 2308 MW LTE rating for T:34&44_CE18/UC30

Transfer: Baseline

Central East Voltage Transfer N-1 NTC

Project ID	Transfer Limit	Incremental
Pre-Project	2,575	-
T018+T019	3,000	425
T021+T022	2,925	350
T021+T023	2,925	350
T025+T019	3,875	1,300
T025+T029	3,700	1,125
T025+T030	3,775	1,200
T026+T029	2,850	275
T026+T030	2,850	275
T027+T019	3,450	875
T027+T029	3,400	825
T027+T030	3,400	825
T028+T029	2,975	400
T028+T030	2,900	325
T031+T032	2,975	400

Cost Per MW

	1	2	3	4	5	6	7	8	9	10
Project ID	Segment A Independent Cost Estimate: 2018 $M	Segment B Independent Cost Estimate: 2018 $M	Cost/MW: incremental Central East Voltage Limit (N-1)		Cost/MW: incremental UPNY-SENY thermal Limit (N-1 NTC)					
					Roseton at 100%		Roseton at 85%		Optimized Transfer	
			Inc. MW	$M/MW	Inc. MW	$M/MW	Inc. MW	$M/MW	Inc. MW	$M/MW
T018+T019	494	423	425	1.16	1,600	0.26	1,675	0.25	1,998	0.21
T021+T022	473	339	350	1.35	1,200	0.28	1,525	0.22	1,519	0.22
T021+T023	473	370	350	1.35	1,200	0.31	1,475	0.25	1,466	0.25
T025+T019	861	445	1,300	0.66	1,050	0.42	1,000	0.45	1,163	0.38
T025+T029	818	368	1,125	0.73	1,825	0.20	2,125	0.17	2,226	0.17
T025+T030	818	386	1,200	0.68	1,925	0.20	2,275	0.17	2,342	0.16
T026+T029	464	368	275	1.69	1,150	0.32	1,400	0.26	1,401	0.26
T026+T030	464	386	275	1.69	1,200	0.32	1,525	0.25	1,535	0.25
T027+T019	741	445	875	0.85	1,750	0.25	1,875	0.24	2,103	0.21
T027+T029	704	368	825	0.85	1,350	0.27	1,325	0.28	1,326	0.28
T027+T030	704	386	825	0.85	1,400	0.28	1,475	0.26	1,470	0.26
T028+T029	487	368	400	1.22	1,175	0.31	1,425	0.26	1,427	0.26
T028+T030	487	386	325	1.50	1,250	0.31	1,575	0.25	1,569	0.25
T031+T032	542	477	400	1.35	1,225	0.39	1,500	0.32	1,476	0.32

NEW YORK INDEPENDENT SYSTEM OPERATOR

DRAFT – FOR DISCUSSION PURPOSES ONLY

Operability

- Substation design and network integration

Princetown Substation

Project ID	# of new Lines	# of new Transformers	Total new elements	Proposed Breaker Arrangement	# of Breakers
T018	No Princetown Substation proposed				
T021	2 – 345kV 2 – 230kV	2	6	Breaker & Half	7 – 345kV 6 – 230kV
T026	No Princetown Substation proposed				
T031	8	0	8	Breaker & Half	12
T025	4	0	4	Ring Bus	4
T027	6	0	6	Breaker & Half (GIS)	9
T028	4	0	4	Ring Bus	4

Operability

Rotterdam Substation

Project ID	# of new Lines	# of new Transformers	Total new elements	Proposed Breaker Arrangement	# of Breakers
T018	2 – 345kV 1 – 230kV 2 – 115kV*	1 – 345kV-230kV 2 – 345kV-115kV	8	Breaker & Half (GIS)	9 – 345kV 1 – 230kV
T021	No changes to Rotterdam proposed.				
T026	2 – 345kV 1 – 230kV 2 – 115kV	1 – 345kV-230kV 2 – 345kV-115kV	8	Breaker & Half	8 – 345kV 1 – 230kV
T031	2 – 345kV	2 – 345kV-230kV	4	Sectionalized Bus	3 – 345kV 1 – 230kV
T025	Same as T026				
T027	Same as T026				
T028	Same as T026				

Operability

Knickerbocker Substation

Project ID	# of new Lines	# of new Transformers	Total new elements	Proposed Breaker Arrangement	# of Breakers
T019	3	0	3 (Including Series Compensation)	Ring Bus	3
T022	3	0	3	Ring Bus	3
T029	3	0	3	Ring Bus	3
T032	3 – 345kV 3 – 115kV	0	6	345kV - Ring Bus 115kV – Ring Bus	3 – 345kV 3 – 115kV
T023	Same as T022.				
T025	1 – 765kV 2 – 345kV	2	5	765kV – Ring Bus 345kV – Ring Bus	3 – 765kV 4 – 345kV
T030	Same as T029				

Operability

- **Benefits under Maintenance Conditions**
  - Based on baseline power flow cases, calculated the N-1 transfer capability under different system maintenance conditions (by using optimal N-1-1 Transfer limits).

Operability

- Incremental UPNY-SENY thermal N-1-1 limits

Maintenance Outage	No Outage	CPV - Rock Tavern 345 kV Line	Marcy - Coopers Corners 345 kV Line	Roseton - East Fishkill 345 kV Line	Athens-Pleasant Valley 345 kV Line
T018+T019	1998	2073	1856	660	1895
T021+T022	1519	1457	1466	449	1248
T021+T023	1466	1408	1418	439	1203
T025+T019	1163	1711	1456	1104	2034
T025+T029	2226	2149	2169	2117	1769
T025+T030	2342	2269	2178	2257	1881
T026+T029	1401	1340	1344	1360	1142
T026+T030	1535	1465	1470	1487	1260
T027+T019	2103	2027	1995	782	1419
T027+T029	1326	1299	1320	1331	1128
T027+T030	1470	1423	1455	1459	1233
T028+T029	1427	1367	1371	1383	1171
T028+T030	1569	1493	1501	1511	1290
T031+T032	1476	1418	1413	455	1217

Operability

- N-1-1: Central East Voltage Analysis

Project ID	Maintenance Outage	Transfer Limit	Delta
Pre-Project	Marcy-New Scotland 345 kV Line	1,861	-
T021+T022	Marcy-Princetown 345 kV Line	2,250	389
T025+T019	Marcy-Knickerbocker 765 kV Line	2,165	304
T025+T029	Marcy-Knickerbocker 765 kV Line	2,243	382
T027+T019	Marcy-New Scotland 345 kV Line	2,976	1,115
T027+T029	Marcy-New Scotland 345 kV Line	2,883	1,022
T031+T032	Marcy-Princetown 345 kV Line	2,400	539
T018+T019	Marcy-New Scotland 345 kV Line	2,285	424

Expandability

- Expandability considers the impact of the proposed projects on future system expansion
- Common transmission expandability for all proposals: with the decommissioning of existing Porter-Rotterdam 230 kV lines and addition of Segment A projects, addition of another circuit is still possible from Edic/Porter to Princetown Junction within the existing ROW

Expandability: Project-Specific

Segment	Project ID	Substation Expandability
A	T018	At Rotterdam Substation, the 345kV gas-insulated substation design provides one open 345kV bay position and room for additional 345kV bays. Design also provides ability to connect one additional 345kV/115kV transformer to support the local transmission system. Lastly, the design allows for the rebuilding of the 115kV straight bus configuration into a breaker-and-a-half configuration.
	T021	NextEra is proposing a "Princetown" substation approximately 2 miles west of Rotterdam Substation on a new greenfield site. The design provides two open 345kV bay positions and room on the property for adding bays. It maintains the existing and aging Rotterdam 230kV yard intact.
	T025, T027, T028	At Rotterdam, rebuilding and relocating the 345kV substation allows for the rebuilding of the 115kV straight bus configuration into a breaker-and-a-half configuration. A new Princetown Substation is proposed at the junction of the 345kV Edic-New Scotland line and the 230kV Porter to Rotterdam lines. Due to the proximity to the neighboring properties, constructing or expanding the substation will be difficult. T025 also creates an open line terminal position at New Scotland substation.
	T026	At Rotterdam, rebuilding and relocating the 345kV substation allows for the rebuilding of the 115kV straight bus configuration into a breaker-and-a-half configuration. The proposed design for New Scotland provides the possibility of reconfiguring the substation as a breaker-and-a-half.
	T031	ITC's proposal does not provide any additional bays at Princetown or Rotterdam Substations. ITC's proposal maintains the existing and aging Rotterdam 230kV yard intact. Additionally, physical limitations at these properties may preclude future expansions without purchasing additional property.

Expandability: Project-Specific

Segment	Project ID	Substation Expandability
B	T019	At Knickerbocker Substation, design provides one open 345kV bay position. The Knickerbocker design also allows the 345kV ring bus configuration to be converted to a breaker-and-a-half configuration with room on the property for adding bays. At Churchtown substation, design provides one open 115kV bay position. Additional breaker-and-a-half bays can be added in the future.
	T022, T023	At Knickerbocker Substation, the proposed design provides one open 345kV bay position. The Knickerbocker design also allows the 345kV ring bus configuration to be converted to a breaker-and-a-half configuration with room on the property for adding bays. At North Churchtown Substation, design provides one open 115kV bay position and with room on the property for adding bays. The southern-most bay could also be built out to a breaker-and-a-half configuration.
	T029, T030	The Developer proposes a new 115kV 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 ring bus configuration to be converted to a breaker-and-a-half configuration with room on the property for adding bays.
	T032	At Knickerbocker Substation, design provides one open 345kV bay position and one open 115kV bay position. Additionally, during detailed design, the ability to connect up to two 345kV – 115kV transformers to support the local transmission system could be provided.

Property Rights

- The NYISO and SECO reviewed, in consultation with the DPS, transmission routing studies provided by developers. Results were considered in schedule, cost estimates, and expandability.
- All projects proposed to use existing ROWs. They either possess or have a plan to obtain the required ROWs.

Project ID	Substation Property Requirements for Segment A Projects				
	Substation	County	Owner		EMF Mitigation (width in feet)
			Incumbent Utility (Acres)	Non-Utility (Acres)	
T018	Rotterdam Substation (Extension)	Schenectady	2.6	0	10
T021	Princetown Substation (New)	Schenectady	0	24.0	10
T025	Knickerbocker Substation (New)	Rensselaer	30.0	0	8 - 25
	Princetown Substation (New)	Schenectady	3.0	0	
	Rotterdam Substation (New)	Schenectady	7.5	0	
T026	Rotterdam Substation (New)	Schenectady	7.5	0	10
T027	Edic Substation (Extension)	Oneida	1.3	0	0
	Princetown Substation (New)	Schenectady	3.0	0	
	Rotterdam Substation (New)	Schenectady	7.5	0	
T028	Princetown Substation (New)	Schenectady	3.0	0	10
	Rotterdam Substation (New)	Schenectady	7.5	0	
T031	Princetown Substation (New)	Schenectady	5.5	2.6	10
	Rotterdam Substation (Extension)	Schenectady	2.5	0	

Property Rights

Project ID	Substation Property Requirements for Segment B Projects				
	Substation	County	Owner		EMF Mitigation (Width in feet)
			Incumbent Utility (Acres)	Non-Utility (Acres)	
T019	Knickerbocker Substation (New)	Rensselaer	14	0	0
	Churchtown Substation (Extension)	Columbia	11.4	0	
	Pleasant Valley Substation (Extension)	Dutches	1.4	0	
T022	Knickerbocker Substation (New)	Rensselaer	14	0	0
	Churchtown Substation (Extension)	Columbia	5.5	0	
T023	Knickerbocker Substation (New)	Rensselaer	14	0	0
	Churchtown Substation (Extension)	Columbia	5.5	0	
T029	Knickerbocker Substation (New)	Rensselaer	14	0	0
	Churchtown Substation (Extension)	Columbia	11.4	0	
T030	Knickerbocker Substation (New)	Rensselaer	14	0	0
	Churchtown Substation (Extension)	Columbia	11.4	0	
T032	Knickerbocker Substation (New)	Rensselaer	20	0	0
	Churchtown Substation (Extension)	Columbia	0.3	0	

Project Schedule

- The independent duration estimates include the anticipated time for Article VII application preparation, Article VII approval, procurement, and construction
- Independent minimum duration estimates are the reasonable best case
- Independent duration estimates consider 4 more months to account for minor siting, permitting, and construction delays

Segment	Project ID	Independent Minimum Duration Estimate: Months	Independent Duration Estimate: Months
A	T018	48	52
	T021	48	52
	T026	48	52
	T028	48	52
	T027	51	55
	T025	50	54
	T031	48	52
B	T019	45	49
	T022	43	47
	T023	45	49
	T029	45	49
	T030	45	49
	T032	47	51

20-Year Production Cost Change: in 2018 M$

Project ID	Baseline	National CO2 Removed	High Natural Gas	Low Natural Gas	CES + Retirement w/o National CO2
		Based off Baseline			
T018+T019	(236)	(268)	(391)	(182)	(830)
T021+T022	(199)	(223)	(329)	(159)	(714)
T021+T023	(196)				(707)
T025+T019	(513)	(555)			(1,492)
T025+T029	(437)	(517)	(815)	(343)	(1,417)
T025+T030	(457)				(1,461)
T026+T029	(190)				(626)
T026+T030	(195)				(615)
T027+T019	(368)				(1,179)
T027+T029	(331)	(373)	(603)	(255)	(1,129)
T027+T030	(337)				(1,108)
T028+T029	(221)				(840)
T028+T030	(205)				(704)
T031+T032	(206)	(242)	(336)	(168)	(570)

NEW YORK INDEPENDENT SYSTEM OPERATOR

DRAFT – FOR DISCUSSION PURPOSES ONLY

Average LBMP Change in 2018 $: Baseline

Project	West	Genesee	Central	North	Mohawk Valley	Capital	Hudson Valley	Millwood	Dunwoodie	NY City	Long Island
T018+T019	0.43	0.41	0.43	0.44	0.47	(0.02)	(0.07)	(0.15)	(0.19)	(0.16)	(0.12)
T021+T022	0.38	0.38	0.40	0.45	0.45	0.01	(0.08)	(0.17)	(0.20)	(0.16)	(0.13)
T021+T023	0.37	0.38	0.40	0.45	0.45	(0.00)	(0.08)	(0.17)	(0.20)	(0.16)	(0.13)
T025+T019	0.97	0.90	0.84	1.29	1.04	(0.31)	(0.13)	(0.24)	(0.26)	(0.22)	(0.16)
T025+T029	0.95	0.90	0.90	1.30	1.05	(0.28)	(0.12)	(0.24)	(0.26)	(0.21)	(0.17)
T025+T030	0.97	0.92	0.91	1.31	1.06	(0.30)	(0.14)	(0.25)	(0.28)	(0.23)	(0.18)
T026+T029	0.39	0.38	0.40	0.48	0.45	0.01	(0.02)	(0.10)	(0.14)	(0.10)	(0.08)
T026+T030	0.41	0.39	0.40	0.48	0.45	0.02	(0.02)	(0.10)	(0.14)	(0.10)	(0.09)
T027+T019	0.75	0.71	0.70	0.84	0.79	(0.26)	(0.19)	(0.29)	(0.32)	(0.27)	(0.20)
T027+T029	0.67	0.66	0.67	0.83	0.78	(0.28)	(0.16)	(0.26)	(0.29)	(0.24)	(0.18)
T027+T030	0.69	0.67	0.68	0.83	0.78	(0.27)	(0.16)	(0.26)	(0.29)	(0.24)	(0.18)
T028+T029	0.43	0.44	0.46	0.58	0.55	(0.13)	(0.08)	(0.17)	(0.20)	(0.16)	(0.12)
T028+T030	0.43	0.41	0.42	0.52	0.49	(0.09)	(0.08)	(0.17)	(0.20)	(0.16)	(0.12)
T031+T032	0.37	0.37	0.38	0.44	0.46	0.06	(0.16)	(0.27)	(0.30)	(0.25)	(0.19)

NEW YORK INDEPENDENT SYSTEM OPERATOR

DRAFT – FOR DISCUSSION PURPOSES ONLY

Average LBMP Change in 2018 $: CES+Retirement

Project	West	Genesee	Central	North	Mohawk Valley	Capital	Hudson Valley	Millwood	Dunwoodie	NY City	Long Island
T018+T019	1.65	1.89	1.96	2.43	2.24	(1.18)	(0.15)	(0.63)	(0.84)	(0.55)	(0.49)
T021+T022	1.41	1.60	1.66	2.04	1.92	(0.66)	(0.10)	(0.57)	(0.79)	(0.49)	(0.46)
T021+T023	1.39	1.60	1.65	2.06	1.92	(0.71)	(0.11)	(0.57)	(0.79)	(0.49)	(0.46)
T025+T019	3.09	3.58	3.58	4.80	4.06	(2.31)	(0.62)	(1.19)	(1.37)	(0.92)	(0.83)
T025+T029	2.94	3.42	3.47	4.64	3.92	(2.21)	(0.65)	(1.22)	(1.40)	(0.93)	(0.85)
T025+T030	3.05	3.55	3.60	4.82	4.06	(2.34)	(0.70)	(1.27)	(1.45)	(0.97)	(0.88)
T026+T029	1.26	1.41	1.47	1.74	1.70	(0.31)	0.02	(0.46)	(0.69)	(0.41)	(0.37)
T026+T030	1.25	1.38	1.44	1.69	1.66	(0.32)	0.02	(0.45)	(0.68)	(0.41)	(0.37)
T027+T019	2.40	2.78	2.83	3.63	3.21	(1.91)	(0.46)	(0.97)	(1.17)	(0.80)	(0.72)
T027+T029	2.27	2.67	2.74	3.56	3.15	(1.82)	(0.43)	(0.96)	(1.15)	(0.77)	(0.71)
T027+T030	2.25	2.63	2.69	3.50	3.09	(1.91)	(0.45)	(0.96)	(1.15)	(0.77)	(0.72)
T028+T029	1.58	1.85	1.94	2.44	2.26	(0.76)	(0.10)	(0.59)	(0.80)	(0.50)	(0.46)
T028+T030	1.38	1.55	1.61	1.95	1.87	(0.42)	(0.02)	(0.50)	(0.73)	(0.44)	(0.40)
T031+T032	1.38	1.59	1.68	2.08	2.02	(1.62)	(0.14)	(0.62)	(0.83)	(0.62)	(0.55)

20-Year Load Payment Change in 2018 M$: Baseline

Project	West	Genesee	Central	North	Mohawk Valley	Capital	Hudson Valley	Millwood	Dunwoodie	NY City	Long Island
T018+T019	143	92	156	40	131	(16)	(42)	(11)	(32)	(238)	(77)
T021+T022	127	85	147	41	106	45	(7)	(12)	(33)	(234)	(78)
T021+T023	124	84	147	41	106	43	(7)	(11)	(32)	(232)	(78)
T025+T019	320	189	301	119	344	(128)	(110)	(16)	(42)	(305)	(93)
T025+T029	303	186	312	120	325	(111)	(24)	(15)	(40)	(282)	(93)
T025+T030	310	190	318	121	331	(117)	(45)	(16)	(42)	(301)	(97)
T026+T029	128	84	145	44	135	6	5	(7)	(23)	(163)	(55)
T026+T030	134	86	147	44	135	10	(2)	(7)	(23)	(165)	(56)
T027+T019	241	149	246	78	255	(125)	(74)	(19)	(49)	(358)	(108)
T027+T029	216	139	235	77	251	(131)	(28)	(17)	(43)	(319)	(100)
T027+T030	222	140	237	77	251	(130)	(37)	(17)	(45)	(323)	(98)
T028+T029	139	94	163	54	173	(57)	(8)	(11)	(31)	(227)	(71)
T028+T030	139	89	152	48	165	(47)	(16)	(11)	(31)	(231)	(74)
T031+T032	122	81	140	39	123	26	(24)	(18)	(44)	(326)	(103)

20-Year Load Payment Change in 2018 M$: CES+Retirement

Project	West	Genesee	Central	North	Mohawk Valley	Capital	Hudson Valley	Millwood	Dunwoodie	NY City	Long Island
T018+T019	496	359	609	215	339	(243)	(36)	(36)	(116)	(627)	(204)
T021+T022	429	310	522	181	286	(80)	(2)	(32)	(110)	(564)	(194)
T021+T023	424	309	521	182	287	(95)	(3)	(33)	(109)	(569)	(195)
T025+T019	903	649	1,083	425	652	(512)	(150)	(66)	(174)	(934)	(307)
T025+T029	856	620	1,048	411	623	(486)	(100)	(66)	(177)	(934)	(314)
T025+T030	885	642	1,085	428	643	(518)	(121)	(69)	(182)	(967)	(323)
T026+T029	387	277	469	154	273	(26)	19	(26)	(97)	(493)	(160)
T026+T030	385	272	460	150	268	(27)	13	(26)	(97)	(491)	(161)
T027+T019	705	509	861	322	509	(441)	(92)	(54)	(152)	(833)	(275)
T027+T029	665	489	832	316	500	(424)	(59)	(53)	(149)	(805)	(275)
T027+T030	660	481	815	310	490	(448)	(68)	(53)	(150)	(807)	(277)
T028+T029	473	351	603	217	361	(147)	1	(33)	(109)	(562)	(188)
T028+T030	419	301	510	173	309	(67)	8	(29)	(101)	(514)	(169)
T031+T032	413	299	520	184	303	(349)	1	(34)	(109)	(653)	(217)

20-Year NYCA Demand Congestion Change in 2018 M$

Project ID	Baseline	National CO2 Removed	High Natural Gas	Low Natural Gas	CES + Retirement w/o National CO2
		Based off Baseline			
T018+T019	(1,556)	(1,991)	(2,578)	(1,405)	(6,863)
T021+T022	(1,253)	(1,597)	(2,126)	(1,089)	(5,629)
T021+T023	(1,233)				(5,661)
T025+T019	(2,959)	(3,820)			(11,851)
T025+T029	(2,675)	(3,598)	(4,707)	(2,364)	(11,363)
T025+T030	(2,801)				(11,837)
T026+T029	(1,355)				(4,831)
T026+T030	(1,385)				(4,749)
T027+T019	(2,576)				(9,633)
T027+T029	(2,333)	(3,003)	(3,958)	(2,088)	(9,292)
T027+T030	(2,369)				(9,194)
T028+T029	(1,683)				(6,499)
T028+T030	(1,575)				(5,336)
T031+T032	(1,369)	(1,935)	(2,636)	(1,184)	(5,733)

20-Year CO_2 Emission Change (in 1000 tons): Baseline

Project ID	NYCA	IESO	PJM	ISO-NE	4 Pool Total
T018+T019	(3,636)	3,235	(1,075)	2,626	1,150
T021+T022	(2,995)	2,805	(564)	1,865	1,111
T021+T023	(2,974)	2,773	(349)	1,856	1,306
T025+T019	(5,299)	8,475	3,138	(3,074)	3,239
T025+T029	(3,802)	6,702	8,477	(3,806)	7,570
T025+T030	(3,917)	6,885	9,172	(3,717)	8,424
T026+T029	(3,688)	2,514	1,644	1,741	2,211
T026+T030	(3,850)	2,585	1,334	1,873	1,943
T027+T019	(4,628)	5,168	1,693	241	2,474
T027+T029	(3,717)	4,572	2,140	(379)	2,616
T027+T030	(3,863)	4,692	1,534	(235)	2,128
T028+T029	(3,030)	2,679	2,931	1,178	3,758
T028+T030	(3,410)	2,695	1,351	1,438	2,074
T031+T032	(1,651)	2,696	(4,345)	1,576	(1,724)

20-Year CO_2 Emission Change (in 1000 tons): CES+Retirement

Project ID	NYCA	IESO	PJM	ISO-NE	4 Pool Total
T018+T019	(8,144)	2,222	4,280	(3,043)	(4,686)
T021+T022	(7,027)	1,924	(850)	(1,345)	(7,298)
T021+T023	(6,905)	1,940	(1,866)	(1,404)	(8,235)
T025+T019	(19,884)	6,267	9,797	(11,596)	(15,416)
T025+T029	(17,832)	5,705	11,910	(11,438)	(11,656)
T025+T030	(18,622)	5,917	13,035	(11,854)	(11,524)
T026+T029	(4,655)	1,724	(1,711)	(1,589)	(6,231)
T026+T030	(4,681)	1,719	(2,694)	(1,251)	(6,908)
T027+T019	(14,180)	4,198	6,788	(7,466)	(10,661)
T027+T029	(13,068)	3,862	7,073	(7,295)	(9,429)
T027+T030	(13,047)	3,903	5,729	(6,770)	(10,184)
T028+T029	(8,067)	2,270	5,594	(3,853)	(4,056)
T028+T030	(6,270)	1,945	453	(2,029)	(5,901)
T031+T032	(1,903)	1,485	(4,561)	(3,836)	(8,814)

Performance

Baseline: 20-year Incremental Energy (GWh)

Project ID	CENTRAL EAST	UPNY-SENY
T018+T019	28,721	27,500
T021+T022	26,420	24,699
T021+T023	26,050	24,058
T025+T019	89,669	40,642
T025+T029	72,646	27,889
T025+T030	76,301	29,734
T026+T029	23,081	15,115
T026+T030	23,806	15,905
T027+T019	61,551	40,089
T027+T029	55,818	27,524
T027+T030	56,664	28,546
T028+T029	26,361	18,984
T028+T030	26,114	19,485
T031+T032	25,775	31,841

Performance

CES + Retirement w/o National CO2: 20-year Incremental Energy (GWh)

Project ID	CENTRAL EAST	UPNY-SENY
T018+T019	52,543	34,444
T021+T022	46,260	32,657
T021+T023	45,841	32,024
T025+T019	149,696	57,394
T025+T029	128,379	46,939
T025+T030	134,174	49,003
T026+T029	38,377	22,467
T026+T030	38,812	23,187
T027+T019	104,019	47,535
T027+T029	96,623	36,942
T027+T030	96,878	38,166
T028+T029	49,548	25,394
T028+T030	44,079	24,472
T031+T032	46,711	26,718

Consequences for Other Regions

- Through the NYISO Transmission Interconnection Procedures, the NYISO has been consulting with the ISO-NE concerning any potential impacts due to the proposed projects.
- Preliminary System Impact Studies indicate NY to NE thermal transfer capability degradation due to overload between Cricket Valley and Long Mountain 345 kV line for all Segment B projects. The preliminary NUF cost has been included in the project cost estimates for all Segment B projects.
- If additional material impacts are identified, the Transmission Interconnection Procedures will identify the necessary upgrades, and any available results will be incorporated into the report.

System Impact Studies

Segment	Project ID	Interconnection Queue	SIS Status	Potential NUF
A	T018	Q542	In progress	No adverse impact identified at this point
	T021	Q537	In progress	
	T026	Q555	In progress	
	T028	Q557	In progress	
	T027	Q556	In progress	
	T025	Q558	In progress	
	T031	Q608	In progress	
B	T019	Q543	In progress	NY to NE transfer degradation due to overload between Cricket Valley and Long Mountain 345 kV line
	T022	Q538	In progress	
	T023	Q539	In progress	
	T029	Q559	In progress	
	T030	Q414	In progress	
	T032	Q609	In progress	

Impact on Wholesale Electricity Markets

- The proposed projects increase the Central East and UPNY-SENY transfer capability and reduce congestion. Therefore, the NYISO staff has not determined any adverse impact on the New York wholesale electricity markets
- The draft results have been provided to Market Monitoring Unit for its review and consideration. MMU's evaluation will be provided prior to the Management Committee meeting

Evaluation of Interaction with Local Transmission Owner Plans

- The OATT requires the NYISO to review the LTPs as they relate to the BPTF to determine whether any proposed regional Public Policy Transmission Project on the BPTF can
  1. more efficiently or cost-effectively satisfy any local needs driven by a Public Policy Requirement identified in the LTPs, or
  2. might more efficiently or cost-effectively satisfy the identified regional Public Policy Transmission Need than any local transmission solutions to needs driven by Public Policy Requirements identified in the LTPs
- TOs' current LTPs have not identified any needs driven by a Public Policy Requirement. Accordingly, the NYISO determined that there is no interaction of the AC Transmission solutions with LTPs

Next Steps

NEW YORK INDEPENDENT SYSTEM OPERATOR

Next Steps

- Please provide additional comments to PublicPolicyPlanningMailbox@nyiso.com by May 3
- Written comments will be posted to ESPWG/TPAS on NYISO website
- Review results at May 10, 2018 ESPWG/TPAS meeting

Questions?

We are here to help. Let us know if we can add anything.

NEW YORK INDEPENDENT SYSTEM OPERATOR

The Mission of the New York Independent System Operator, in collaboration with its stakeholders, is to serve the public interest and provide benefits to consumers by:

- Maintaining and enhancing regional reliability
- Operating open, fair and competitive wholesale electricity markets
- Planning the power system for the future
- Providing factual information to policy makers, stakeholders and investors in the power system

www.nyiso.com

NEW YORK INDEPENDENT SYSTEM OPERATOR

DRAFT – FOR DISCUSSION PURPOSES ONLY