New York ISO
Independent System Operator

2020 Assessment of Planning Transfer Capability for the Near Term Planning Horizon

(NERC Standard FAC-013-2)

A Report by the
New York Independent System Operator

March 26, 2020

1. Introduction

1.1. Background

This report comprises the 2020 New York Independent System Operator ("NYISO") assessment of Planning Transfer Capability ("PTC") of the planned New York State Bulk Power Transmission Facilities ("BPTF") for the near-term (years one through five) planning horizon, assessing the planned system for year five (2024).

Consistent with the "Methodology for Assessment of Transfer Capability in the Near-Term Transmission Planning Horizon" [1] ("PTC Methodology"), and the methodology employed within the annual Area Transmission Review ("ATR") [2], the NYISO conducts the annual Assessment of Planning Transfer Capability ("PTC Assessment") of the planned New York State BPTF in accordance with applicable North American Electric Reliability Corporation ("NERC") Reliability Standards [3], Northeast Power Coordinating Council ("NPCC") Design Criteria [4], New York State Reliability Council ("NYSRC") Reliability Rules and Procedures[5], and NYISO planning and operation practices.

Transfer Capability is defined by NERC as the measure of the ability of interconnected electric systems to move or transfer power in a reliable manner from one area to another over all transmission lines (or paths) between those areas under specified system conditions.

PTC is determined by the NYISO in its role as Planning Coordinator in accordance with NERC Standard FAC-013-2, "Assessment of Transfer Capability for the Near-Term Transmission Planning Horizon" [6], and is not directly related to calculations of Total Transfer Capability ("TTC") or Available Transfer Capability ("ATC").

The PTC Assessment is not intended to determine the maximum transfer capability. The PTC may be sensitive to various factors including, but not limited to, base case load and generation conditions, Phase Angle Regulator ("PAR") schedules, and inter-area transfers. These sensitivities are not considered in determining the PTC as no attempts are made to optimize transfer limits.

The NYISO conducted simulations in accordance with the PTC Methodology [1]. For the assessed study year (2024), the assessment of PTC evaluates BPTF facilities.

1.2. NYCA Interfaces

The PTC Assessment monitors and evaluates eleven major interfaces between zones within the New York Control Area ("NYCA") as depicted in Figure 1: Dysinger East, West Central, Volney East, Moses South, Central East, Total East, UPNY-SENY, UPNY-ConEd, Millwood South, Sprain Brook – Dunwoodie South, and LIPA Import. Additionally the PTC Assessment monitors and evaluates interfaces between the NYISO and all neighboring control areas: Ontario ("IESO"), Hydro-Quebec, ISO-New England, and PJM.

Figure 1: NYCA Interfaces and Load Zones

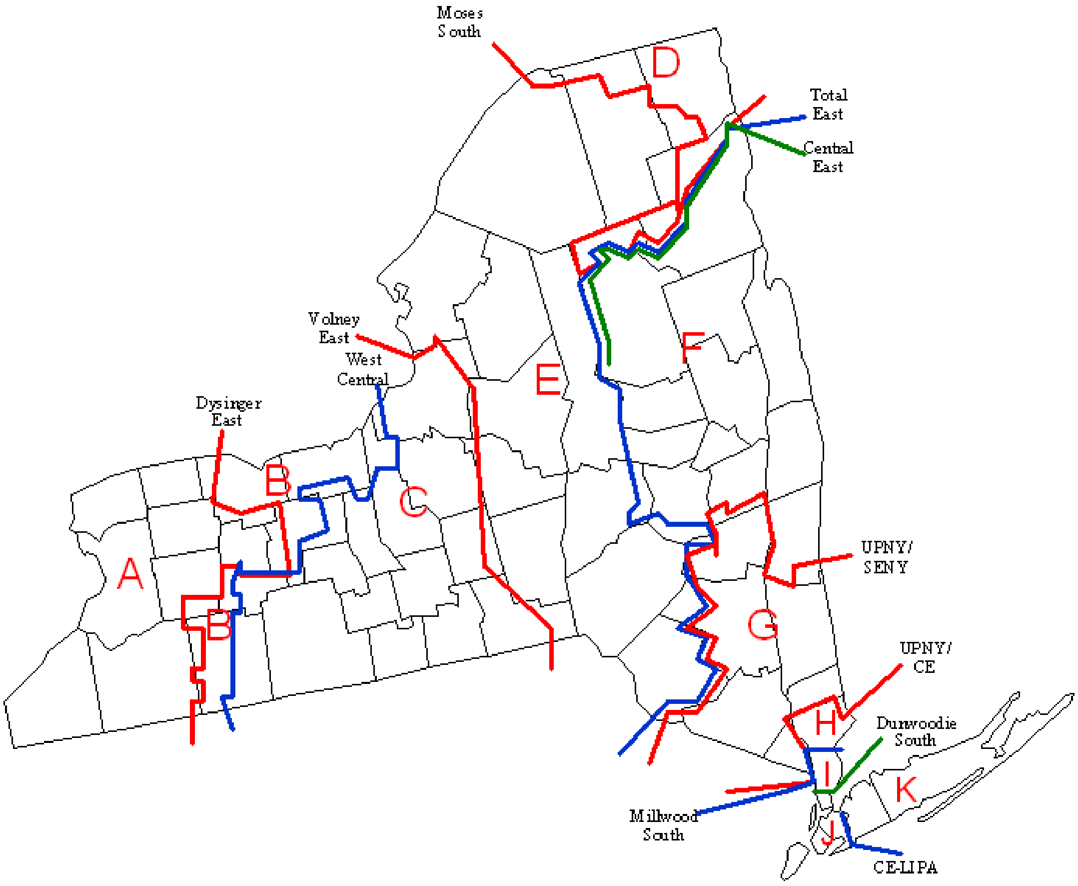

Figure 1 geographically depicts the NYCA interfaces and load zones.

1.3. Criteria and Assumptions

Criteria and assumptions as well as detailed descriptions of the transfers performed can be found in sections 2-4 of the PTC Methodology [1].

2. Thermal Transfer Analysis

2.1. Thermal Transfer Methodology

Thermal transfer limit analysis is performed using the PowerGEM TARA program utilizing the Proportional Scale Transfer activity by shifting generation across the interface under evaluation. The thermal transfer limit analysis is performed on the 2024 summer peak load base case in accordance with the PTC Methodology [1].

The thermal transfer analysis monitors transmission facilities above 100 kV, including all New York State BPTF elements under contingency conditions while shifting power across interfaces within NYCA and neighboring systems.

The thermal transfer analysis includes over 1,000 contingencies consistent with NERC, NPCC, and NYSRC Design Criteria [3]-[5]. Neighboring system design criteria contingencies are also included, as appropriate, to evaluate their impact on thermal transfer limits. The contingencies evaluated include the most severe impedance changes, and include the majority of possible contingencies on the BPTF system. The applied contingencies are modeled to simulate the removal of all elements that the protection system and other automatic controls would disconnect without operator intervention.

For thermal transfer analysis, tap settings of PARs and auto-transformers regulate power flow and voltage, respectively, in the pre-contingency solution, but are fixed at their corresponding pre-contingency settings in the post-contingency solution. Similarly, switched shunt capacitors and reactors are switched at pre-determined voltage levels in the pre-contingency solution, but are held at their corresponding pre-contingency position in the post-contingency solution.

Thermal transfer limits are sensitive to the base case load and generation conditions, and to the generation selection utilized to create the transfer, PAR schedules, and inter-Area power transfers. No attempts are made to optimize transfer limits; therefore, these parameters are not varied to determine an optimal dispatch.

To determine the Transfer Capability, the generation resources in the source and sink areas are adjusted uniformly to allow for equal participation of aggregated generators based on the ratio of maximum power and reserve power for each generator. Wind, nuclear, and run-of-river hydro units are excluded from generation shifts. The general direction of generation shifts is from the north and west to southeastern New York. The results are based on deterministic summer peak load power flow analysis and may not be applicable for use in probabilistic resource adequacy analysis.

2.2. Thermal Analysis Results

Tables 1, 2, 3, and 4 summarize the normal and emergency thermal transfer limits determined for the NYCA intra-Area and inter-Area transmission interfaces. Where both open and closed interface definitions exist, the open interface limits are reported in the table. The assessment of thermal Transfer Capability demonstrates that the New York State BPTF system meets the applicable NERC, NPCC, and NYSRC Reliability Rules [3]-[5] with respect to thermal ratings. The New York State BPTF system security is maintained by limiting power transfers according to the determined thermal constrained transfer limits. The following provides explanations for changes in transfer limits of greater than 100 MW:

- The Dysinger East and West Central Interfaces normal and emergency transfer limits increased compared to the 2015 Comprehensive ATR. The increase in transfer limit is the result of the Empire State Line/Western New York Public Policy Transmission Project, which alleviates the burden placed on the 230 kV transmission. The Dysinger East and West Central Interfaces' transfer limits are sensitive to the Empire State Line PAR schedule. For this assessment, the Empire State Line PAR was scheduled at 550 MW from Dysinger 345 kV substation to the East Stolle 345 kV substation. No attempt was made to optimize the Dysinger PAR schedule for this assessment.
- The Volney East Interface's normal and emergency transfer limits increased compared to the 2015 Comprehensive ATR. This increase is primarily due to the addition of the AC Transmission Public Policy Transmission Project Segment A.
- The Total East and Central East Interfaces' normal and emergency limits increased compared to the 2015 Comprehensive ATR. This increase is due to the addition of the AC Transmission Project Segment A, which is located directly on the interfaces.
- The UPNY SENY Interface's normal and emergency limits increased when compared to the 2015 Comprehensive ATR. This increase is due to the addition of the AC Transmission Project Segment B, which is located directly on the interface.
- The UPNY Con Edison Interface's normal and emergency transfer limits increased when compared to the 2015 Comprehensive ATR. The increased transfer limits are due to the non-renewal of the Con Edison and PSE&G Wheeling Agreement, as well as the combination of generation retirements and additions located near the interface. The increase is also due to the addition of the AC Transmission Project Segment B.

When analyzing the inter-Area transfer limits, generation dispatch assumptions in neighboring areas can have a significant impact. Pre-shift generation dispatch in neighboring Control Areas dictates generation participation factors in generation-to-generation shifts. If generation close to the NYCA border participates more as a source or a sink, transmission lines in the vicinity of the source or sink may appear to be more or less limiting. The following provides explanations for changes in inter-Area transfer limits:

- The New York - New England Interface’s normal and emergency transfer limit increased while the New England - New York normal and emergency transfer limits decreased compared to the 2015 Comprehensive ATR. These changes in transfer limits are due to the combination of generation retirements and additions in the areas near the interface, as well as reduced New England loop flow.
- The New York – Ontario and Ontario – New York Interfaces’ emergency transfer limit increased compared to the 2015 Comprehensive ATR. This increase is primarily due to the Empire State Line/Western New York Public Policy Transmission Project.
- The changes to the New York - PJM and PJM - New York Interfaces’ normal and emergency limits are primarily due to the changes to the NYISO-PJM Joint-Operating Agreement (JOA). Changes to tie-line topology between New York and PJM also impacted the observed transfer limits.

Table 1: Normal Transfer Criteria Intra – Area Thermal Transfer Limits

Interface	2015 Comprehensive ATR	2019 Transfers	Limiting Constraint 2015 Comprehensive ATR	Limiting Constraint 2019 Transfers
Dysinger East	1,750 (A)	1,800 (A)	**Huntley-Sawyer 230 kV (80)** at 654 MW LTE rating for L/O Huntley-Sawyer 230 kV (79)	**Niagara - Packard 230 kV (61)** at 847 MW STE rating for L/O Niagara - Packard 230 kV (62) and Packard - Beck 230 kV (76)
West Central	400 (A)	625 (A)		
Volney East	4,125	4,925	**Fraser-Coopers Corners 345 kV (33)** at 1,721 MW LTE rating for L/O Porter-Rotterdam 230 kV and Marcy-Coopers Corners 345 kV	**Fraser–Coopers Corners 345 kV (33)** at 1,721 MW LTE rating for L/O Edic-Princetown 345 kV and Marcy – Coopers Corners 345 kV (UCC2-41)
Moses South	2,350 (D)	2,325	**Browns Falls-Taylorville 115 kV (3)** at 134 MW STE rating for L/O Chateauguay-Massena-Marcy 765 kV	**Higley - Browns Falls 115 kV (1)** at 135 MW STE rating for L/O Chateauguay–Massena–Marcy 765 kV (MSU-1)
Central East	2,350	3,300	**New Scotland - Leeds 345 kV (77)** at 1,538 MW LTE rating for L/O New Scotland (99)–Leeds 345kV	**New Scotland (77)–Knickerbocker 345 kV** at 1,762 MW LTE rating for L/O Marcy-Coopers Corners 345 kV (UCC2-41) and Fraser-Coopers Corners 345 kV (33)
Total East	4,850	6,075	**Dolson-Rock Tavern 345 kV (DART44)** at 1,793 MW LTE rating for L/O Coopers Corners-Middletown Tap-Rock Tavern 345 kV and Rock Tavern-Roseton 345 kV	
UPNY SENY	5,075 (B)(C)	6,675 (C)(G)	**Leeds-Pleasant Valley 345 kV (92)** at 1,538 MW LTE rating for L/O CPV-Rock Tavern 345 kV and Coopers Corners – Middletown Tap - Rock Tavern 345 kV	**New Scotland (77)–Knickerbocker 345 kV** at 1,762 MW LTE rating for L/O Rock Tavern – Dolson Avenue 345 kV (DART-44) and Coopers Corners – Rock Tavern 345 kV (CCRT34)
UPNY ConEdison	4,950 (C)(D)	7,525 (C)(G)	**Shoemaker-Chester 138 kV** at 317 MW STE rating for L/O Rock Tavern-Ramapo 345 kV and Rock Tavern-Sugarloaf-Ramapo 345 kV	**Ladentown - Lovett 345 kV** at 1,994 MW LTE rating for L/O Pleasant Valley - Millwood 345 kV (F31) and L/O Wood St 345/115 kV
Dunwoodie South	5,625 (E)	5,750 (C)(G)	**Dunwoodie-Mott Haven 345 kV (71)** at 786 MW Normal rating for pre-contingency loading	
LIPA Import	1,700 (F)	1,700 (H)	**Dunwoodie-Shore Rd. 345 kV (Y50)** at 962 MW LTE rating for L/O Sprain Brook-E.G.C. 345 kV and Sprain Brook-Academy 345/138 kV	

Notes:

A. Used Reliability Rules Exception Reference No. 13 – Post Contingency Flows on Niagara Project Facilities.
B. Used Reliability Rules Exception Reference No. 23 – Generation Rejection at Athens.
C. Ramapo PAR1 and PAR2 are scheduled at 80% of the RECO load.
D. Followed NYISO Emergency Operations Manual Attachment A-7 (formerly section 4.1.3).
E. Dunwoodie North PAR1 and PAR2 are scheduled at 115 MW each into NYC.
Dunwoodie South PAR is scheduled at 235 MW into NYC.
Sherman Creek PAR1 and PAR2 are scheduled at 200 MW each into NYC.
Parkchester PAR1 and PAR2 are scheduled at 245 MW each into NYC.
F. E.G.C. PAR1 and PAR2 are scheduled at 315 MW each into Long Island.
Lake Success and Valley Stream PARs are scheduled at 165 MW and 123 MW, respectively, into NYC.
Neptune and CSC HVdc are scheduled at 660 MW and 96 MW, respectively, into Long Island.
G. Dunwoodie North PAR1 and PAR2 are scheduled at 95 MW each into NYC.
Dunwoodie South PAR is scheduled at 220 MW into NYC.
Sherman Creek PAR1 and PAR2 are scheduled at 220 MW each into NYC.
Parkchester PAR1 and PAR2 are scheduled at 250 MW each into NYC.
H. E.G.C. PAR1 and PAR2 are scheduled at 315 MW each into Long Island.
Lake Success and Valley Stream PARs are scheduled at 200 MW and 100 MW, respectively, into NYC.
Neptune and CSC are scheduled at 660 MW, and 96 MW respectively, into Long Island.

Table 2: Emergency Transfer Criteria Intra – Area Thermal Transfer Limits

Interface	2015 Comprehensive ATR	2019 Transfers	Limiting Constraint 2015 Comprehensive ATR	Limiting Constraint 2019 Transfers
Dysinger East	2,325	2,700	**Packard-Sawyer 230 kV (77)** at 704 MW STE rating for L/O Packard-Niagara 230 kV, Packard-Sawyer 230 kV (78), and Packard 230/115 kV	**Packard – Sawyer 230 kV (77)** at 746 MW STE rating for L/O Packard – Sawyer 230 kV (78) and Packard – Niagara 230 kV (61) and Packard 230/115 kV Transformer (XMFR 3)
West Central	975	1,525		
Volney East	4,400	5,375	**Fraser-Coopers Corners 345 kV (33)** at 1,793 MW STE rating for L/O Marcy-Coopers Corners 345 kV (UCC2-41)	
Moses South	2,350 (F)	2,325	**Browns Falls-Taylorville 115 kV (3)** at 134 MW STE rating for L/O Chateauguay-Massena-Marcy 765 kV	**Higley - Browns Falls 115 kV (1)** at 135 MW STE rating for L/O Chateauguay–Massena–Marcy 765 kV (MSU-1)
Central East	2,650	3,725	**New Scotland (77)-Leeds 345 kV** at 1,724 MW STE rating for L/O New Scotland (99)-Leeds 345 kV	**New Scotland (77) - Knickerbocker 345 kV** at 1,423 MW normal rating for pre-contingency loading
Total East	5,100	6,750	**Dolson-Rock Tavern 345 kV (DART44)** at 1,793 MW STE rating for L/O Coopers Corners-Middletown Tap 345 kV	
UPNY SENY	5,300 (A)	7,475 (A)		
UPNY ConEdison	6,325 (A)	10,400 (A)	**Roseton-East Fishkill 345 kV** at 1,936 MW Normal rating for pre-contingency loading	**Lovett 345 - Buchanan S 345 kV** at 2,531 MW STE rating for L/O Ramapo-Buchanan 345 kV (Y94)
Dunwoodie South	5,625 (B)	5,750 (A)(D)	**Dunwoodie-Mott Haven 345 kV (71)** at 786 MW Normal rating for pre-contingency loading	
LIPA Import	2,250 (C)	2,325 (E)	**Dunwoodie-Shore Road 345 kV (Y50)** at 687 MW Normal rating for pre-contingency loading	

Notes:

A. Ramapo PAR1 and PAR2 are scheduled at 80% of the RECO load.
B. Dunwoodie North PAR1 and PAR2 are scheduled at 115 MW each into NYC.
   Dunwoodie South PAR is scheduled at 235 MW into NYC.
   Sherman Creek PAR1 and PAR2 are scheduled at 200 MW each into NYC.
   Parkchester PAR1 and PAR2 are scheduled at 245 MW each into NYC.
C. E.G.C. PAR1 and PAR2 are scheduled at 315 MW each into Long Island.
   Lake Success and Valley Stream PARs are scheduled at 87 MW and 88 MW, respectively, into Long Island.
   Neptune and CSC HVdc are scheduled at 660 MW and 96 MW, respectively, into Long Island.
D. Dunwoodie North PAR1 and PAR2 are scheduled at 95 MW each into NYC.
   Dunwoodie South PAR is scheduled at 220 MW into NYC.
   Sherman Creek PAR1 and PAR2 are scheduled at 220 MW each into NYC.
   Parkchester PAR1 and PAR2 are scheduled at 250 MW each into NYC.
E. E.G.C. PAR1 and PAR2 are scheduled at 315 MW each into Long Island.
   Lake Success and Valley Stream PARs are scheduled at 50 MW and 210 MW, respectively, into Long Island.
   Neptune and CSC are scheduled at 660 MW, and 96 MW respectively, into Long Island.
F. Followed NYISO Emergency Operations Manual Attachment A-7 (formerly section 4.1.3).

Table 3: Normal Transfer Criteria Inter-Area Thermal Transfer Limits

Interface	2015 Comprehensive ATR	2019 Transfers	Limiting Constraint 2015 Comprehensive ATR	Limiting Constraint 2019 Transfers
New York-New England	1,125	2,075	**Pleasant Valley-Long Mountain 345 kV** at 1,382 MW LTE rating for L/O Sandy Pond HVdc	**Cricket Valley-Long Mountain 345 kV (398)** at 1,323 MW Normal rating for pre-contingency loading
New England - New York	1,500	1,475	**Reynolds Rd. 345/115 kV** at 562 MW LTE rating for L/O Alps – New Scotland 345 kV	**Pleasant Valley-Cricket Valley 345 kV (F83)** at 1,382 MW LTE rating for L/O Pleasant Valley-Cricket Valley 345 kV (F84)
New York - Ontario	1,600	1,525	**Beck – Niagara 230 kV (PA27)** at 460 MW LTE rating for L/O Niagara-Beck 345 kV (PA302)	**Beck – Niagara 230 kV (PA27)** at 460 MW LTE rating for L/O Niagara-Beck 345 kV (PA301)
Ontario – New York	1,850	2,000	**Beck – Niagara 230 kV (PA27)** at 460 MW LTE rating for L/O Niagara-Beck 345 kV (PA301)	
New York - PJM	2,475 (A)	2,625 (C)	**Huntley-Sawyer 230 kV (80)** at 654 MW LTE rating for L/O Huntley-Gardenville 230 kV (Line 79)	**S. Ripley - Erie E 230 kV (69)** at 368 MW LTE rating for L/O Glade-Warren 230 kV (2088) and L/O Warren 230/115 kV
PJM-NY	3,100 (B)	2,825 (D)	**East Towanda-Hillside 230 kV (70)** at 531 MW LTE rating for L/O Watercure-Mainesburg 345 kV & North Waverly-East Sayre 115 kV (North Waverly-East Sayre 115 kV tripped via overcurrent relay)	**N. Waverly – E. Sayre 115 kV (956)** at 108 MW Normal rating for pre-contingency loading

Notes:

A. Ramapo PAR1 and PAR2 are scheduled at 500 MW each into PJM.
Neptune and HTP are scheduled at 0 MW.
Linden VFT is scheduled at 315 MW into PJM.

B. Ramapo PAR1 and PAR2 are scheduled at 500 MW each into NY.
Neptune is scheduled at 660 MW into NY.
Linden VFT is scheduled at 315 MW into NY.
HTP is scheduled at 320 MW into NY.

C. NY/PJM PARS are scheduled according to the NYISO-PJM JOA.
Neptune is scheduled at 0 MW.
Linden VFT is scheduled at 315 MW into PJM.
HTP is scheduled at 0 MW.

D. NY/PJM PARS are scheduled according to the NYISO-PJM JOA.
Neptune is scheduled at 660 MW into NY.
Linden VFT is scheduled at 315 MW into NY.
HTP is scheduled at 0 MW.

Table 4: Emergency Transfer Criteria Inter-Area Thermal Transfer Limits

Interface	2015 Comprehensive ATR	2019 Transfers	Limiting Constraint 2015 Comprehensive ATR	Limiting Constraint 2019 Transfers
New York-New England	1,725	2,075	**Pleasant Valley-Long Mountain 345 kV** at 1,680 MW STE rating for L/O Sandy Pond HVdc	**Cricket Valley-Long Mountain 345 kV (398)** at 1,323 MW normal rating for pre-contingency loading
New England - New York	2,700	2,125	**Pleasant Valley-Long Mountain 345 kV** at 1,195 MW Normal rating for pre-contingency loading	**Pleasant Valley-Cricket Valley 345 kV (F83)** at 2,221 MW STE rating for L/O Pleasant Valley-Cricket Valley 345 kV (F84)
New York - Ontario	1,900	2,125	**Beck – Niagara 230 kV (PA27)** at 400 MW Normal rating for pre-contingency loading	
Ontario - New York	2,200	2,400	**Beck – Niagara 230 kV (PA27)** at 400MW normal rating for pre-contingency loading	**Beck – Niagara 230 kV (PA27)** at 558 MW STE rating for L/O Beck – Niagara (PA 301) 345 kV
New York - PJM	2,575 (A)	2,625 (C)	**Dunkirk-South Ripley 230 kV** at 475 MW STE rating for L/O Wayne-Handsome Lake 345	**S. Ripley - Erie E 230 kV (69)** at 368 MW STE rating for L/O Glade-Warren 230 kV (2088) and L/O Warren 230/115 kV
PJM-NY	3,425 (B)	2,825 (D)	**East Towanda-Hillside 230 kV** at 636 MW LTE rating for L/O Watercure-Mainesburg 345 kV & North Waverly-East Sayre 115 kV (North Waverly-East Sayre 115 kV tripped via overcurrent relay)	**N. Waverly – E. Sayre 115 kV (956)** at 108 MW Normal rating for pre-contingency loading

Notes:

A. Ramapo PAR1 and PAR2 are scheduled at 500 MW each into PJM.
Neptune and HTP are scheduled at 0 MW.
Linden VFT is scheduled at 315 MW into PJM.

B. Ramapo PAR1 and PAR2 are scheduled at 500 MW each into NY.
Neptune is scheduled at 660 MW into NY.
Linden VFT is scheduled at 315 MW into NY.
HTP is scheduled at 320 MW into NY.

C. NY/PJM PARS are scheduled according to the NYISO-PJM JOA.
Neptune is scheduled at 0 MW.
Linden VFT is scheduled at 315 MW into PJM.
HTP is scheduled at 0 MW.

D. NY/PJM PARS are scheduled according to the NYISO-PJM JOA.
Neptune is scheduled at 660 MW into NY.
Linden VFT is scheduled at 315 MW into NY.
HTP is scheduled at 0 MW.

3. Voltage Transfer Analysis

3.1. Voltage Transfer Methodology

Voltage-constrained transfer limit analysis is performed using PowerGEM TARA software considering specific bus voltage limits (*i.e.* OP-1 buses) [7]. The OP-1 bus voltage limit criteria include specific minimum and maximum voltage limits for pre-contingency and post-contingency conditions. The required post-contingency voltage is typically within 5% of nominal.

A voltage transfer case is created from the summer 2024 peak load case. A set of power flow cases with increasing transfer levels is created for each interface from the 2024 summer peak load voltage transfer case by applying generation shift pattern similar to those used for thermal transfer analysis. For voltage transfers, a sequential order is applied to the generation shift starting from the generators near the interface being evaluated then from resources further away from the interface until voltage collapse is observed. For each interface, PowerGEM TARA evaluates the system response to the set of the most severe NERC, NPCC and NYSRC Design Criteria contingencies [3]-[5]. The applied contingencies are modeled to simulate the removal of all elements that the protection system or other automatic controls would disconnect without operator intervention. Selection of these contingencies is based on an assessment of cumulative historical power system analysis, actual system events, and planned changes to the system. Additionally, all design criteria contingencies consistent with NERC, NPCC, and NYSRC criteria [3]-[5] are screened to provide that the most limiting contingencies for the planned system are included in this analysis. The resulting contingencies evaluated include the most severe loss of reactive capability and increased impedance on the BPTF system.

For the 2020 NERC FAC-013 Assessment of Planning Transfer Capability for the Near Term Planning Horizon, the load is modeled as constant power in all NYCA zones except the Con Edison service territory. The Con Edison voltage-varying load model is used to model the load in their service territory for all cases.

While constructing the voltage transfer case, in order to maintain bus voltage within the applicable pre-and post-contingency limits under transfer conditions, adjustments are made to reactive power sources (*e.g.* generators, PARs, autotransformers). The reactive power of generators is regulated, within the capabilities of the units, to maintain a scheduled voltage in both the pre-contingency and post-contingency power flows. Tap settings of PARs and autotransformers regulate power flow and voltage, respectively, in the pre-contingency solution, but are fixed at their corresponding pre-contingency settings in the post-contingency solution. Similarly, switched shunt capacitors and reactors are switched at pre-determined voltage levels in the pre-contingency solution, but are held at their corresponding pre-contingency position in the post-contingency solution. In accordance with the NYISO normal (pre-contingency) operating practice, SVC and FACTS devices are held at or near zero reactive power output in the pre-contingency solution, but are allowed to regulate in the post-contingency power flow solution.

Voltage-constrained transfer limit analysis is performed to evaluate the adequacy of the system post-contingency voltage and to find the region of voltage instability. As the transfer level across an interface is increased, the voltage-constrained transfer limit is determined to be the lower of: (1) the pre-contingency power flow at which the pre/post-contingency voltage falls below the voltage limit criteria; or (2) 95% of the pre-contingency power flow at the “nose” of the post-contingency PV curve. The “nose” is the point at which the slope of the PV cure becomes infinite (*i.e.* vertical). Reaching the “nose” (which is the point of voltage collapse) occurs when reactive capability supporting the transfer of real power is exhausted. The region near the “nose” of the curve is generally referred to as the region of voltage instability.

Voltage-constrained transfer limit analysis is sensitive to the base case load and generation conditions, generation selection utilized to create the power transfers, PAR schedules, key generator commitment, SVC dispatch, switched shunt availability, and the scheduled inter-Area power transfers modeled in the study case. No attempts are made to optimize the voltage-constrained transfer limits; therefore, these parameters are not varied to determine an optimal dispatch.

The NYISO evaluates the voltage-constrained transfer limits for the Dysinger East, West Central, Volney East, Central East, UPNY-SENY, UPNY-Con Edison, and Sprainbrook-Dunwoodie South interfaces. The Moses-South and Long Island interfaces are historically thermally limited; therefore, given the minimal changes to these areas, the voltage-constrained transfer limits are not evaluated for these interfaces.

3.2. Voltage Analysis Results

Table 5 provides a summary of the voltage-constrained transfer limits. The assessment of voltage Transfer Capability demonstrates that the New York State BPTF system meets the applicable NERC [3], NPCC and NYSRC Reliability Rules [4]-[5] with respect to voltage performance. The New York State BPTF system security is maintained by limiting power transfers according to the determined voltage-constrained transfer limits. The following provides explanations for changes in transfer limits of greater than 100 MW:

- The West Central voltage-constrained transfer limit increased compared to the 2015 Comprehensive ATR. This is primarily due to the Empire State Line/ Western New York Public

Policy Transmission Project.

- The Volney East and Central East voltage-constrained transfer limits increased compared to the 2015 Comprehensive ATR. This increase is primarily due to the addition of the AC Transmission Project Segment A.
- The UPNY SENY voltage-constrained transfer limit increased compared to the 2015 Comprehensive ATR. This increase is due to the addition of the AC Transmission Project Segment B, which is located directly on the interface.
- The UPNY Con Edison voltage-constrained transfer limits increased compared to the 2015 Comprehensive ATR. This is due to the addition of reactive power generation from multiple new generators compensating for generation loss in the area as well as the change in series reactor status.
- The Dunwoodie South voltage-constrained transfer limits increased compared to the 2015 Comprehensive ATR. This is due to the change in series reactor status of the lines located on the interface.

Table 5: Summary of Voltage Constrained Transfer Limits

Interface	2015 Comprehensive Review (Study Year 2020)		2019 Transfers (Study Year 2024)	
	Pre-Contingency Low	95% of Nose	Pre-Contingency Low	95% of Nose
Dysinger East	2,950 (A)	3,000 (B)	2,975 (C)	3,100 (L)
West Central	1,525 (A)	1,650 (B)	1,775 (C)	1,900 (M)
Volney East	4,300 (D)	4,400 (E)	4,700 (F)	5,450 (N)
Central East	2,650 (D)	2,725 (E)	3,250 (F)	3,800 (E)
UPNY-SENY	5,850 (G)(1)(2)	5,875 (H)(1)(2)	6,075 (G)(1)(3)	6,475 (O)(1)(3)
UPNY-CONED	5,550 (I)(1)(2)	5,625 (H)(1)(2)	7,750 (I)(1)(3)	8,025 (K)(1)(3)
Dunwoodie South	5,275 (J)(1)(2)	5,525 (H)(1)(2)	5,925 (P)(1)(3)	6,325 (K)(1)(3)

Notes:
Pre-Contingency Low is the pre-contingency power flow at which the pre/post-contingency voltage falls below the voltage limit criteria.
At “Nose Point” is 95% of the pre-contingency power flow at the “nose” of the post-contingency PV curve.

A. Station 80 345 kV bus voltage pre-contingency low limit.
B. 95% of PV nose occurs for breaker failure at N. Rochester 345 kV (L/O Rochester-Pannell 345 kV and N. Rochester-Rochester 345 kV).
C. Rochester 345kV bus voltage pre-contingency low limit.
D. Edic 345 kV bus voltage pre-contingency low limit.
E. 95% of PV nose occurs for L/O northern Marcy South double circuit. (L/O Marcy-Coopers Corners 345 kV and Edic-Fraser 345 kV).
F. Marcy 345 kV bus voltage pre-contingency low limit.
G. Pleasant Valley 345 kV bus voltage pre-contingency low limit.
H. 95% of PV nose occurs for L/O Tower 34/42 (Dolson-Rock Tavern 345 kV and Coopers Corners-Rock Tavern 345 kV).
I. Millwood 345 kV bus voltage pre-contingency low limit.
J. Dunwoodie 345 kV bus voltage pre-contingency low limit.
K. 95% of PV nose occurs for L/O Tower W89/W90 (Dunwoodie-Pleasantville E 345 kV and Dunwoodie-Pleasantville E 345 kV).
L. 95% of PV nose occurs for L/O Tower 77/78 (Huntley to Packard 230 kV).
M. 95% of PV nose occurs for L/O Niagara - Dysinger 345 kV and L/O Somerset - Dysinger 345 kV.
N. 95% of PV nose occurs for L/O Edic - Princetown 345 kV and L/O Edic - Fraser (EF-24-40) 345 kV.
O. 95% of PV nose occurs for L/O: Tower Y88/Y94 (Buchanan S – Lovett 345 kV and Buchanan N to Ramapo 345 kV).
P. Sprainbrook 345 kV bus voltage pre-contingency limit.

1. Ramapo PAR1 and PAR2 are scheduled at 80% of the RECO load.
2. Dunwoodie North PAR1 and PAR2 are scheduled at 115 MW each into NYC.
   Dunwoodie South PAR is scheduled at 235 MW into NYC.
   Sherman Creek PAR1 and PAR2 are scheduled at 200 MW each into NYC.
   Parkchester PAR1 and PAR2 are scheduled at 245 MW each into NYC.
3. Dunwoodie North PAR1 and PAR2 are scheduled at 95 MW each into NYC.
   Dunwoodie South PAR is scheduled at 220 MW into NYC.
   Sherman Creek PAR1 and PAR2 are scheduled at 220 MW each into NYC.
   Parkchester PAR1 and PAR2 are scheduled at 250 MW each into NYC.

4. Stability Transfer Analysis

4.1. Stability Transfer Methodology

The dynamic data for this analysis is developed from the NPCC 2019 BCD library. This data includes generator, exciter, power system stabilizers, SVC, DC transmission controller, turbine governor, relay, and other miscellaneous models that provide dynamic control to the electrical system. The load model has significant impact on the stability performance of the New York transmission system. The primary load model in the NPCC 2019 BCD library is comprised of 100% constant impedance for both active and reactive power load for the NYCA and New England areas. The real power load models used for the other Planning Areas are: constant current (power varies with the voltage magnitude) for Hydro Quebec, New Brunswick, MRO, RFC, SERC, and SPP; 50% constant current/50% constant impedance for Ontario, Nova Scotia, and Cornwall; and 90% constant current/10% constant impedance for FRCC. The reactive load is modeled as constant impedance for FRCC, MRO, RFC, SERC, SPP, and all NPCC areas except Hydro Quebec, which uses a 13% constant current and 87% constant impedance.

Starting with the 2024 summer peak load stability base case, the NYISO created four NYCA margin cases (UPNY margin, Central East margin, West Central margin, and Moses South margin). The margin cases are used to evaluate the stability performance of the NYCA system against normal design criteria contingencies to evaluate if the interfaces are restricted by a stability constraint (*i.e.,* stability transfer limit). For each margin case, the power flow on the affected interfaces are tested at a value of at least 200 MW or 10% above the more restrictive of the emergency thermal or voltage transfer limit. If there are no stability violations at this margin transfer level, this testing provides that the stability limit is higher than the emergency thermal or voltage transfer level.

The Central East margin case has the Oswego Complex generation dispatched at an output of 3,735 MW and 1,257 MW of import from Hydro Quebec (supplied by Beauharnois hydro generation) with the Chateauguay HVdc poles out-of-service to exclude the dynamic benefit of the HVdc controls. The Central East interface of the Central East margin case is loaded at 3,575 MW. The Central East Interface limit is more limiting at 3,250 MW (for voltage collapse).

The UPNY margin case has the Oswego Complex generation dispatched at an output of 4,750 MW and 1,257 MW of import from Hydro Quebec (supplied by Beauharnois hydro generation) with the Chateauguay HVdc poles out-of-service to exclude the dynamic benefit of the HVdc controls. The UPNY-SENY and UPNY-Con Edison open interfaces of the UPNY margin case are loaded at 7,475 MW and 8,675 MW, respectively. The Central East interface of the UPNY margin case is loaded at 3,225

MW. The UPNY-SENY voltage limit is more limiting at 6,075 MW, and UPNY-Con Edison is voltage limited at 7,750 MW. The Ramapo PARs are scheduled at 130 MW each into New York.

The Western margin case is loaded to the following open interface levels: Dysinger East 3,000 MW, West Central 1,800 MW, Ontario-to-New York 2,650 MW, and HQ-to-New York 1,100 MW (Chateauguay HVdc 822 MW, Beauharnois 286 MW). The Dysinger East and West Central interfaces are thermally limited at 2,700 MW and 1,525 MW for emergency transfer conditions, respectively.

The Moses South margin case has the Moses South open interface loaded to 2,575 MW, HQ-to-New York 1,781 MW (Chateauguay HVdc 973 MW, Beauharnois 808 MW), and the St. Lawrence L33/34 PARs scheduled at 150 MW each. The Moses South interface emergency thermal limit is more limiting at 2,325 MW.

4.2. Stability Analysis Results

For the margin cases, there are no stability-limited interfaces in the NYCA when tested at transfer levels that are the greater of 200 MW or 10% above the more restrictive of the emergency thermal or voltage transfer limit for normal design criteria faults.

This PTC Assessment demonstrates that the New York State BPTF system meets the criteria for stability performance. The New York State BPTF system security is maintained by limiting power transfers according to the determined stability limits. The PTC Assessment performed dynamic stability simulations for those contingencies expected to produce the more severe system impacts based on examination of actual system events and assessment of changes to the planned system. This analysis did not determine actual stability transfer limits, but shows that the stability limits are not more limiting than the emergency thermal or voltage-based transfer limits. All contingencies evaluated are stable, damped, and no generating unit lost synchronism other than by fault clearing action or special protection system response.

5. Conclusion

Table 6 provides a summary of the normal and emergency transfer limits for the open transmission interfaces used in the NYISO transmission planning studies. These results confirm that the planned system meets the applicable reliability criteria. Additionally, the application of design criteria contingencies shows no loss of a major portion of the system or unintentional separation of a major portion of the system. By limiting power transfers consistent with the transfer limits reported in this review, the security of the New York State BPTF will be maintained and projected demand will be supplied in accordance with NPCC Transmission Design Criteria [4] and NYSRC Reliability Rules [5]. The NYISO did not identify marginal conditions that warranted analysis beyond the five-year study period.

Table 6: Transfer Limit Comparison

Interface	2015 Comprehensive Review (Study Year 2020)				2019 Transfers (Study Year 2024)			
	Normal (MW)		Emergency (MW)		Normal (MW)		Emergency (MW)	
Dysinger East	1,750	T	2,325	T	1,800	T	2,700	T
West Central	400	T	975	T	625	T	1,525	T
Volney East	4,125	T	4,300	V	4,700	V	4,700	V
Moses South	2,350	T	2,350	T	2,325	T	2,325	T
Central East	2,350	T	2,650	T/V	3,250	V	3,250	V
Total East	4,850	T	5,100	T	6,075	T	6,750	T
UPNY-SENY	5,075	T	5,300	T	6,075	V	6,075	V
UPNY-CONED	4,950	T	5,550	V	7,525	T	7,750	V
Dunwoodie South	5,275	V	5,275	V	5,750	T	5,750	T
LIPA Import	1,700	T	2,250	T	1,700	T	2,325	T

Notes:
- Transfer limits expressed in MW and rounded down to nearest 25 MW point.
- Thermal and voltage limits apply under summer peak load conditions.
- Emergency limits account for more restrictive voltage collapse limit.
- Limits determined in this study are not optimized.

Type Codes
T – Thermal
V – Voltage Pre/Post-contingency low limit

References

1. New York Independent System Operator, “Methodology for Assessment of Transfer Capability in the Near-Term Transmission Planning Horizon”, Version 3, Dated June 8, 2018.
2. New York Independent System Operator, “2019 Interim Area Transmission Review of the New York State Bulk Power Transmission System”, Final Report, dated December 23, 2019.
3. North American Electric Reliability Corporation, “Transmission System Planning Performance Requirements” TPL-001-4.
4. Northeast Power Coordinating Council, “NPCC Regional Reliability Reference Directory #1, Design and Operation of the Bulk Power System”, Version 2, dated September 30, 2015.
5. New York State Reliability Council, “Reliability Rules and Compliance Manual”, Version 44, dated April 11, 2019.
6. North American Electric Reliability Corporation, “Assessment of Transfer Capability for the Near-Term Transmission Planning Horizon”, FAC-013-2.
7. New York Independent System Operator, “Emergency Operations Manual”, Table A.2 Bus Voltage Limits and Table A.3 Bus Voltage Limits for Various Sensitivities, Version 7.5, dated July 2, 2019.
8. New York Independent System Operator, “Transmission Expansion and Interconnection Manual”, Attachment H: NYISO Transmission Planning Guideline #3-1 – Guideline for Stability Analysis and Determination of Stability-Based Transfer Limits, Version 4.0, dated August 2, 2019.