New York ISO
Independent System Operator

2020 Comprehensive Area Transmission Review of the New York State Bulk Power Transmission System
(Study Year 2025)

A Draft Report by the
New York Independent System Operator

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Caution and Disclaimer

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Executive Summary

The New York Independent System Operator (NYISO) conducts an annual Area Transmission Review (ATR) of the New York State Bulk Power System (BPS) as required by the Northeast Power Coordinating Council (NPCC) and the New York State Reliability Council (NYSRC). The purpose of this assessment is to demonstrate conformance with the applicable NPCC Directory #1 and NYSRC Reliability Rules. The ATR is prepared in accordance with NPCC and NYSRC procedures for Area Transmission Reviews as well as NYISO guidelines and procedures. In the ATR the NYISO evaluates the Bulk Power Transmission Facilities (BPTF), which include all of the facilities designated by the NYISO to be part of the BPS in accordance with NPCC and the NYSRC requirement and certain other non-BPS facilities. Although this Comprehensive ATR analyzed the BPTF, only BPS facilities are subject to NPCC Directory #1 and the NYSRC Reliability Rules.

This report comprises the 2020 NYISO Comprehensive Area Transmission Review (CATR) of the planned system for the year 2025. The 2015 NYISO CATR (approved by the NYSRC in March 2016 and by the NPCC Reliability Coordinating Council (RCC) in June 2016) was the last comprehensive review. In 2017 and 2019, the NYISO completed interim reviews; intermediate reviews were completed in 2016 and 2018.

The system representations of neighboring areas are from the interregional transmission planning coordination conducted under the NPCC and Eastern Interconnection Reliability Assessment Group (ERAG) Multiregional Modeling Working Group (MMWG) processes. For the 2020 CATR, the external area representations are from the 2019 ERAG MMWG series library cases. The New York Control Area (NYCA) system representation is from the NYISO 2020 FERC 715 filing power flow models with updates according to the NYISO *2020 Load & Capacity Data Report* (Gold Book).

Changes to the five-year case for this review (2025) compared to the five-year case for the 2015 CATR (2020) include a 2,598 MW decrease in load forecast, a decrease of approximately 5,877 MW in capacity resources, the non-renewal of the 1,000 MW wheeling agreement between Con Edison and the Public Service Electric and Gas (PSE&G), and the inclusion of the Western New York and AC Transmission public policy transmission projects. The case assumptions used in this ATR are the same as those used for the *2020 Reliability Needs Assessment* (RNA) [17].

In 2019, the New York State Department of Environmental Conservation adopted a regulation to limit nitrogen oxides (NOx) emissions from simple-cycle combustion turbines (referred to as the "Peaker Rule[1]"). Combustion turbines known as "peakers" typically operate to maintain bulk power system

[1] https://www.dec.ny.gov/regulations/116131.html

reliability during the most stressful operating conditions, such as periods of peak electricity demand. Many of these units also maintain transmission security by supplying energy within certain constrained areas of New York City and Long Island – known as load pockets. The Peaker Rule, which phases in compliance obligations between 2023 and 2025, will impact turbines located mainly in the lower Hudson Valley, New York City, and Long Island. The Peaker Rule required all impacted plant owners to file compliance plans by March 2, 2020. The plans indicate approximately 1,500 MW of peaker capability would be unavailable during the summer by 2025 to comply with the emissions requirements.

Five assessments and two reviews were conducted to complete this CATR.

The first assessment evaluates the transmission security and stability of the planned system for year 2025. Transmission security is the ability of the power system to withstand disturbances, such as electric short circuits or unanticipated loss of system elements, and continue to supply and deliver electricity. Transmission security is assessed deterministically with potential disturbances being applied without concern for the likelihood of the disturbance in the assessment. These disturbances are categorized as planning design criteria contingencies and are explicitly defined in NPCC Directory #1 [1] and NYSRC Reliability Rules [2]. Power system stability is a property of a power system that evaluates if the system will remain in operating equilibrium when subjected to disturbances, such as electric short circuits or unanticipated loss of system elements. Stability is assessed under both N-1 and N-1-1 conditions.

As observed in the *2020 RNA*, with the peakers unavailable the BPTF could not securely and reliably serve the forecasted load in New York City (Zone J). With the full implementation of the Peaker Rule in 2025, several 345 kV circuits in the Con Edison service territory would not meet thermal transmission security requirements equating to a thermal deficiency of 700 MW. In 2025, the thermal deficiency may be observed for approximately nine hours (3,853 MWh). Additionally, dynamics transmission security issues are observed which include low transient voltage response, loss of generator synchronism, and undamped voltage oscillations. The dynamics deficiency, as measured in terms of compensatory MVA to address these issues, is 1,020 MVA.

Compensatory MW/MVA amounts are determined by adding generic “perfect capacity” resources to NYISO zones or substations to effectively satisfy the needs. “Perfect capacity” is a term used to describe resources that are always able to produce energy on demand, without any limitations due to factors such as equipment failures or lack of fuel, without energy duration limitations, and without consideration of transmission security or interface impacts. Actual resources would need to be larger in order to achieve the same impact as perfect-capacity resources. The Reliability Needs could be met by combinations of solutions including generation, transmission, energy efficiency, demand response measures, or changes in operating protocols.

Before the CATR was completed, three updates were received that resolved the reliability issues noted in the CATR.

The first update involved a reduction of the load forecast. At a November 19, 2020 stakeholder meeting the NYISO presented an updated peak load forecast to account for the expected impact of COVID-19 and the associated economic and societal effects. The total NYCA reduction in forecast for the summer 2025 peak is 240 MW. Specifically, the Zone J peak load forecast decreased by 323 MW.

The second update involved Con Edison Local Transmission Plan (LTP) updates. At a January 25, 2021 stakeholder meeting, Con Edison presented an update to their Local Transmission Plan (LTP) to address thermal deficiencies in their Astoria East/Corona 138 kV Transmission Load Area (TLA) and Greenwood/Fox Hills 138 kV TLA. The Con Edison LTP update includes three new 345/138 kV PAR controlled 138 kV feeders at Rainey – Corona (planned in-service date by summer 2023), Gowanus – Greenwood (planned in-service date by summer 2025) and Goethals – Fox Hills (planned in-service date by summer 2025).[2]

The third update was a solution submitted by Con Edison in response to a solicitation in the NYISO Short-Term Reliability Process (STRP) for a reliability need occurring in 2023 that was first identified in the 2020 Quarter 3 Short-Term Assessment of Reliability (STAR).[3] The Con Edison solution changes the planned series reactor status by placing the 71, 72, M51 and M52 series reactors in-service, while by-passing the series reactors on the 41, 42, and Y49 transmission lines. The NYISO selected the Con Edison solution as fulfilling the identified need.[4]

With these three updates, all thermal and stability violations are resolved. As such, no Corrective Action Plans are needed for this CATR.

In the second assessment, power flow and stability analysis are conducted to evaluate the performance of the BPS for low probability extreme contingencies as defined in NPCC Directory #1 and NYSRC Reliability Rules. The power flow analysis results indicate that most of the extreme contingencies do not cause significant thermal or voltage violations over a widespread area. The stability analysis results indicate that the system remains stable for most extreme contingencies. In a few cases, a steady state extreme contingency may result in a loss of local load or reduction of local generation within an area due

[2] Meeting material for the November 19, 2020 ESPWG/TPAS and January 25, 2021 ESPWG/TPAS: https://www.nyiso.com/espwg

[3] https://www.nyiso.com/documents/20142/16004172/2020-Q3-STAR-Report-vFinal.pdf/

[4] https://www.nyiso.com/documents/20142/15930753/2020-Quarter-3 Short-Term-Reliability-Process-Report-vFinal3.pdf/

to low voltage or thermal violations.

The third assessment evaluates the fault current duty at BPTF buses in the short circuit representation. No overdutied breakers are observed in this assessment.

The fourth assessment evaluates extreme system conditions, which have a low probability of occurrence (e.g., high peak load conditions resulting from extreme weather and the loss of fuel (gas) supply). For both the high peak load and loss of gas supply conditions, the power flow analysis results indicate that these system conditions do not cause thermal or voltage violations on the BPTF.

In order to perform the dynamics assessment for the extreme weather condition, the NYISO had to add dynamic support to the cases to pass the disturbance-based test criteria. To pass the disturbance-based test the system is required to respond such that electrical power deviations of more than 1 MW or 1 MVAR are not observed. Due to the simulation not passing the disturbance-based test, the 1,020 MVA compensatory resources observed in the transmission security dynamics assessment were added to the model. These resources were added to the model as representations for the future solutions needed to address the baseline transmission security issues. With the compensatory MVA, the dynamics assessment passed the disturbance based test. Additionally, with the compensatory MVA all evaluated stability events indicated stable and damped response.

For the loss fuel supply (gas) assessment, the stability analysis results show that most contingencies are stable and damped. For instances where instabilities are observed, an evaluation of implementing a change to design or operating practices to address the issues was conducted. This evaluation concludes that about 400 MVA of dynamic reactive capability would be needed to meet dynamics reliability criteria.

The fifth assessment evaluates other requirements specific to the NYSRC Reliability Rules. The NYSRC requirements include: System Restoration Assessment and Local Operation Area criteria. The planned system meets these NYSRC Reliability Rules.

The first review conducted for this CATR evaluates Special Protection Systems (SPS). New York has added new SPS since the 2015 CATR. Some SPS have been retired since the 2015 CATR but these retirements have passed the NPCC SPS retirement evaluation. Changes in system conditions have not impacted the operation or classification of existing SPS as well as the classification of new SPS. The utilization of the SPS are not expected to change.

The second review conducted for this CATR evaluates exclusions to NPCC Directory #1 criteria. The NYCA has no existing exclusions to NPCC Basic Criteria and no requests for new exclusions have been made.

As the results of this ATR indicate, in consideration of the three base case updates, the planned bulk power transmission facilities, as planned through year 2025, conform to the applicable NPCC Directory #1 and NYSRC Reliability Rules.

Introduction

Background

The New York Independent System Operator (NYISO) conducts an annual Area Transmission Review (ATR) of the New York State Bulk Power System (BPS) as required by the Northeast Power Coordinating Council (NPCC) and the New York State Reliability Council (NYSRC). This study is prepared in accordance with NPCC Directory #1 [1] and NYSRC Reliability Rules and Compliance Manual (NYSRC Reliability Rules) [2], and NYISO guidelines and procedures [3]-[6]. Although this Comprehensive ATR (CATR) analyzed the BPTF, only BPS facilities are subject to NPCC Directory #1 and the NYSRC Reliability Rules. The ATR may conduct additional analysis to address the Long-Term Transmission Planning Horizon (years 6 through 10) if needed to address identified marginal conditions that may have longer lead-time solutions.

NPCC, a Regional Reliability Organization of the NERC, has established Regional Reliability Reference Directory #1 the "Design and Operation of the Bulk Power System" [1] which describes the Planning Design Criteria that apply to each Area of Northeastern North America. NPCC and NYSRC contingencies are consistent with or more stringent than the NERC planning events [8] for BPS elements. As part of NPCC's ongoing reliability compliance and enforcement program, NPCC requires each of the five NPCC Areas (New York, New England, Ontario, Quebec, and Maritimes) to conduct and present an annual ATR: an assessment of the reliability of the planned bulk power transmission system within the Planning Coordinator Area and the transmission interconnections to other Planning Coordinator Areas for a study year timeframe of 4 to 6 years from the reporting date. The process for compliance with NPCC requirements for the annual ATR is outlined in NPCC Directory #1 [1], "Appendix B – Guidelines and Procedures for NPCC Area Transmission Review.

The NYSRC has established rules for planning and operating the New York State BPS [2]. The NYSRC Reliability Rules [2] are consistent with and in certain cases more specific or more stringent than the NPCC Directory #1 Planning Design Criteria [1]. The process for compliance with the NYSRC requirements for the annual ATR is outlined in the NYSRC Reliability Rules [2] Section 4, "NYSRC Procedure for New York Control Area Transmission Reviews."

The Guidelines and Procedures for NPCC Area Transmission Reviews require each Area to conduct a Comprehensive Area Transmission Review (CATR) at least every five years and to conduct either an Interim or Intermediate ATR in each of the years between CATRs, as appropriate. This assessment is conducted in accordance with the requirements for a Comprehensive Review, as described in NPCC Directory #1 [1]. The previous CATR of the New York State BPTF was performed in 2015 (assessed the planned year 2020) and approved by the NYSRC in March 2016 and by the NPCC Reliability Coordinating Council (RCC) in June 2016.

This 2020 CATR assesses the planned year 2025 system. The planned system includes the updated forecast of system conditions, including a number of proposals for new, retired, or cancelled generation and transmission facilities since the previous CATR [9]. The case assumptions used in this ATR are the same as those used for the 2020 *Reliability Needs Assessment* (RNA).

As the results of this ATR indicate, the planned bulk power transmission facilities will not be in conformance with NPCC Directory #1 and the NYSRC Reliability Rules. The corrective action plan to achieve conformance with NPCC Directory #1 and the NYSRC Reliability Rules is to obtain solutions to the observed criteria violations through the Reliability Planning Process. The first step in the Reliability Planning Process is the RNA, which was completed in November 2020 and identified identical reliability criteria violations as are reported in this ATR. Following the completion of the RNA, the NYISO will consider system updates that meet the inclusion rules, and if necessary, will solicit solutions to the remaining Reliability Needs. The NYISO would then proceed to assess the viability and sufficiency of each of the solutions, as well as to evaluate and select the more efficient and cost effective transmission solution(s) to satisfy the needs, leading to the development of the Comprehensive Reliability Plan (CRP). The CRP provides the plan to maintain system reliability and documents the solutions determined to be viable and sufficient to meet any identified Reliability Needs.

The next NYISO Area Transmission Review will re-evaluate the areas of the system impacted by these violations and the associated solutions to maintain the security of the New York State BPTF and supply the projected demand.

Facilities Included in this Review

The system representations of neighboring areas are from the interregional transmission planning coordination conducted under the NPCC and Eastern Interconnection Reliability Assessment Group (ERAG) Multiregional Modeling Working Group (MMWG) processes. For the 2020 CATR, the external area representation is from the 2019 ERAG MMWG series library cases. The New York Control Area (NYCA) system representation is from the NYISO 2020 FERC 715 filing power flow models with updates according to the NYISO *2020 Load & Capacity Data Report* (Gold Book) [10].

The New York State BPS, as defined by NPCC and the NYSRC Reliability Rules, primarily consists of approximately of 4,200 miles of 765, 500, 345, and 230 kV transmission. Only a few hundred miles of the approximately 7,000 miles of 138 and 115 kV transmission is also considered to be part of the New York

State BPS. Also included in the New York State BPS, per the NYSRC Reliability Rules [2], are a number of large generating units (generally 300 MW or larger).

The New York State BPTF defined in this review includes all BPS facilities, as defined by the NPCC and the NYSRC, as well as other transmission facilities that are relevant to planning the New York State transmission system. The New York State BPTF are listed in Appendix A. The remaining non-BPTF transmission facilities are evaluated by the local Transmission Owners in their transmission areas and coordinated through the NYISO Local Transmission Planning Process.

As part of this review, the NYISO performs simulations in accordance with the NPCC Classification of Power System Elements (Document A-10) methodology [11] to determine any change in BPS status to existing or planned transmission facilities. A-10 evaluations are performed on planned substations as well as existing substations with planned changes on facilities that also connect to existing BPS substations. For this CATR, 9 substations were evaluated: (1) Alps 345 kV, (2) Princetown 345 kV, (3) Rotterdam 345 kV, (4) Knickerbocker 345 kV, (5) Rotterdam 230 kV, (6) Ball Hill Wind 230 kV, (7) Chases Lake 230 kV, (8) Baron Wind 230 kV, and (9) Rotterdam 115 kV. The results of the A-10 testing and the list of BPS facilities are documented in Appendix B.

The transmission plans shown in Figure 1below reflect the changes in BPTF since the 2015 CATR. Proposed major changes to generation projects included in the base case are listed in Figure 2 and Figure 3. Figure 4 provides a summary of the units that are unavailable during the summer capability period. Additional changes to transmission plans, generation additions/up-rates, or shutdowns/de-ratings that occurred following the publication of the NYISO *2020 Gold Book* [10] will be captured in future reviews.

Figure 1: Changes in the Bulk Power Transmission Facilities

Bulk Transmission	2015 Comprehensive ATR	2020 Comprehensive ATR
	Included/IS Date	Included/IS Date
CPV Valley 345 kV Substation (Q#251) (Dolson Ave.)	Y/2016-05	Y/In-Service
Leeds-Hurley Series Compensation SDU	Y/2018S	Y/2021S
Rochester Transmission Reinforcement 345 kV Substation (Q#339)	Y/2019W	Y/2020W
Con Edison Rainey-Corona Transformer/Phase Shifter	Y/2019S	Y/In-Service
Con Edison Goethals-Linden 345 kV feeder separation	Y/2016S	Y/In-Service
NYPA Marcy-Coopers Corners 345 kV series compensation	Y/2016S	Y/In-Service
NYPA Edic-Fraser 345 kV series compensation	Y/2016S	Y/In-Service
NYPA Fraser-Coopers Corners 345 kV series compensation	Y/2016S	Y/In-Service

Bulk Transmission	2015 Comprehensive ATR	2020 Comprehensive ATR
	Included/IS Date	Included/IS Date
NYSEG Watercure 345/230 kV Transformer	Y/2018S	Y/2020W
NYSEG Coopers Corners 345 kV Shunt Reactor	Y/2015S	Y/In-Service
NYSEG Gardenville 230/115 kV Transformer	Y/2017S	Y/2023W
NYSEG/N. Grid Five Mile Rd 345 kV (New Substation)	Y/2015W	Y/In-Service
NYSEG Mainesburg (Q#394)	Y/2015S	Y/In-Service
RG&E Station 122 Station Upgrade (Transformers)	Y/2016W	Y/In-Service
O&R Sugarloaf 345/138 kV (New Substation)	Y/2016S	Y/In-Service
Feeder 76 Ramapo to Rock Tavern (Q#368)	Y/2016S	Y/In-Service
N. Grid Porter Reactors	Y/2017W	Y/In-Service
N. Grid Clay – Lockheed Martin 115 kV reconductoring	Y/2016W	Y/In-Service
N. Grid Clay – Dewitt 115 kV reconductoring	Y/2017W	Y/2021S
N. Grid Clay – Teall 115 kV reconductoring	Y/2017W	Y/2021S
N. Grid Clay-Woodard 115 kV (conductor clearance)	Y/2015W	Y/In-Service
N. Grid Packard – Huntley 77/78 Series Reactors	N/2016S	Y/In-Service
N. Grid Eastover Road 230/115 kV Transformer	N/2017S	Y/In-Service
O&R Lovett 345 kV (New Station)	N/2018S	Y/2021S
NextEra Energy Transmission Empire State Line Project (Q#545A)	N/A	Y/2022S
Con Edison E. 13th Street station reconfiguration (Transformers 12 & 13)	N/A	In-Service
Con Edison E. 13th Street station reconfiguration (Transformers 14 & 15)	N/A	In-Service
Con Edison E. 13th Street station reconfiguration (Transformers 10 & 11)	N/A	In-Service
N. Grid Edic MV Edge (Transformers 5 & 6)	N/A	In-Service
NYSEG South Perry 230 kV (New Substation)	N/A	In-Service
NYSEG Oakdale 345/115/34.5 Transformer	N/A	N/2027S
NYSEG Fraser 345/115 Transformer	N/A	Y/2022W
NYSEG Coopers Corners 345/115 Transformer	N/A	N/2025W
NYSEG Wood St. 345/115 Transformer	N/A	Y/2023W
Cricket Valley Energy Center 345 kV Substation (Q#444)	N/A	Y/In-Service
LS/NYPA (Q#556) Segment A Double Circuit	N/A	Y/2023W
NY Transco (Q#543) Segment B	N/A	Y/2023W
NYSEG South Perry 230/115 kV Transformer	N/A	Y/2022W
PSEG Long Island Kings Highway 138 kV (New Substation)	N/A	In-Service
Con Edison B3402 and C3403 Cables	N/A	Out-of-Service

Figure 2: Additions/Up-rates in Generation Facilities[1]

Additions/Up-rates	Queue	Size (MW)	2015 Comprehensive ATR	2020 Comprehensive ATR
			Included/IS Date	Included/IS Date
CPV Valley Energy Center	251	670.9	Y/2017-10	Y/In-Service
Rochester Gas & Electric Station 2	338	8.5	N/A	Y/In-Service
Cassadaga Wind	387	126.5	N/A	Y/2021-12
Copenhagen Wind	395	79.9	N/A	Y/In-Service
Baron Wind	396	238.4	N/A	Y/2021-12
Bethlehem Energy Center Uprate	403	72	N/A	Y/In-Service
Arkwright Summit	421	78.4	N/A	Y/In-Service
Eight Point Wind	422	101.8	N/A	Y/2021-12
Cricket Valley Energy Center II	444	1020	N/A	Y/In-Service
East River 1 Uprate	461	2	N/A	Y/In-Service
East River 2 Uprate	462	2	N/A	Y/In-Service
Shoreham Solar	467	25	N/A	Y/In-Service
Riverhead Solar	477	20	N/A	Y/In-Service
Ball Hill Wind	505	100	N/A	Y/2022-12
Roaring Brook Wind	546	79.7	N/A	Y/2021-12
Calverton Solar Energy Center	678	22.9	N/A	Y/2021-12

Notes:

1. The values noted in this figure are from 2020 Gold Book Table IV-3, IV-4, and IV-5.

Figure 3: Shutdowns/De-ratings in Generation[1]

Shutdowns/ De-ratings	Size (MW)	2015 Comprehensive ATR	2020 Comprehensive ATR
		Included/OS Date	Included/OS Date
Ravenswood 04	12.9	In-service	Out-of-Service
Ravenswood 05	15.5	In-Service	Out-of-Service
Ravenswood 06	12.6	In-Service	Out-of-Service
Niagara Bio-gen	39.7	In-Service	Out-of-Service
Dunkirk 2	75	In-Service	Out-of-Service
Dunkirk 3	185	In-Service	Out-of-Service
Dunkirk 4	185	In-Service	Out-of-Service
Huntley 67	187.9	In-Service	Out-of-Service
Huntley 68	189.5	In-Service	Out-of-Service
Astoria GT 05	12.3	In-Service	Out-of-Service
Astoria GT 07	11.5	In-Service	Out-of-Service
Astoria GT 08	11.4	In-Service	Out-of-Service
Astoria GT 10	18.4	In-Service	Out-of-Service
Astoria GT 11	16.5	In-Service	Out-of-Service
Astoria GT 12	17.7	In-Service	Out-of-Service
Astoria GT 13	16.9	In-Service	Out-of-Service
Binghamton	43.7	In-Service	Out-of-Service
Ravenswood 09	16.3	In-Service	Out-of-Service
Indian Point 2	1011.5	In-Service	Out-of-Service
Indian Point 3	1036.3	In-Service	2021-04
Albany LFGE	5.6	In-Service	Out-Of-Service
Somerset	676.4	In-Service	Out-Of-Service
Cayuga 1	151.0	Out-Of-Service	Out-Of-Service
Cayuga 2	139.6	Out-Of-Service	Out-Of-Service
West Babylon 4	50.2	In-Service	Out-Of-Service
Monroe Livingston	2.4	In-Service	Out-Of-Service
Steuben County LF	3.2	In-Service	Out-Of-Service
Hudson Ave 3	16.6	In-Service	Out-Of-Service
Hudson Ave 4	14.0	In-Service	Out-Of-Service
Auburn-State St.	4.1	In-Service	Out-Of-Service
Glenwood GT 01	11.4	In-Service	Out-Of-Service
Ravenswood GT 2-1, 2-2, 2-3, 2-4, 3-1, 3-2, and 3-4	213.4	In-Service	Out-Of-Service
Lyonsdale	19.3	In-Service	Out-Of-Service

Notes:

1. The values noted in this figure are from 2020 Gold Book Table IV-3, IV-4, and IV-5.

Figure 4: Proposed Status Change to Comply with DEC Peaker Rule[1]

Owner	Station Name	Zone	Nameplate (MW)	Summer Capability (MW)	Winter Capability (MW)	Status Change Date
Central Hudson Gas & Elec. Corp.	Coxsackie GT	G	21.6	20.2	23.9	5/1/2023
Central Hudson Gas & Elec. Corp	South Cairo	G	21.6	18.1	22.5	5/1/2023
Consolidated Edison Co. of NY, Inc.	74 St. GT 1 & 2	J	37	35.2	40.9	5/1/2023
NRG Power Marketing, LLC	Astoria GT 2-1, 2-2, 2-3, 2-4	J	186	141.8	185.4	5/1/2023
NRG Power Marketing, LLC	Astoria GT 3-1, 3-2, 3-3, 3-4	J	186	140.8	181.8	5/1/2023
NRG Power Marketing, LLC	Astoria GT 4-1, 4-2, 4-3, 4-4	J	186	132.8	176.2	5/1/2023
Astoria Generating Company, L.P.	Gowanus 1-1 through 1-8	J	160	138.2	180.6	5/1/2023
Astoria Generating Company, L.P.	Gowanus 4-1 through 4-8	J	160	135.3	184.8	5/1/2023
Consolidated Edison Co. of NY, Inc.	Hudson Ave 5	J	16.3	14.2	20.2	5/1/2023
Helix Ravenswood, LLC	Ravenswood 01	J	18.6	8.1	10.1	5/1/2023
Helix Ravenswood, LLC	Ravenswood 10	J	25	16.5	24.4	5/1/2023
Helix Ravenswood, LLC	Ravenswood 11	J	25	16.4	22.4	5/1/2023
National Grid	Northport GT	K	16	11.7	15.1	5/1/2023
National Grid	Port Jefferson GT 01	K	16	12.9	16.6	5/1/2023
Consolidated Edison Co. of NY, Inc.	59 St. GT 1	J	17.1	15.6	20.3	5/1/2025
NRG Power Marketing, LLC	Arthur Kill GT 1	J	20	12	15	5/1/2025
Astoria Generating Company, L.P.	Astoria GT 01	J	16	14.1	19.1	5/1/2025
Astoria Generating Company, L.P.	Gowanus 2-1 through 2-8	J	160	142.3	190	5/1/2025
Astoria Generating Company, L.P.	Gowanus 3-1 through 3-8	J	160	135.5	182.8	5/1/2025
Astoria Generating Company, L.P.	Narrows 1-1 through 2-8	J	352	286.5	379.9	5/1/2025
	2023 Total		1,075.10	842.2	1,104.90	
	2025 Total		725.1	606	807.1	
	Total		1,800.20	1,448.20	1,912.00	

Notes:

1. Units listed have not provided a notice to the NYSPSC or completed a Generator Deactivation Notice with the NYISO.

For this 2020 CATR, the Con Edison series reactors located in Zones I and J are operated in the configuration shown in Figure 5 below compared to the 2015 CATR.

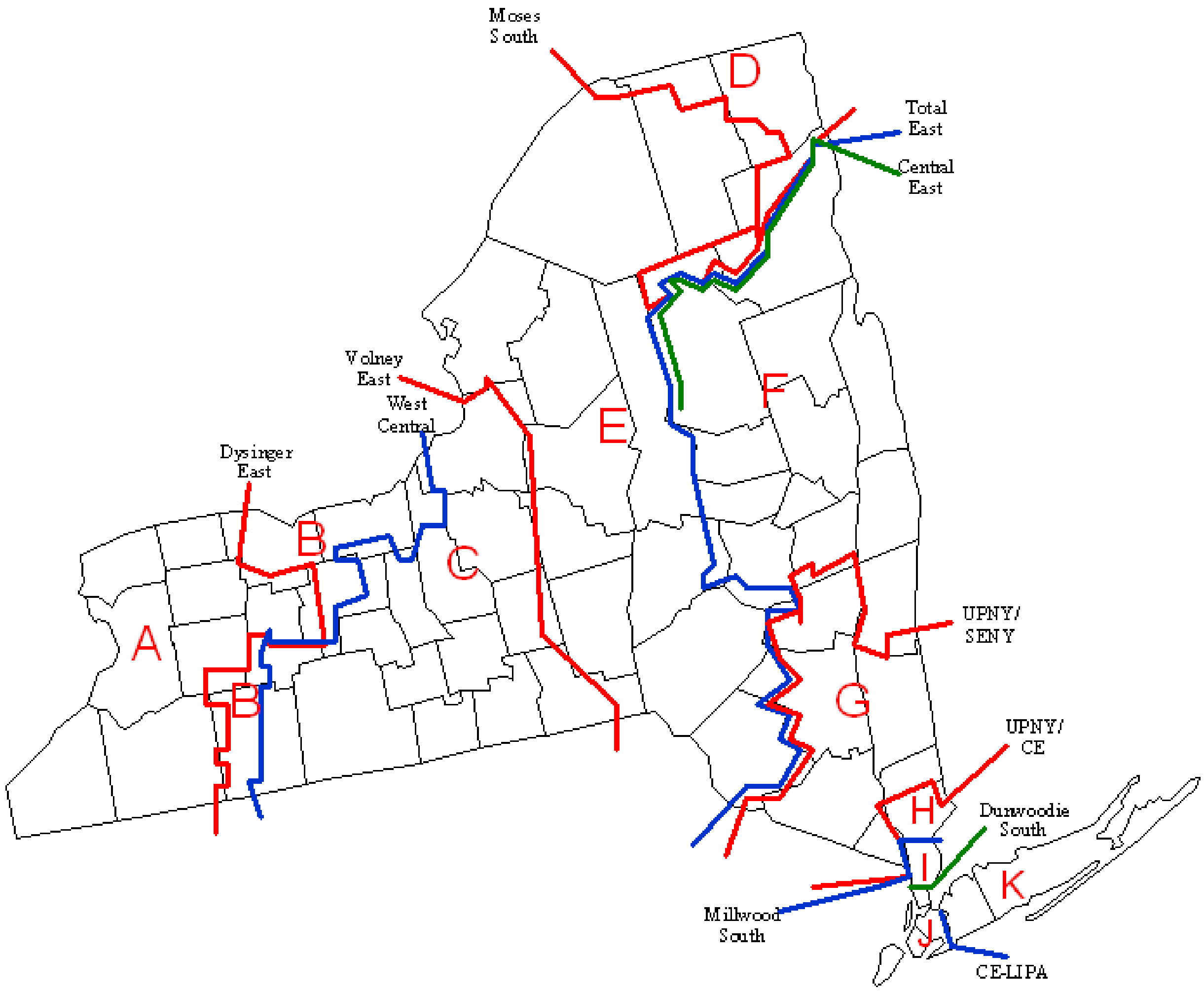
Figure 5: Con Edison Series Reactor Configuration

Series Reactor Terminals		ID	kV	2020 Configuration from 2015 CATR	2025 Configuration from 2020 CATR
Gowanus	Farragut	41	345	In-Service	In-Service
Gowanus	Farragut	42	345	In-Service	In-Service
Sprainbrook	East Garden City	Y49	345	Bypassed	In-Service
Sprainbrook	W. 49th St	M51	345	In-Service	Bypassed
Sprainbrook	W. 49th St	M52	345	In-Service	Bypassed
Dunwoodie	Mott Haven	71	345	In-Service	Bypassed
Dunwoodie	Mott Haven	72	345	In-Service	Bypassed

Interface Definitions

The NYISO monitors and evaluates the eleven major interfaces between the zones within the NYCA. Figure 6 below geographically depicts the NYCA interfaces and Locational Based Marginal Pricing (LBMP) load zones. The NYCA planning interfaces are: Dysinger East, West Central, Volney East, Moses South, Central East, Total East, UPNY-SENY, UPNY-ConEd, Millwood South, Sprainbrook-Dunwoodie South, and Long Island Import. The NYISO also evaluates the interfaces between the NYCA and all neighboring systems: IESO (Ontario), ISO-New England, and PJM. The Planning Interfaces are described in Appendix C.

Figure 6: NYCA Interfaces and LBMP Load Zones



Scheduled Transfers

Figure 7 below lists the NYCA scheduled inter-Area transfers modeled in all study cases between the NYCA and each neighboring system for study year 2025.

Figure 7: NYCA Scheduled Inter-Area Transfers

Region		Transaction (MW)
From	To	2025
NYCA	NE	83
NYCA	HQ	-1110
NYCA	PJM and Others	-817
NYCA	Ontario	0

Load and Capacity

Figure 8 below provides a comparison of the load, capacity, and reserve margin between the 2015 CATR and the 2020 CATR. As shown in Figure 8, the 2025 study year reserve margin is greater than the required Installed Reserve Margin (IRM) of 18.9% approved by the NYSRC for the 2020-2021 Capability Year [12].

Figure 8: Load and Capacity Forecast

Description	Comprehensive Review 2015 Forecast for Summer 2020	Comprehensive Review 2020 Forecast for Summer 2025	Change From Previous CATR
Peak Load (MW)	34,309	31,711	-2,598
Total Capacity (MW)	43,779 (1)	37,902 (2)	-5,877
Reserve Margin	27%	20%	-7%

Notes:

1. This amount is derived from the NYISO 2015 Gold Book and represents the 2020 Total Resource Capability from Table V-2a; net resource changes from Tables IV-1, IV-2a, IV-2b, and IV-3.
2. This amount is derived from the NYISO 2020 Gold Book and represents the 2025 Total Resource Capability from Table V-2a plus changes in generation facilities changes included in this review.

Steady State and Stability Conformance Assessment

The Steady State Assessment consists of thermal transfers, voltage transfers, and transmission security analyses. The Stability Assessment consists of stability transfer and transmission security analyses. A summary of the planning transfer capability is also discussed in this section.

Steady State and Stability Methodology

The analysis for the 2020 CATR is conducted in accordance with NPCC Transmission Directory #1 [1] and NYSRC Reliability Rules [2] planning criteria. The NYISO follows specific guidelines regarding the NYISO methodology for evaluating the performance of the New York State BPTF. Guidelines specific to thermal transfer limits, voltage transfer limits, and stability analysis are found in the NYISO Transmission Expansion and Interconnection Manual [3]-[5] and the Methodology for Assessment of Transfer Capability in the Near-Term Transmission Planning Horizon [13]. These guidelines conform to NPCC Directory #1, "Appendix B – Guidelines and Procedures for NPCC Area Transmission Reviews" [1] and the NYSRC Reliability Rules, "NYSRC Procedure for New York Control Area Transmission Reviews" [2]. The steady state and stability assessments respect all known planning horizon System Operating Limits (SOLs). The methodology used to define SOLs is provided in the NYISO methodology for determining System Operating Limits for the Planning Horizon [13].

The procedure to evaluate the performance of the New York State BPTF consists of the following basic steps:

1. Develop a mathematical model (or representation) of the NYCA and external electrical systems for the study period (in this case, the year 2025);
2. Develop various power flow study cases to model the system conditions (load and power transfer levels, commitment and dispatch of generation and reactive power devices) to be tested; and
3. Conduct steady state power flow and stability analysis to determine if the performance of the New York State BPTF, as modeled, meets the applicable Reliability Standards [1]-[2].

Description of Steady State and Stability Cases

The steady state power flow and stability models for evaluating the New York State BPTF performance are developed from 2019 ERAG MMWG series databases. The NYCA system representation is derived from the NYISO 2020 FERC 715 filing. Changes are made to the NYCA system representation to reflect the updates included in the NYISO 2020 Gold Book [10]. Additional adjustments to the case include the New York State Department of Environmental Conservation (DEC) adoption of a regulation to limit nitrogen oxides (NOx) emissions from simple-cycle combustion turbines (referred to as the “Peaker Rule”) generation removals, consistent with the decisions made for the NYISO Reliability Planning Process. Extended planned outages known at the start of the study are incorporated into the system model. Generation is dispatched to match load plus system losses while respecting transmission security. As a conservative planning assumption, all steady state peak load study cases assume wind generation is unavailable.

For the 2020 CATR, 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. As a conservative planning assumption, demand response is not considered to be available.

As part of the base case development process, transmission security analysis is performed on the base case using PowerGEM TARA software. If thermal or voltage violations are observed on the New York State BPTF, system adjustments (e.g., generator output or Phase Angle Regulator (PAR) taps) are made to satisfy the NPCC Directory #1 [1] and NYSRC Reliability Rules [2] planning criteria. This report documents this analysis.

Summer peak load stability margin transfer cases (West Central margin, Moses South margin, Central East margin, and UPNY margin cases) are created from the 2025 summer peak load case. In the margin cases, the transfer levels of the interfaces in western, northern, and southeastern New York are at least 200 MW or 11% higher than the lower of either the emergency thermal or the voltage constrained transfer limits in accordance with NYISO Transmission Planning Guideline #3-1 [5].

The extreme contingency steady state and stability cases are developed from their 2025 summer peak cases, respectively, with the intra-area interface flows adjusted to values not expected to be exceeded more than 25% of the time, but not more than the Normal Transfer Limit identified in this study.

The extreme weather system condition steady state and stability study cases are developed from their 2025 summer peak load base case with the load increased to meet the forecast statewide coincident high peak load (i.e., 90th percentile load – forecasted to be 33,576 MW at coincident peak) [10], reflecting weather conditions expected to occur no more than once in 10 years.

Figure 9 below provides a summary of the power flow schedule on the inter-area controllable ties in the study cases. Diagrams and descriptions of the study cases utilized can be found in Appendix D.

Figure 9: Schedules on Inter-Area Controllable Devices

Location	Comprehensive Review 2015 Forecast for Summer 2020[2] MW Schedule	Comprehensive Review 2020 Forecast for Summer 2025[2] MW Schedule
Ramapo PAR 1[1]	200	135
Ramapo PAR 2[1]	200	135
St. Lawrence PARs (L33/34)	0	0
Sandbar PAR (PV-20)	0	0
Goethals PAR (A2253)[1]	334	-11
Farragut PAR 1 (B3402)[1]	333	Out-of-Service
Farragut PAR 2 (C3403)[1]	333	Out-of-Service
Linden VFT	315	315
Hudson Transmission HVDC	320	0
Neptune HVDC	660	660
Cross Sound Cable HVDC	96	96
Northport PAR	0	0
Chateauguay HVDC	826	825
Blissville PAR	0	0
Waldwick PAR 1[1]	-345	-8
Waldwick PAR 2[1]	-330	-8
Waldwick PAR 3[1]	-325	-8

Notes:
1. Phase angle regulators between New York and PJM are scheduled according to the NYISO and PJM Joint Operating Agreement.
2. MW Schedule towards PJM is negative and towards NY is positive.

Thermal Transfer Limit Analysis

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 2025 summer peak load base case in accordance with the NYISO Methodology for Assessment of Transfer Capability in the Near-Term Transmission Planning Horizon [13]. A listing of NYCA intra-area and inter-area interface definitions used for the 2020 CATR is provided in Appendix C.

The thermal transfer limit 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 limit analysis evaluates the impact of over 1,000 planning design criteria contingencies. 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 includes 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. The list of these contingencies is provided in Appendix D.

For thermal transfer limit 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, 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 their reserve power ratio (i.e., difference between maximum power capability and power generation output of the unit). 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.

Analysis Results

Figures 10, 11, 12, and 13 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. Details regarding the thermal transfer limit analysis are provided in Appendix E. All study assumptions used for this assessment are described earlier in this report and include several key changes such as the Western New York and AC Transmission public policy transmission projects and several generator deactivations such as the Indian Point units (and several others).

- The Dysinger East and West Central Interfaces normal transfer limits increased compared to the 2015 Comprehensive ATR. Under emergency transfer limits both interfaces have minor differences compared to the 2015 CATR. ATRs performed after the last comprehensive assessment have noted a significant decrease in transfer limits across these interfaces due to generation retirements in the area. However, with the planned addition of the Empire State Line Western New York Public Policy Transmission Project the transfer limits have been restored to above the 2015 CATR. 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 400 MW from Dysinger 345 kV substation to the East Stolle 345 kV substation. No attempt was made to optimize the Dysinger PAR schedule.
- 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.

- The Dunwoodie – South normal transfer limit decreased compared to the 2015 Comprehensive ATR. The decreased transfer limit is due to the inability of the system to meet the established NYSRC criteria for underground cable circuits to be loaded to its STE rating. The primary driver for the inability to use STE for normal transfers on underground cable circuits is the peaker status changes in Zone J. The emergency transfer limit increased compared to the 2015 Comprehensive ATR. This is because of change in distribution of flows due to the generation and series reactor changes.

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 of greater than 100 MW:

- 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 the impact of new phase angle regulators.
- The New York – Ontario Interface's normal transfer limit decreased while the emergency transfer limit has a negligible change compared to the 2015 Comprehensive ATR. This is due to the generation retirements in NYCA and changes in generation dispatch.
- The Ontario – New York Interface's normal and 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. Significant changes in PJM generation dispatch also contributed to the changes in transfer limits.

Figure 10: Normal Transfer Criteria Intra–Area Thermal Transfer Limits

Interface	2015 Comprehensive ATR	2020 Comprehensive ATR	Limiting Constraint 2015 Comprehensive ATR	Limiting Constraint 2020 Comprehensive ATR
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 230kV (61)** at 846 MW STE rating for L/O Niagara - Packard 230 kV (62) and Packard - Beck 230 kV (76)
West Central	400 (A)	575 (A)		
Volney East	4,125	5,000	**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
Moses South	2,350 (D)	2,425 (D)	**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	3,250	**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	6,275	**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)	6,425 (I)	**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	**Shoemaker – Shoemaker TAP 138 kV (69)** at 706.7 MW STE rating for L/O Rock Tavern - Ramapo (77) 345kV and Rock Tavern – Sugarloaf – Ramapo (76) 345 kV
UPNY ConEdison	4,950 (C)(D)	7,600(I)	**Shoemaker-Chester 138 kV** at 317 MW STE rating for L/O Rock Tavern-Ramapo 345 kV and Rock Tavern-Sugarloaf-Ramapo 345 kV	**Lovett - Buchanan** at 1994 MW LTE rating for L/O Pleasant Valley - Millwood 345 kV (F30, W80), L/O Pleasant Valley - Millwood 345 kV (F31, W81), and L/O Wood St 345/115 kV
Dunwoodie South	5,625 (E)	5,475 (G)(I)	**Dunwoodie-Mott Haven 345 kV (71)** at 785 MW Normal rating for pre-contingency loading	**Dunwoodie-Mott Haven 345 kV (71)** at 925 MW LTE rating for L/O Ravenswood 3
LIPA Import	1,700 (F)	1,700 (H)	**Dunwoodie-Shore Rd. 345 kV (Y50)** at 963 MW LTE rating for L/O Sprain Brook-E.G.C. 345 kV and Sprain Brook-Academy 345/138 kV	**Dunwoodie-Shore Rd. 345 kV (Y50)** at 963 MW LTE rating for L/O Sprainbrook - East Garden City 345kV (Y49) and Academy 345kV bus

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.
I. Ramapo PAR1 and PAR2 are scheduled based on the NYISO-PJM JOA.

Figure 11: Emergency Transfer Criteria Intra–Area Thermal Transfer Limits

<table>
<tr><th>Interface</th><th>2015 Comprehensive ATR</th><th>2020 Comprehensive ATR</th><th>Limiting Constraint 2015 Comprehensive ATR</th><th>Limiting Constraint 2020 Comprehensive ATR</th></tr>
<tr><td>Dysinger East</td><td>2,325</td><td>2,300</td><td rowspan="2">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</td><td rowspan="2">Niagara - Q545A_Dysinger 345kV Ckt 1 at 1685 MW STE rating for L/O Niagara - Q545A_Dysinger 345 kV Ckt 2</td></tr>
<tr><td>West Central</td><td>975</td><td>1,075</td></tr>
<tr><td>Volney East</td><td>4,400</td><td>5,450</td><td colspan="2">Fraser-Coopers Corners 345 kV (33) at 1,793 MW STE rating for L/O Marcy-Coopers Corners 345 kV (UCC2-41)</td></tr>
<tr><td>Moses South</td><td>2,350 (F)</td><td>2,425 (F)</td><td>Browns Falls-Taylorville 115 kV (3) at 134 MW STE rating for L/O Chateauguay-Massena-Marcy 765 kV</td><td>Higley - Browns Falls 115 kV (1) at 135 MW STE rating for L/O Chateauguay–Massena–Marcy 765 kV (MSU-1)</td></tr>
<tr><td>Central East</td><td>2,650</td><td>3,650</td><td>New Scotland (77)-Leeds 345 kV at 1,724 MW STE rating for L/O New Scotland (99)-Leeds 345 kV</td><td rowspan="3">New Scotland (77) - Knickerbocker 345 kV at 1,423 MW normal rating for pre-contingency loading</td></tr>
<tr><td>Total East</td><td>5,100</td><td>7,100</td><td rowspan="2">Dolson-Rock Tavern 345 kV (DART44) at 1,793 MW STE rating for L/O Coopers Corners-Middletown Tap 345 kV</td></tr>
<tr><td>UPNY SENY</td><td>5,300 (A)</td><td>7,950 (G)</td></tr>
<tr><td>UPNY ConEdison</td><td>6,325 (A)</td><td>10,825 (G)</td><td>Roseton-East Fishkill 345 kV at 1,936 MW Normal rating for pre-contingency loading</td><td>Pleasant Valley - Wood C 345 kV (F31) at 1811 MW normal rating for pre contingency loading</td></tr>
<tr><td>Dunwoodie South</td><td>5,625 (B)</td><td>5,750 (D)(G)</td><td colspan="2">Dunwoodie-Mott Haven 345 kV (71) at 785 MW Normal rating for pre-contingency loading</td></tr>
<tr><td>LIPA Import</td><td>2,250 (C)</td><td>2,200 (E)</td><td>Dunwoodie-Shore Road 345 kV (Y50) at 687 MW Normal rating for pre-contingency loading</td><td>Shore Road - Glenwood South 138kV (365) at 358 MW STE rating for the L/O Sprainbrook - East Garden City 345kV (Y49)</td></tr>
</table>

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).
G. Ramapo PAR1 and PAR2 are scheduled based on the NYISO-PJM JOA.

Figure 12: Normal Transfer Criteria Inter-Area Thermal Transfer Limits

Interface	2015 Comprehensive ATR	2020 Comprehensive ATR	Limiting Constraint 2015 Comprehensive ATR	Limiting Constraint 2020 Comprehensive ATR
New York-New England	1,125	2,300	**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 1880 MW LTE rating for L/O Northfield – Berkshire 345kV (312), Berkshire – Alps 345kV (393), Northfield Gen 1 & 2, and Berkshire 345/115kV
New England - New York	1,500	1,450	**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	1,475	**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	2,100	**Beck – Niagara 230 kV (PA27) at 460 MW LTE** rating for L/O Niagara-Beck 345 kV (PA301)	
New York - PJM	2,475 (A)	1,975 (C)	**Huntley-Sawyer 230 kV (80)** at 654 MW LTE rating for L/O Huntley-Gardenville 230 kV (Line 79)	**Westover - Laurel 115kV (952)** at 108MW Normal rating for pre-contingency loading
PJM-NY	3,100 (B)	3,250 (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)	**Hopatcong - Ramapo 500kV (5018)** at 1052MW 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.

E. Alps PAR1 and PAR2 are scheduled at 550 MW each into ISO-NE.

F. Alps PAR1 and PAR2 are scheduled at 335 MW each into NY.

Figure 13: Emergency Transfer Criteria Inter-Area Thermal Transfer Limits

Interface	2015 Comprehensive ATR	2020 Comprehensive ATR	Limiting Constraint 2015 Comprehensive ATR	Limiting Constraint 2020 Comprehensive ATR
New York-New England	1,725	2,675 (E)	**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 1,327 MW normal rating for pre-contingency loading
New England - New York	2,700	1,900 (F)	**Pleasant Valley-Long Mountain 345 kV** at 1,195 MW Normal rating for pre-contingency loading	**Pleasant Valley-Cricket Valley 345 kV (F83)** at 1680 MW STE rating for L/O Pleasant Valley-Cricket Valley 345 kV (F84)
New York - Ontario	1,900	1,925	**Beck – Niagara 230 kV (PA27)** at 400 MW Normal rating for pre-contingency loading	
Ontario - New York	2,200	2,525	**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)	1,975 (C)	**Dunkirk-South Ripley 230 kV** at 475 MW STE rating for L/O Wayne-Handsome Lake 345	**Westover - Laurel 115kV (952)** at 108MW Normal rating for pre-contingency loading
PJM-NY	3,425 (B)	3,250 (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)	**Hopatcong - Ramapo 500kV (5018)** at 1052MW 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.

E. Alps PAR1 and PAR2 are scheduled at 550 MW each into ISO-NE.

F. Alps PAR1 and PAR2 are scheduled at 335 MW each into NY.

Voltage Transfer Limit Analysis

Methodology

Voltage-constrained transfer limit analysis is performed using PowerGEM TARA software considering specific bus voltage limits [14]. The 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. The voltage transfer limit analysis is performed on the 2025 summer peak load base case in accordance with the NYISO methodology for Assessment of Transfer Capability in the Near-Term Transmission Planning Horizon [13].

A voltage transfer case is created from the summer 2025 peak load case. A set of power flow cases with increasing transfer levels is created for each interface from the 2025 summer peak load voltage transfer case by applying generation shifts similar to those used for thermal transfer analysis. For each interface, PowerGEM TARA evaluates the system response to the set of the most severe NERC [8], NPCC Directory #1 [1], and NYSRC Reliability Rules [2] planning design criteria contingencies. 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 NPCC Directory #1 [1], and NYSRC Reliability Rules [2] planning design criteria contingencies 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.

For the 2020 CATR, 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 cases, 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 curve 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-ConEd, 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.

Analysis Results

Figure 14 provides a summary of the voltage-constrained transfer limits. The assessment of voltage Transfer Capability demonstrates that the New York State BPTF meets the applicable NERC [8], NPCC Directory #1 [1], and NYSRC Reliability Rules [2] planning design criteria contingencies with respect to voltage performance. The New York State BPTF transmission security is maintained by limiting power transfers according to the determined voltage-constrained transfer limits. For the majority of the interfaces, the decreased reserve margin within NYCA requires an increased amount of generation from Ontario to stress the system sufficiently, creating longer transmission paths for the source of generation, thereby reducing the voltage at the interfaces. Explanations for changes in transfer limits of greater than 100 MW are provided below. Details regarding the voltage-constrained transfer limit analysis are provided in Appendix F.

- The Dysinger East voltage-constrained transfer limits decreased compared to the 2015 Comprehensive ATR. This decrease is primarily due to the retirement of generators near the interface.
- 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.

Figure 14: Summary of Voltage-Constrained Transfer Limits

Interface	2015 Comprehensive Review (Study Year 2020)		2020 Transfers (Study Year 2025)	
	Pre-Contingency Low	95% of Nose	Pre-Contingency Low	95% of Nose
Dysinger East	2,950 (A)	3,000 (B)	2,875 (C)	2,800 (M)
West Central	1,525 (A)	1,650 (B)	1,600 (C)	1,575 (M)
Volney East	4,300 (D)	4,400 (E)	4,550 (F)	4,825 (R)
Central East	2,650 (D)	2,725 (E)	3,325 (F)	3,925 (Q)
UPNY-SENY	5,850 (G)(1)(2)	5,875 (H)(1)(2)	6,250 (G)(1)(3)	6,075 (K)(1)(3)
UPNY-CONED	5,550 (I)(1)(2)	5,625 (H)(1)(2)	7,775 (I)(1)(3)	7,975 (K)(1)(3)
Dunwoodie South	5,275 (J)(1)(2)	5,525 (H)(1)(2)	5,875 (P)(1)(3)	6,000 (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.
Q. 95% of PV nose occurs for L/O Tower 34/44 (Rock Tavern – Dolson Av 345 kV and Coopers Corner – Rock Tavern 345 kV).
R. 95% of PV nose occurs for L/O Sandy Pond HVDC.

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.

Stability Transfer Limit Analysis

Methodology

The dynamic data for this analysis are developed from the 2019 ERAG MMWG series databases. The New York Control Area (NYCA) system representation is from the NYISO 2020 FERC 715 filing power flow models with updates according to the NYISO *2020 Load & Capacity Data Report* ("Gold Book"). Additional adjustments to the case include the New York State Department of Environmental Conservation (DEC) adoption of a regulation to limit nitrogen oxides (NOx) emissions from simple-cycle combustion turbines (referred to as the "Peaker Rule") generation removals, consistent with the decisions made for the NYISO Reliability Planning Process. The dynamics data includes generator, exciter, power system stabilizers, SVC, DC transmission controller, turbine governor, relays, 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 for this assessment 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.

The methodology for stability analysis is described in NYISO Transmission Planning Guideline #3-1 [5]. For a stability simulation to be deemed stable, oscillations in angle and voltage must exhibit positive damping within 10 seconds after initiation of the disturbance. If a secondary mode of oscillation exists within the initial 10 seconds, then the simulation time is increased sufficiently to demonstrate that successive modes of oscillation exhibit positive damping before the simulation is deemed stable.

All simulations assume that generators with an angle separation greater than 300 degrees from the rest of the system will trip out-of-service. Further, the out-of-step scanning model (OSSCAN) and generic relay model are used to determine the tripping of transmission lines and transformers for transient swings. The generic relay model is a typical distance impedance relay on the element. The OSSCAN scans the entire network to check whether the apparent impedance is less than the line impedance.

The stability analysis evaluates about 300 NERC [8], NPCC Directory #1 [1], and NYSRC Reliability Rules [2] planning design criteria stability contingencies that are expected to produce a more severe system impact on the BPTF. These contingencies include the most severe loss of reactive capability and increased impedance on the BPTF. The contingencies are modeled to simulate the removal of all elements that the protection system or other automatic controls would disconnect without operator intervention. The stability performance contingencies include the impact of successful high speed (less than one second) reclosing and unsuccessful high speed reclosing into a fault, where high speed reclosing is utilized. A detailed description of the applied faults, elements switched, and clearing times are provided in Appendix D.

To assess the stability transfer capability of the system (i.e., stability transfer limit), stability margin cases are created to evaluate the stability performance of the NYCA system against normal design criteria contingencies. For each margin case, the power flow on the affected interfaces are tested at a value of at least 200 MW or 11% above the more restrictive of the emergency thermal transfer limit 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 limit. The stability transfer limit analysis is performed on the 2025 summer peak load base case in accordance with the NYISO methodology for Assessment of Transfer Capability in the Near-Term Transmission Planning Horizon [13].

Starting with the 2025 summer peak load stability base case, the NYISO created four NYCA margin cases (Central East margin, UPNY margin, West Central margin, and Moses South margin).

The Central East margin case has the Oswego Complex generation dispatched at an output of 5,245 MW and 1,135 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 3,690 MW. The Central East Interface limit is more limiting at 3,325 MW (for voltage collapse).

The UPNY margin case has the Oswego Complex generation dispatched at an output of 5,245 MW and 1,135 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 6,745 MW and 8,630 MW, respectively. The Central East interface of the UPNY margin case is loaded at 3,295 MW. The UPNY-SENY voltage limit is more limiting at 6,075 MW, and UPNY-Con Edison is voltage limited at 7,775 MW.

The Western margin case stressed the West-Central open interface to 1,280 MW. The other open interfaces in the area are at the following levels: Dysinger East 2,500 MW, Ontario-to-New York 2,260 MW, and HQ-to-New York 1,110 MW (Chateauguay HVdc 825 MW, Beauharnois 286 MW). The Dysinger East and West Central interfaces are thermally limited at 2,300 MW and 1,075 MW for emergency transfer conditions, respectively.

The Moses South margin case has the Moses South open interface loaded to 2,695 MW, HQ-to-New York 1,978 MW (Chateauguay HVdc 979 MW, Beauharnois 999 MW), and the St. Lawrence L33/34 PARs scheduled at 150 MW each. The Moses South interface emergency thermal limit is more limiting at 2,425 MW.

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 11% above the more restrictive of the emergency thermal or voltage transfer limit for normal design criteria faults.

This assessment of transfer capability 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 assessment of transfer capability 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.

Assessment of Planning Transfer Capability

Figure 15 below provides a summary of the normal and emergency transfer limits for the open transmission interfaces used in this assessment. The application of planning 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 NERC [8], NPCC Directory #1 [1], and NYSRC Reliability Rules [2] planning design criteria contingencies.

Figure 15: Transfer Limit Comparison

Interface	2015 Comprehensive Review (Study Year 2020)				2020 Comprehensive Review (Study Year 2025)			
	Normal (MW)		Emergency (MW)		Normal (MW)		Emergency (MW)	
Dysinger East	1,750	T	2,325	T	1,800	T	2,300	T
West Central	400	T	975	T	575	T	1,075	T
Volney East	4,125	T	4,300	V	4,550	V	4,550	V
Moses South	2,350	T	2,350	T	2,425	T	2,425	T
Central East	2,350	T	2,650	T/V	3,250	T	3,325	V
Total East	4,850	T	5,100	T	6,275	T	7,100	T
UPNY-SENY	5,075	T	5,300	T	6,075	VX	6,075	VX
UPNY-ConEd	4,950	T	5,550	V	7,600	T	7,775	V
Sprain Brook-Dunwoodie South	5,275	V	5,275	V	5,475	T	5,750	T
Long Island Import	1,700	T	2,250	T	1,700	T	2,200	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
VX – Voltage 95% from collapse point
S – Stability

Steady State Transmission Security Analysis

Methodology

Transmission security is the ability of the power system to withstand disturbances, such as electric short circuits or unanticipated loss of system elements, and continue to supply and deliver electricity. Transmission security is assessed deterministically with potential disturbances being applied without concern for the likelihood of the disturbance in the assessment. These system disturbances are categorized as planning design criteria contingencies and are explicitly defined in the NERC TPL [8], NPCC Directory #1 [1], and NYSRC Reliability Rules [2] planning criteria.

Steady state transmission security analysis evaluates the thermal and voltage performance of NYCA BPTF in response to planning design criteria contingencies (over 1,000 events within NYCA). Transmission security analysis includes an evaluation of the system response to both single (N-1) and multiple (N-1-1) contingency events. For this ATR, the local area operation NYSRC Reliability Rule G.1 R1, which requires that certain areas of the Con Edison system shall be designed and operated for the occurrence of a second contingency, was also evaluated. The evaluated contingencies within NYCA include those that are expected to produce a more severe system impact on the BPTF including the most severe loss of reactive capability and increased impedance on the BPTF. The contingency events are modeled to simulate the removal of all elements that the protection system or other automatic controls would disconnect without operator intervention. Neighboring systems planning design criteria contingency events are also included, as appropriate.

To evaluate the impact of a single event from the normal system condition (N-1) on the BPTF, all events impactful to the BPTF are evaluated. To evaluate the impact of multiple events on the BPTF, design criteria first level contingencies, such as the loss of any critical transmission circuit, transformer, compensating device, generator, or single pole of an HVDC facility are first applied to the normal system condition (N-1-0) followed by allowable system adjustments to posture the system to be secure for all other design criteria second level contingencies (N-1-1). For N-1-1-0, allowable system adjustments occur post-second contingency to attempt to return to the normal system condition.

Transmission security analysis allows for system adjustments including generator redispatch, PAR adjustments, switched shunt adjustments, transformer tap adjustments, and HVDC adjustments between the first (N-1-0) and second (N-1-1) contingency and, for certain areas of the Con Edison system following the occurrence of a second contingency (N-1-1-0) . For N-1 analysis, no system adjustments are allowed post contingency; similarly, no system adjustments are allowed following the second contingency of N-1-1 analysis. The 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 power flow solution, but are allowed to regulate in the post-contingency power flow solution. The system adjustments between contingencies are made such that all monitored elements (i.e.. BPS, BPTF, and ISO-secured facilities) are secured for the occurrence of each first contingency paired with all possible second contingencies.

An N-0, N-1, N-1-0, N-1-1, or N-1-1-0 violation occurs when the power flowing through a transmission element exceeds its applicable rating (thermal violation) or the voltage at a bus exceeds its specified range (voltage violation). For example, an N-1-0 violation occurs when the power flow cannot be reduced to below the normal rating following the occurrence of a contingency event followed by allowable system adjustments. An N-1-1 violation occurs when the facility is reduced to (or below) its normal rating following the first level contingency and system adjustments, but the power flow following the second contingency exceeds the applicable post-contingency rating. An N-1-1-0 violation occurs when the power flow cannot be reduced to below the normal rating following the occurrence of the second level contingency event followed by allowable system adjustments.

For this assessment, the transmission security analysis is performed on the system model for study year 2025 using the baseline forecast of the statewide coincident peak load. For transmission security analysis, generation is dispatched to match load plus system losses while respecting transmission security. Scheduled inter-Area transfers modeled in the base case between the NYCA and each neighboring system are held constant.

The transmission security analysis is performed using the Siemens PTI PSS®E and PowerGEM TARA programs. The list of contingencies is provided in Appendix D.

Analysis Results

Under N-0, N-1 and N-1-0 conditions, there were no observed thermal or voltage violations on the BPTF.

Under N-1-1 and N-1-1-0 conditions, several thermal loading violations were present in 2025 on the Con Edison 345kV system. Figure 16 provides a summary of the worst overload for each BPTF element with a thermal criteria violation under N-1-1 conditions. Figure 17 provides a summary table for N-1-1-0. Appendix H provides details of additional contingency combinations that also result in thermal criteria violations for these BPTF elements.

Figure 16: Steady State Transmission Security N-1-1 Violations

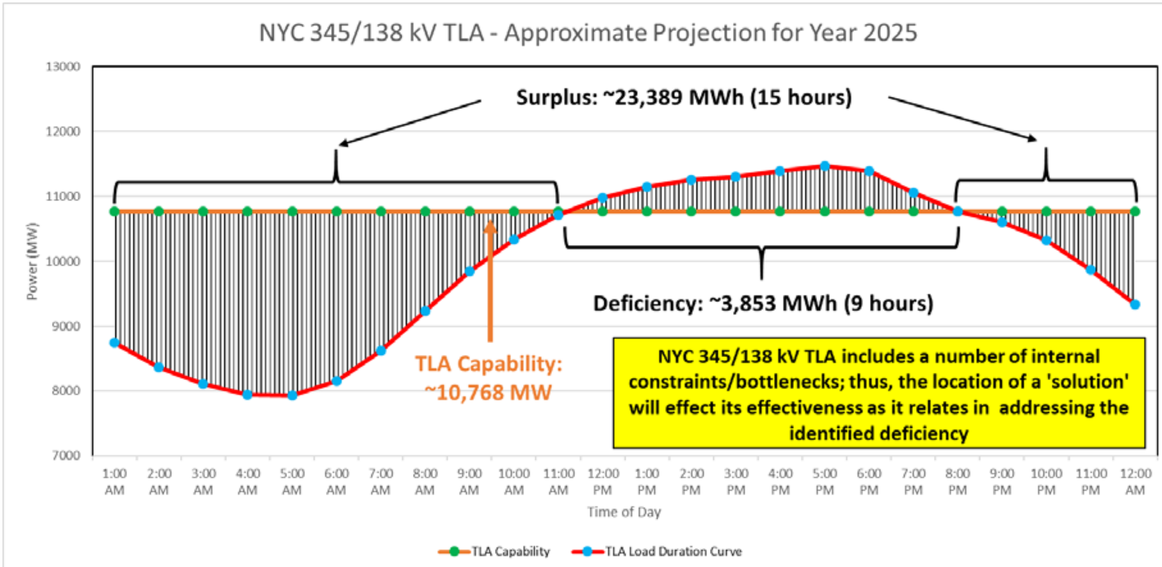
Zone	Owner	Monitored Element	Normal Rating (MVA)	Contingency Rating (MVA)	1st Contingency	2nd Contingency	2025 Summer Peak Flow (%)
I/J	ConEd	Dunwoodie-Mott Haven 345 kV (71)	785	925	Loss of Ravenswood 3	Dunwoodie-Mott Haven 345 kV (72)	110
I/J	ConEd	Dunwoodie-Mott Haven 345 kV (72)	785	925	Loss of Ravenswood 3	Dunwoodie-Mott Haven 345 kV (71)	108
J	ConEd	Goethals-Gowanus 345 kV (26)	518	738	Loss of Ravenswood 3	Stuck Breaker at Goethals 5	102
J	ConEd	Goethals-Gowanus 345kV (25)	518	738	Loss of Ravenswood 3	Gowanus - Goethals 345 kV (26)	103
I	ConEd	Sprainbrook/Dunwoodie 345/138 kV (N7)	366	423	Loss of Ravenswood 3	Tower W89 & W90	106
I	ConEd	Sprainbrook/Dunwoodie 345/138 kV (S6)	309	438	Loss of Ravenswood 3	Tower W89 & W90	103

Figure 17: Steady State Transmission Security N-1-1-0 Violations

Zone	Owner	Monitored Element	Normal Rating (MVA)	Contingency Rating (MVA)	1st Contingency	2nd Contingency	2025 Summer Peak Flow (%)
I/J	ConEd	Dunwoodie-Mott Haven 345 kV (71)	785	925	Loss of Ravenswood 3	Dunwoodie-Mott Haven 345 kV (72)	132

Considering the utilization of all available PAR controls, the observed maximum deficiency (*i.e.* compensatory MW) for the New York City 345/138 kV Transmission Load Area (TLA) in 2025 is 700 MW. Based on the load duration curve shown in Figure 18 below, the deficiency in 2025 may be observed for approximately nine hours (3,853 MWh).

Figure 18: NYC 2025 345/138 kV TLA Load Duration Curve



Steady State Compensatory MW

Transmission security compensatory MW amounts were determined by adding generic resources to combinations of locations of need. The compensatory MW provide a generic order-of-magnitude measure to guide the formulation of future system upgrades to correct transmission security needs. Approximately 700 MW of compensatory MW would be required to address the transmission security needs in 2025.

Steady State Corrective Action Plan

The steady state criteria violations discussed above were the same as reported in the 2020 RNA. Before the CATR was completed, three updates were received that resolved the reliability issues noted in the CATR. The first update involved a reduction in the load forecast. At a November 19, 2020 stakeholder meeting the NYISO presented an updated peak load forecast to account for the expected impact of COVID-19 and the associated economic and societal effects. The total NYCA reduction in forecast for the summer 2025 peak is 240 MW. Specifically, the Zone J peak load forecast decreased by 323 MW. Figure 19 provides a comparison of between the 2020 Gold Book and long-term forecast updates for the summer coincident peak period.

The second update involved Con Edison Local Transmission (LTP) updates. At a January 25, 2021 stakeholder meeting, Con Edison presented an update to their Local Transmission Plan (LTP) to address thermal deficiencies in their Astoria East/Corona 138 kV Transmission Load Area (TLA) and Greenwood/Fox Hills 138 kV TLA. The Con Edison LTP update includes three new 345/138 kV PAR controlled 138 kV feeders at Rainey – Corona (planned in-service date by summer 2023), Gowanus –

Greenwood (planned in-service date by summer 2025) and Goethals – Fox Hills (planned in-service date by summer 2025).[5]

Figure 19: Comparison of Summer Coincident Peak Forecast

	Year	A	B	C	D	E	F	G	H	I	J	K	NYCA
2020 Load and Capacity Data Report	2021	2,641	1,943	2,719	613	1,329	2,329	2,153	646	1,427	11,300	5,029	32,129
	2022	2,626	1,941	2,715	640	1,313	2,313	2,144	646	1,435	11,397	4,958	32,128
	2023	2,610	1,938	2,711	663	1,297	2,297	2,134	646	1,428	11,362	4,832	31,918
	2024	2,597	1,936	2,708	682	1,283	2,285	2,127	647	1,429	11,395	4,749	31,838
	2025	2,585	1,935	2,705	693	1,271	2,276	2,118	647	1,425	11,390	4,666	31,711
Long Term Forecast Update	2021	2,627	1,955	2,818	618	1,396	2,366	2,193	631	1,369	11,010	5,162	32,145
	2022	2,603	1,933	2,804	643	1,375	2,342	2,161	632	1,388	11,174	5,057	32,112
	2023	2,582	1,912	2,793	665	1,357	2,322	2,131	632	1,383	11,138	4,952	31,867
	2024	2,565	1,899	2,785	682	1,341	2,307	2,108	633	1,376	11,089	4,844	31,629
	2025	2,553	1,892	2,782	694	1,329	2,298	2,095	633	1,373	11,067	4,755	31,471
Delta	2021	-14	12	99	5	67	37	40	-15	-58	-290	133	16
	2022	-23	-8	89	3	62	29	17	-14	-47	-223	99	-16
	2023	-28	-26	82	2	60	25	-3	-14	-45	-224	120	-51
	2024	-32	-37	77	0	58	22	-19	-14	-53	-306	95	-209
	2025	-32	-43	77	1	58	22	-23	-14	-52	-323	89	-240

The third update was a solution submitted by Con Edison in response to a solicitation in the NYISO Short-Term Reliability Process (STRP) for a reliability need first identified in the 2020 Quarter 3 Short-Term Assessment of Reliability (STAR).[6] The Con Edison solution changes the planned series reactor status by placing the 71, 72, M51 and M52 series reactors in-service, while by-passing the series reactors on the 41, 42, and Y49 transmission lines. The NYISO selected the Con Edison solution as fulfilling the identified reliability need.[7]

With these three updates, the thermal overload identified in the CATR are resolved. Therefore, for this ATR no Corrective Action Plans are needed to address any steady state criteria violations.

[5] Meeting material for the November 19, 2020 ESPWG/TPAS and January 25, 2021 ESPWG/TPAS: https://www.nyiso.com/espwg

[6] https://www.nyiso.com/documents/20142/16004172/2020-Q3-STAR-Report-vFinal.pdf/

[7] https://www.nyiso.com/documents/20142/15930753/2020-Quarter-3 Short-Term-Reliability-Process-Report-vFinal3.pdf/

Dynamics Transmission Security Analysis

Methodology

Transmission security is the ability of the power system to withstand disturbances, such as electric short circuits or unanticipated loss of system elements, and continue to supply and deliver electricity. Transmission security is assessed deterministically with potential disturbances being applied without concern for the likelihood of the disturbance in the assessment. These system disturbances are categorized as planning design criteria contingencies and are explicitly defined in the NERC TPL [8], NPCC Directory #1 [1], and NYSRC Reliability Rules [2] planning criteria.

The stability analysis includes both N-1 and N-1-1 analysis. Design criteria stability N-1-1 analysis evaluates the ability of the system to meet design criteria following the occurrence of a single event and allowable system adjustments. Allowable system adjustments between the first (N-1-0) and second contingency (N-1-1) include: generator redispatch, PAR adjustments, switched shunt adjustments, transformer tap adjustments, and HVDC adjustments. Figure 20 below lists the first event outages (N-1-0) for N-1-1 analysis. For stability analysis, the loss of these elements represents the most severe impedance change to the BPTF as well as a reduced capability to transfer power among the various NYCA zones. The second contingencies (N-1-1) are the normal design criteria contingencies.

The methodology for stability analysis is described in NYISO Transmission Planning Guideline #3-1 [5]. For a stability simulation to be deemed stable, oscillations in angle and voltage must exhibit positive damping within 10 seconds after initiation of the disturbance. If a secondary mode of oscillation exists within the initial 10 seconds, then the simulation time is increased sufficiently to demonstrate that successive modes of oscillation exhibit positive damping before the simulation is deemed stable. The transient voltage response criterion is a recovery to 0.9 per unit by 5 seconds after the fault has cleared; For PSE&G Long Island, the transient voltage response criteria is a recovery to 0.9 per unit by one second after the fault has cleared.

All simulations assume that generators with an angle separation greater than 300 degrees from the rest of the system will trip out-of-service. Further, the out-of-step scanning model (OSSCAN) and generic relay model are used to determine the tripping of transmission lines and transformers for transient swings. The generic relay model is a typical distance impedance relay on the element. The OSSCAN scans the entire network to check whether the apparent impedance is less than the line impedance.

The stability analysis evaluates about 300 NERC [8], NPCC Directory #1 [1], and NYSRC Reliability Rules [2] planning design criteria stability contingencies that are expected to produce a more severe system impact on the BPTF. These contingencies include the most severe loss of reactive capability and increased impedance on the BPTF. The contingencies are modeled to simulate the removal of all elements that the protection system or other automatic controls would disconnect without operator intervention. The stability performance contingencies include the impact of successful high speed (less than one second) reclosing and unsuccessful high speed reclosing into a fault, where high speed reclosing is utilized. A detailed description of the applied faults, elements switched, and clearing times are provided in Appendix D.

Figure 20: Stability Analysis First Contingency Outages (N-1-0)

First Contingency	Location
Nine Mile Point #2	Zone C
Ravenswood #3	Zone J
Northport #1	Zone K
Rochester – Pannell 345	Zone B
Marcy – Massena 765 kV	Moses South
Marcy – Coopers Corners 345 kV	Zone E
Edic – Princetown 345 kV	Central East
Niagara - Dysinger 345 kV	Dysinger East
Leeds – Pleasant Valley 345 kV	UPNY-SENY

Analysis Results

Dynamic stability violations were observed for 2025. The criteria violations included transient voltage response violations, loss of generator synchronism, and undamped voltage oscillations. The transient voltage response violations arose on transmission facilities owned by Con Edison in its Transmission District and extended into areas adjacent to its service territory. The loss of generator synchronism was observed in generators within the ConEd service territory and is primarily driven by the transient voltage response in the local area. The undamped voltage oscillations were also predominantly in the Con Edison area and were primarily driven by the reduction in dynamic reactive capability and MW to serve the load. Reduction in system inertia may also play a role. For N-1-1, violations were observed for first level outages Leeds- Pleasant Valley 345 kV and the loss of Ravenswood 3, which is the most severe event. Figure 21 provides a summary of generator synchronism and transient response criteria violations under N-1 and Figure 22 provides the summary for N-1-1. Additional information including all events run and results are found in Appendix I.

Figure 21: Dynamic Stability Criteria N-1 Violations

Dynamic Stability Criteria N-1 Violations [1]			
Contingency Name	**Contingency Description**	**Generator Synchronism**	**Transient Voltage Response**
ConEd08	Fault at E. 13th St. 138 kV with stuck breaker 4E		non-BPTF
ConEd15	Fault at Greenwood 138 kV with stuck breaker 7S	X	non-BPTF
ConEd16	Fault at Hellgate 138 kV with stuck breaker 5		non-BPTF
ConEd25-Q461-Q462	Fault at E. 13th St. 138 kV with stuck breaker		non-BPTF
UC11	Fault at Sprainbrook 345 kV and L/O Sprainbrook - Tremont (X28) 345 kV and Buchanan - Sprainbrook (W93/W79) 345kV		BPTF & non-BPTF
UC25A	Fault at Ravenswood 3 345 kV and L/O Ravenswood 3	X	BPTF & non-BPTF
UC25B	Fault at Rainey 345 kV and L/O 60L 345 kV circuit	X	BPTF & non-BPTF
UC048A_Q510	Fault at Gowanus 345 kV and L/O Gowanus 345/138 kV 14TR	X	non-BPTF
UC049_Q510	Fault at Gowanus 345 kV with stuck breaker 14		non-BPTF

Notes:

1. Non-BPTF issues are reported for information only.

Figure 22: Dynamic Stability Criteria N-1-1 Violations

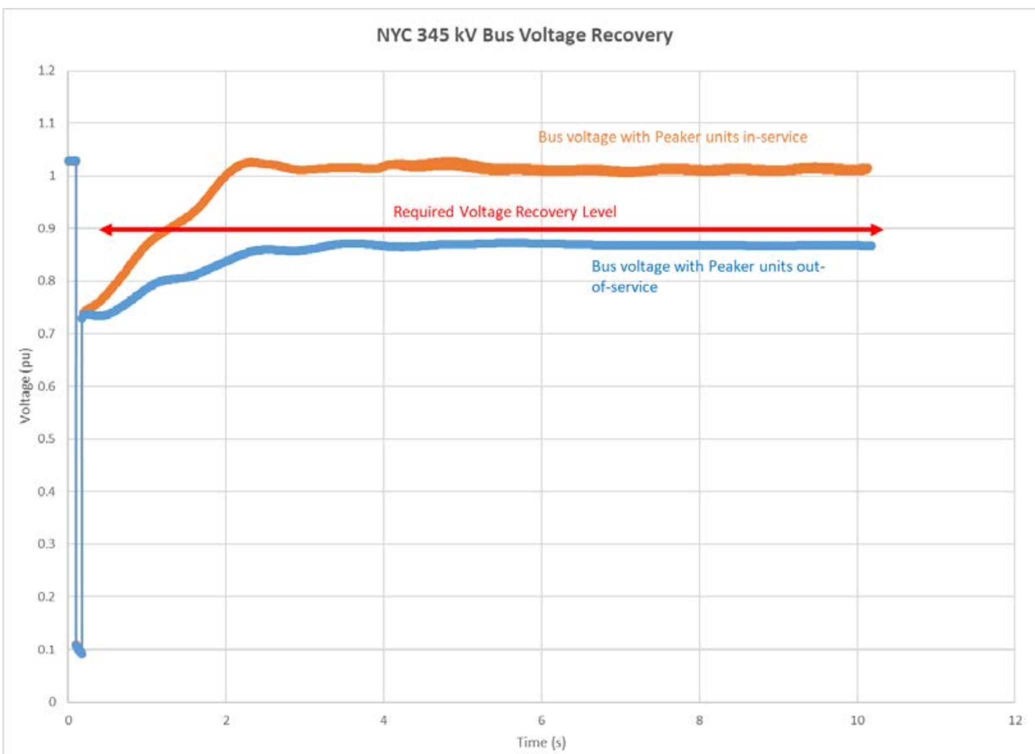
Dynamic Stability Criteria N-1-1 Violations[1]			
Second Level Contingency Name	Contingency Description	First Level: L/O Ravenswood 3	
		Generator Synchronism	Transient Voltage Response
ConEd08	Fault at E. 13th St. 138 kV with stuck breaker 4E		non-BPTF
ConEd12	Fault at Freshkills 138 kV with stuck breaker 4E		non-BPTF
ConEd14	Fault at Greenwood 138 kV with L/O Gowanus 345/138 (T2) 345 kV and PAR		non-BPTF
ConEd15	Fault at Greenwood 138 kV with stuck breaker 7S	x	non-BPTF
ConEd16	Fault at Hellgate 138 kV with stuck breaker 5		non-BPTF
ConEd25-Q461-Q462	Fault at E. 13th St. 138 kV with stuck breaker		non-BPTF
TE03-UC03	Fault at Sprainbrook 345 kV and L/O Sprainbrook - Millwood (W64/W99, W79/W93) 345 kV		BPTF & non-BPTF
TE20-UC20	Fault at Dunwoodie 345 kV and L/O Dunwoodie - Pleasantville (W89 and W90) 345 kV		BPTF & non-BPTF
UC11	Fault at Sprainbrook 345 kV and L/O Sprainbrook - Tremont (X28) 345 kV and Buchanan - Sprainbrook (W93/W79) 345kV	x	BPTF & non-BPTF
UC19	Fault at Millwood 345 kV and L/O Millwood - Sprainbrook (W82/W65 and W85/W78) 345 kV		non-BPTF
UC25A	Fault at Ravenswood 3 345 kV and L/O Ravenswood 3	x	BPTF & non-BPTF
UC25B	Fault at Rainey 345 kV and L/O 60L 345 kV circuit	x	BPTF & non-BPTF
UC048A_Q510	Fault at Gowanus 345 kV and L/O Gowanus 345/138 kV 14TR	x	non-BPTF
UC049_Q510	Fault at Gowanus 345 kV with stuck breaker 14	x	non-BPTF
UC58_Q510	Fault at Farragut 345 kV (near B44 line) with stuck breaker 11W	x	BPTF & non-BPTF

Notes:

1. Non-BPTF issues are reported for information only.

Figure 23 shows the transient voltage response for a 345 kV bus in the Con Edison service territory that passes the stated criteria as observed in assessments that have the peaker units in-service, as compared to the response observed with the peaker units out-of-service. To pass the transient voltage response criteria, the post-fault value must settle to at least 0.9 p.u. voltage 5 seconds after the fault has cleared for most Transmission Owners. The PSEG Long Island Criteria is to settle to at least 0.9 p.u. voltage one second after the fault has cleared. When the transient voltage response fails the stated criteria (as shown in Figure 22) this is referred to as fault induced delayed voltage recovery (FIDVR). FIDVR events are driven by end-use load behavior and load composition, primarily the induction motor loads. One of the causes of FIDVR is the stalling of induction motors due to low voltages. When induction motors stall, the motors draw excessive reactive power from the grid and require five to six times their typical steady-state running current in this locked-rotor condition,[8] which can eventually lead to a significant loss of generation and load.

Figure 23: New York City (NYC) 345 kV Bus Voltage Recovery



[8] https://www.nerc.com/docs/pc/tis/FIDVR_Tech_Ref%20V1-2_PC_Approved.pdf

During a fault, the observed voltage drop at a bus depends on the location of the fault on the system relative to the bus and the amount of time the fault remains on the system before it is cleared by protective relaying actions. Following the clearing of a fault on the system by protection system actions, the bus voltage and generator rotor usually enter an oscillatory period. The generator excitation system controls the generator terminal voltage to improve and stabilize the voltages. Nevertheless, depending on the severity of voltages and generator size, the voltages may or may not stabilize. Generator rotor swings after a fault are caused by the accumulation of energy, i.e., an imbalance between electrical power and mechanical power, during the fault. After the clearing of the fault, the generator rotor swings (or "oscillations") dissipate that accumulated energy over time. For a stable system response, these oscillations damp out over time to an acceptable post-fault value. For an unstable system response, the system may observe unacceptable damping, system separation, cascading, and generating units losing synchronism with the system.

As shown in Figure 20 and Figure 21, several contingencies result in loss of generator synchronism with the transmission system. A primary driver to the loss of synchronism for these machines is the sustained low voltages following the clearing of the fault. Examples of low voltages as observed from the high-side of the generator step-up (GSU) transformer are shown in Figure 24 in response to a contingency. As can be seen in Figure 24, the sustained low voltages are also observed at the high side of the GSU and remain in the NERC PRC-024 "may trip" zone. In this example, due to the sustained low voltages an equilibrium point for the generators is not reached, and the generators lose synchronism with the system. As shown in Figure 25, Generator 1 loses synchronism and trips off line at about 3.5 seconds and Generator 2 goes out of synchronism and trips off line at about 10 seconds. The rotor angles plotted in Figure 25 are relative to the system average rotor angle.

Figure 24: High Side of GSU Voltage

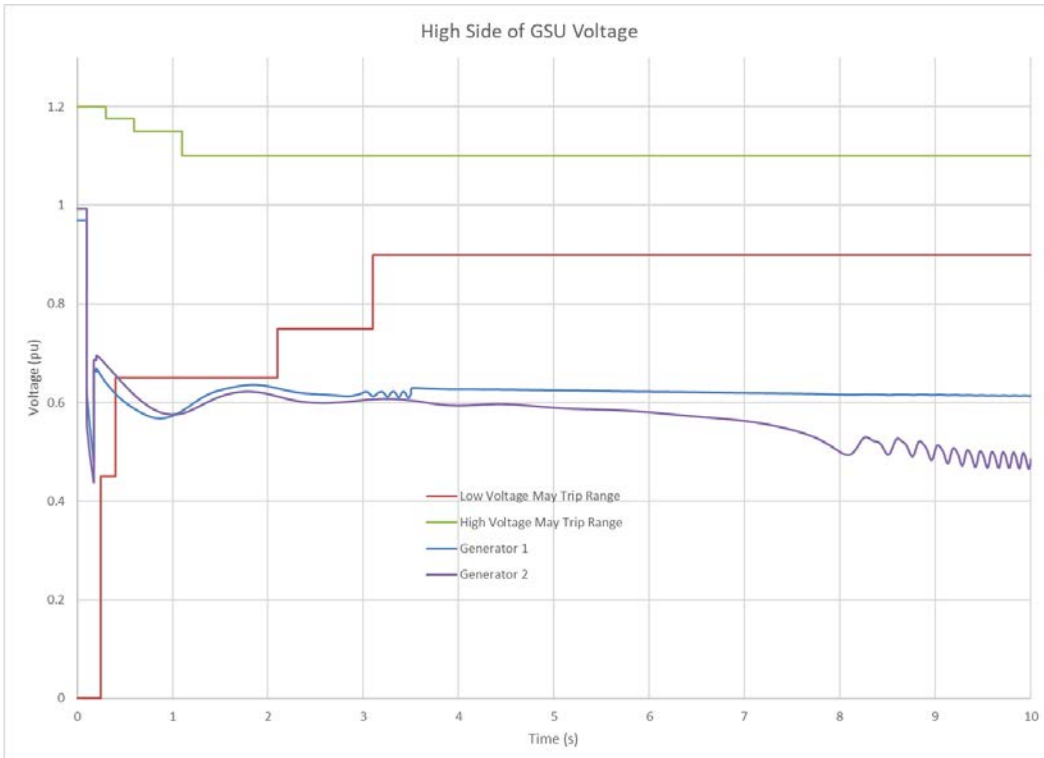
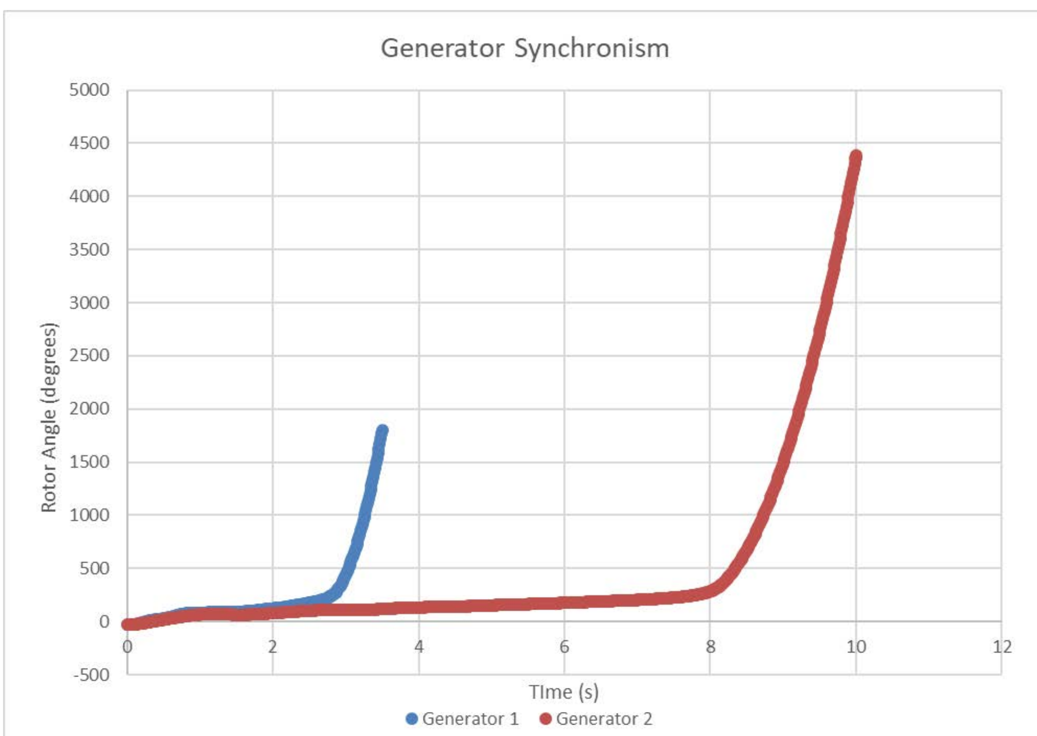


Figure 25: Generator Synchronism



Stability Compensation

In the pre-fault (N-0) system condition, voltages are maintained with various static (*e.g.* fixed and switched shunt devices, transmission circuits) and dynamic (e.g., Generators, FACTS devices, STATCOMs) reactive resources maintaining voltages within prescribed ranges. Manual adjustments to these devices occur as load and other system conditions change in order to maintain the required voltage level.

During the dynamic simulation timeframe, sufficient dynamic reactive resources to sustain transient voltage support during the natural swings of the system are crucial. Generally, the system response to these swings to maintain voltage comes from generator excitation system response, STATCOMs, static VAr compensators (SVCs), wind and solar plant voltage controls, and other fast-acting resources.[9] While pre-contingency voltages can be maintained using static reactive resources, the dynamic system response timeframe focuses primarily on dynamic reactive capability due to the transient nature of large power and voltage swings and the short response time required.

The BPTF dynamic stability criteria violations compensatory values are measured by modeling fictitious generators at the Farragut 345 kV, Astoria East 138 kV, and Greenwood North 138 kV buses with a MW size determined by the compensatory MW for thermal violations. Focusing on the event combination of the loss of Ravenswood 3 followed by event UC11 (as one of the more severe events), reactive capability was added to the fictitious generators to the point where the BPTF transient voltage violations, sustained oscillations, and generator synchronism criteria violations are no longer observed. Figure 26 provides a description of dynamic compensation needed to address the event combination of the loss of Ravenswood 3 followed by event UC11. The impact of the added dynamic reactive capability is highly non-linear and other event combinations and the location of the fictitious generators may cause significant variance to the values stated in Figure 25.

Figure 26: Description of Dynamic MVA Added To System

Dynamics Compensatory Resource Values		
Location	**Machine MVA**	**Pgen (MW)**
Farragut 345 kV	400	230
Astoria East 138 kV	170	110
Greenwood North 138 kV	450	360
Total	1,020	700

9 https://www.nerc.com/comm/PC_Reliability_Guidelines_DL/Reliability%20Guideline%20-%20Reactive%20Power%20Planning.pdf

Dynamics Corrective Action Plan

The dynamics criteria violations discussed above were the same as reported in the 2020 RNA. With the three updates noted in the steady-state section, the dynamic instability issues are resolved and no Correction Action Plan is required.

Fault Current Assessment

Methodology

The short circuit assessment evaluates the fault duty at BPTF and other critical buses in the short-circuit representation. Fault duty is calculated using the ASPEN OneLiner® program following the NYISO guideline for Fault Current Assessments [6]. Consistent with generally accepted practices for short circuit studies, the guideline requires that the transmission lines and transformers be modeled in their normal operating condition with all generating units modeled in-service. This configuration provides adequate design margin for safety and reliability by yielding the worst-case and most conservative fault levels. Additionally, current limiting series reactor protocols [16] are respected for this analysis.

The Lowest Circuit Breaker (LCB) rating for each of the selected substations is obtained from the breaker owner (i.e., the Transmission or Generator Owner). The rating is the nameplate symmetrical rating, the de-rated symmetrical value as determined by the breaker owner, or the approximate symmetrical value converted from a total current basis (circuit breakers rated on a total current basis are converted to an approximate symmetrical current rating by using the nominal voltage of the substation). Advanced circuit breaker rating techniques such as asymmetrical current analysis, de-rating for reclosing, or de-rating for age are not considered by the NYISO in this analysis. However, the equipment owner may take into account the effects of these advanced circuit breaker rating techniques in the LCB value provided to the NYISO for this assessment.

Fault Current Analysis

Description of the Fault Current Base Case

The NYISO statewide short circuit case represents year 2025 (case dated May 1st, 2020 with the file name 2025_RNA_2025_FINAL_V2_correction.OLR). The short circuit representation includes the modeling assumptions discussed earlier in this report.

Fault Current Analysis Results

No overdutied breakers are observed in this assessment. Details of the short circuit assessment are provided in Appendix J.

Extreme Contingency Assessment

Methodology

The NYCA steady state and stability performance analysis for extreme contingencies is performed using the Siemens PTI PSS®E and PowerGEM TARA software packages. Each extreme contingency event is simulated to evaluate the New York State BPTF transient stability, voltage, and thermal response in accordance with NPCC Directory #1 [1], and NYSRC Reliability Rules [2] planning criteria.

In order to test the ability of the system to return to a stable operating point after an extreme contingency, the NYISO performs dynamic simulations. The system model is first initialized to the pre-contingency power flow conditions and then run to 0.1 seconds before applying the contingency. For no-fault contingencies, the elements are removed from service. In the case of contingencies that include a fault, the system is changed in sequence to match breaker actions. After inspecting the simulation plots and dynamic simulation log files for each contingency, a determination is made to determine the extent of any widespread system disturbance.

Power flow simulations are performed via the PowerGEM TARA software package to determine voltage impacts and line overloads under extreme contingency conditions. For this assessment, the NYCA transmission system is evaluated against their Short-Term Emergency (STE) rating. This procedure requires that each element removed from service as part of the contingency and as a result of the contingency, due to tripping actions caused by line overloads above STE or low voltages observed on generator or load buses, shall also be removed from service for the steady state power flow analysis.

The extreme contingency steady state and stability analysis examines the post-contingency steady state conditions as well as stability, overloads, cascading outages, and voltage collapse to obtain an indication of system robustness and to determine the extent of any widespread system disturbance. A widespread system disturbance is defined as outages that propagate outside of the local area.

Extreme Contingency Analysis

Description of Steady State and Stability Study Cases

The extreme contingency steady state and stability base cases are derived from the system representation discussed in the introduction of the main report. However, the cases are modified by adjusting the intra-area interface flows for NYCA intra-area interfaces to a minimum of the transfer levels expected not to be exceeded more than 25% of the time on a load flow duration basis, but less than the Normal Transfer limit. The expected transfer level is obtained using actual flow values for 2020 obtained from Markets and Operations (Power Grid Data for Interface Limits and Flows). A description of the extreme contingency case is provided in Appendix D.

Extreme Contingency Analysis Contingency Events

Steady state and stability extreme contingencies are considered very low probability events. Extreme contingencies for the NYCA are developed in conformance with NPCC Directory #1 [1], and NYSRC Reliability Rules [2] planning criteria. For this study, over 60 extreme contingencies expected to have severe system impacts are evaluated including loss of entire substations, loss of entire generation plants, loss of all circuits along a transmission right-of-way, and the sudden loss of a fuel delivery system (i.e., gas pipeline contingencies). For extreme contingency analysis, no system adjustments are allowed post-event. The contingencies evaluated include the most severe loss of source, loss of reactive capability, and increased impedance on the BPTF. The details of the analysis results are classified as Critical Energy Infrastructure Information and are not discussed in the body of this report. The list of extreme contingencies is provided in Appendix K.

Extreme Contingency Summary

Most of the studied contingencies are stable and show no thermal overloads over the Short-Term Emergency (STE) rating or significant voltage violations or deviations on the BPTF. Some contingencies show voltage violations, significant voltage drops, and/or thermal overloads on the underlying 138/115 kV sub-transmission system, but these conditions are local in nature. In a few cases, an extreme contingency may result in a loss of local load within an area due to low voltage or first-swing instability of isolated generations. Most contingencies evaluated converge and are stable and damped. In all of the evaluated cases and conditions tested, the affected area is confined to the NYCA system (no contingencies result in a widespread system disturbance). Details of the extreme contingency analysis are provided in Appendix K.

The purpose of the extreme contingency assessment is to obtain an indication of system strength, or to determine the extent of widespread system disturbance, even though extreme contingencies do have low probabilities of occurrence [1]-[2]. In this review, the system response to extreme contingencies is comparable to previous reviews with the exception of some extreme contingencies located in the Con Edison service territory which are impacted by the removal of the peaker units. However, as the baseline transmission security analysis is observing various transmission security concerns in the Con Edison service territory, the impact of the ultimate solution(s) to these issues will also impact the conclusions of the affected extreme contingencies. The next NYISO ATR will re-evaluate the impact of these solutions on the extreme contingencies.

Extreme System Condition Assessment

NPCC Directory #1 [1], and NYSRC Reliability Rules [2] planning criteria require assessment of extreme system conditions, which have a low probability of occurrence, such as extreme weather (i.e., 90th percentile load forecast), or the loss of fuel (gas) supply.

The NYCA steady state and stability performance analysis for extreme system conditions is performed using the Siemens PTI PSS®E and PowerGEM TARA software packages. The stability and steady state methodology for the Extreme System Condition Assessment is the same as discussed in the transmission security and stability sections earlier in this report.

Extreme Weather Condition Analysis

Description of Extreme Weather Study Case

The extreme weather steady state and stability study cases are derived from the system representation discussed earlier in this report. However, load is increased to meet the forecast statewide coincident peak load, reflecting weather conditions expected to occur no more than once in ten years. As a conservative planning assumption, the extreme weather condition case assumes that wind generation is unavailable.

Figure 27 below provides a comparison of the baseline and 90th percentile forecast of the 2025 coincident summer peak load [10]. Details of the study case are provided in Appendix D.

Figure 27: 2025 Baseline and 90th Percentile Coincident Summer Peak Load Delta by Zone (MW)

Zone	A	B	C	D	E	F	G	H	I	J	K	NYCA
Baseline	2,585	1,935	2,705	693	1,271	2,276	2,118	647	1,425	11,390	4,666	31,711
90th Percentile	2,763	2,068	2,891	741	1,358	2,439	2,270	681	1,500	11,797	5,068	33,576
Delta	178	133	186	48	87	163	152	34	75	407	402	1,865

The NYISO uses guidelines by the Multiregional Modeling Working Group (MMWG) to accept the working dynamic case. Pursuant to the guideline, the NYISO performs a 20-second no-fault simulation and 60-second disturbance (performed at the Marcy 345 kV bus) simulation to construct an acceptable dynamic case. The no-fault simulation is expected to show no initialization concerns and no significant drift to the base dynamic case is detected. In the 60-second disturbance simulation, a six-cycle duration three-phase fault is applied at the Marcy 345 kV bus without tripping any branches and simulated for 60 seconds to make sure the system reaches a new steady condition. As the pre-disturbance and post-disturbance network topology are identical, the simulation is expected to return to a steady condition as in the pre-disturbance case. In comparing the electrical power output of the generators between the pre-disturbance base case and the post-disturbance case, it is expected to not have more than 1 MW or 1 MVAR of generator deviation. The Marcy disturbance based test for the 90th percentile dynamic case indicated deviations of more than 1 MW and 1 MVAR across various generators in NYCA. According to MMWG guidelines, the NYISO expects generator MW or MVAR change of no more than 1 MW or 1 MVAR between the pre-disturbance base case and the 60-seconds post-disturbance case.

The 2025 90th percentile dynamic case was tested for the no-fault simulation and the 60-second disturbance simulation to determine the dynamic case usability. The no-fault test indicated no initialization concerns and indicated a flat response across NYCA system.

The 60-second disturbance simulation applied at the Marcy 345 kV bus did not meet the defined MMWG criteria. Therefore, additional dynamic reactive capability was added to the case to meet the MMWG criteria. This simulation is accomplished by using the Compensatory MVA generators identified in the RNA. The values for the Compensatory MVAs generators are shown in Figure 25. These resources were added to the model as representations for the future solutions needed to address the baseline transmission security issues.

Extreme Weather Analysis Results

The 2025 90th percentile case steady state analysis indicated no thermal or voltage issues on the BPTF system for N-0 and N-1 analysis.

With compensatory MVA considered in the 2025 90th percentile load case, all contingencies evaluated indicated a stable response. No voltage recovery issues on the BPTF system were identified, and no generator unit indicated an out-of-step condition other than by the fault clearing action. As the baseline transmission security analysis is observing various transmission security concerns in the Con Edison service territory, the impact of the ultimate solution(s) to these issues will also impact the conclusions of the extreme weather analysis. The next ATR will re-evaluate the impact of these solutions for the extreme weather analysis.

Loss of Gas Supply Analysis

Description of Loss of Gas Supply Analysis Study Case

Natural gas-fired generation in the NYCA is supplied by various networks of major gas pipelines. From a statewide perspective, New York has a relatively diverse mix of generation resources. Details of the fuel mix in New York State are outlined in the 2020 Gold Book [10] and 2020 Power Trends Report [15].

The study case for the extreme system condition of a natural gas fuel shortage is more likely to occur during the winter peak demand period. Therefore, the study model for this assessment uses the winter peak demand level with all NYCA gas-only units modeled as unavailable (out-of-service) for this analysis. The unavailability of dual fuel units that contain limitations on the amount of oil they can burn was also considered. Further, corresponding reductions in peak output capability on dual fuel units when operating on their alternative fuel source are modeled in this analysis. The total reduction in generating capability is approximately 8,700 MW. Details of the study case are provided in Appendix D.

Loss of Gas Supply Analysis Results

The steady state analysis showed no thermal or voltage violations. For dynamic analysis, most contingencies evaluated are stable, damped, and no generating unit lost synchronism other than by fault clearing action or special protection system response. Under the system conditions evaluated for this extreme system condition, events listed in Figure 28 show angular instability on some generating units, transient recovery voltage and simulation collapse. In performing this assessment generator voltage schedules for units in the Oswego Complex are held near 1.05 pu.

Figure 28: Dynamic Stability Criteria N-1 Violation – Loss of Gas Extreme System Conditions

Dynamic Stability Criteria N-1 Violations (BPTF)		
Contingency Name	**Contingency Description**	**Generator Synchronism**
CE36	Fault at Scriba 345kV with stuck breaker R100	x
CE99	Fault at Scriba 345kV with stuck breaker R935	x
VE07	Fault at Clay 345kV with stuck breaker R35	Simulation collapse

Following the clearing action of a fault on the system by protection system actions, the bus voltage and generator rotor usually enter an oscillatory period. The generator excitation system controls the generator terminal voltage to improve and stabilize the voltages. Nevertheless, depending on the severity of voltages and generator size, the voltages may or may not stabilize. Generator rotor swings after a fault are caused by the accumulation of energy, *i.e.* an imbalance between electrical power and mechanical power, during the fault. After the clearing of the fault, the generator rotor swings (or “oscillations”) dissipate that accumulated energy over time. For a stable system response, these oscillations damp out over time to an acceptable post-fault value. For an unstable system response, the system may observe unacceptable damping, system separation, cascading, and generating units losing synchronism with the system.

As there are dynamic instabilities in this assessment, the NYISO conducted an evaluation of implementing a change to design or operating practices to address the identified issues. The details of this evaluation is described in Appendix M.

During the dynamic simulation timeframe, sufficient dynamic reactive resources to sustain transient voltage support during the natural swings of the system are crucial. Generally, the system response to these swings to maintain voltage comes from generator excitation system response, STATCOMs, static VAr compensators (SVCs), wind and solar plant voltage controls, and other fast-acting resources.[10] While pre-contingency voltages can be maintained using static reactive resources, the dynamic system response timeframe focuses primarily on dynamic reactive capability due to the transient nature of large power and voltage swings and the short response time required. Another key contributor to reducing oscillations is reducing the amount of time needed to clear a fault (*i.e.* a quicker clearing time results in less accumulation of energy imbalances between mechanical and electrical power over time).

Additional dynamic reactive capability can address the observed dynamic stability criteria violations. Utilizing a STATCOM as a compensatory MVA resource placed at the Independence 345 kV bus, approximately 400 MVA would be sufficient to address the dynamic instabilities. However, this result assumes that there is no change to the protection system clearing times. Consideration of potential updates to the clearing times that could occur through relay replacements and setting changes has also been evaluated. Updates to clearing times that could occur through relay replacements and setting changes alone is insufficient to address the dynamic instabilities. However, it does reduce the amount of compensatory MVA needed to address these issues. In consideration of the reduced clearing times, a STATCOM of approximately 350 MVA at the Independence 345 kV bus would be sufficient in this scenario to address the dynamic instabilities.

The compensatory MVA additions are not intended to represent specific solutions, as the impact of specific solutions can depend on the type of the solution and its location on the grid. Rather, the compensatory MVA provides a generic order-of-magnitude measure to design or operating practices to address the issues.

[10] https://www.nerc.com/comm/PC_Reliability_Guidelines_DL/Reliability%20Guideline%20-%20Reactive%20Power%20Planning.pdf

Review of Special Protection Systems

The purpose of this review is to present the need and utilization of Type 1 and Type II existing and planned Special Protection Systems (SPS) as well as the validity of the classification of Type III SPS, including any back-up or redundant systems. This review evaluates the designed operation and possible consequences of failure or mis-operation of the SPS within the NYCA that are due to steady state or stability issues. The steady state and stability cases used for this review are identified in Appendix L and details on the cases are available in Appendix D. A complete list of the NYCA SPS along with a results summary is provided in Appendix L.

Methodology

The steady state and stability review of the NYCA SPS is performed using the Siemens PTI PSS®E Rev 34 software package. Each SPS was tested for several actions including correct operation, non-operation, and mis-operation. To evaluate the correct operation of an SPS, a fault or contingency is applied, including the cross-trip or generation rejection, to determine whether the action would help the system remain stable. To evaluate the non-operation of the SPS, a fault or contingency is applied without the cross-trip or generation rejection. The outcome of this test helps to determine the classification (Type I, II, or III) of the SPS. To evaluate the mis-operation of the SPS, the cross-trip or generation rejection occurs without an initiating fault or contingency.

Analysis Results

The simulation of the Type I SPS-#41/48, which involved the tripping of the Hydro Quebec import to Chateauguay initiated by the loss of the Massena-Chateauguay (MSC-7040) line or the loss of the Massena-Marcy (MSU1) line or the loss of one of the Marcy 765kV/345kV transformers (AT1 and AT2) or a split bus condition which transfer trips to Hydro Quebec and then Massena, was stable for correct operation and mis-operation of the SPS but unstable for the failure to operate. This SPS was tested for the 2025 50/50 Base Case and Moses South margin case. SPS-#41/48 should remain classified as Type I. Based on the forecasted load and system conditions, the NYISO does not anticipate an increase in utilization of this SPS or a change in the need for this SPS.

The simulation of the Type I SPS-#43, which rejects generation at St. Lawrence for local design contingencies, was stable for correct operation, failure to operate, and mis-operation. While the results for the conditions tested indicate that this SPS could potentially be considered a Type III, no change in type is requested at this time. This SPS was tested for the 2025 50/50 Base Case and Moses South margin case.

Based on the forecasted load and system conditions we do not anticipate an increase in utilization of this SPS or a change in the need for this SPS.

All Type III SPS are tested for correct operation, non-operation, and mis-operation. The study results show that they should remain classified as Type III. Therefore, no change in classification of the Type III SPS is requested at this time.

Review of Exclusions from NPCC Basic Criteria

NPCC Directory #1 [1] contains a provision that allows a member to request an exclusion from criteria contingencies that are simultaneous permanent phase to ground faults on different phases of each of two adjacent transmission circuits on a multiple circuit tower, with normal fault clearing. Given that the NYCA does not have any such exclusion at this time, none were reviewed. Furthermore, no requests for exclusions are anticipated in the near future.

Additional NYSRC Requirements

This section addresses additional requirements specific to NYSRC Reliability Rules [2] that are not addressed in other sections of this report.

System Restoration Assessment (B.2 R1.3 Assessment 5)

NYSRC Reliability Rules B.2 R1.3 Assessment 5 [2] requires the NYISO to evaluate the impact of system expansion or configuration facility plans on the NYCA System Restoration Plan. The list below outlines planned system expansion facilities which will have an impact on the NYCA System Restoration Plan:

- The Empire State Line Western New York Project is a new 345 kV transmission facility planned to connect into the Niagara – Kintigh – Rochester 345 kV path. This transmission project includes a new Dysinger 345 kV substation, a new East Stolle 345 kV switchyard, and PAR.
- The Rochester Gas & Electric (RG&E) Rochester Transmission Reinforcement is a planned 345/115 kV substation (Station 255) located approximately 2 miles west of Station 80, connecting to the two Niagara-Rochester 345 kV lines. This addition also corresponds with a reconfiguration of Station 80.
- The NYSEG South Perry 230/115 kV transformer is an addition to the existing South Perry facility.
- The NYSEG Watercure 345/230 kV transformer is an addition to the existing Watercure facility. Additionally, the Watercure 345 kV substation has reconfiguration plans.
- The NYSEG Gardenville 230/115 kV transformer is an addition to the Gardenville facility.

Additionally, the Gardenville 230/115 kV substation has reconfiguration plans and existing Gardenville 230/115 kV transformers TB#3 and TB#4 will be replaced.

- The NYSEG Oakdale 345/115/34.5 kV transformer is an addition to the exiting Oakdale facility. The Oakdale 345 kV substation has reconfiguration plans.
- The NYSEG Coopers Corners 345/115 kV transformer is an addition to the existing Coopers Corners facility. The Coopers Corners 345 kV substation has reconfiguration plans.
- The NYSEG Fraser 345/115 kV transformer is an addition to the existing Fraser facility. Additionally, the Fraser 345 kV substation has reconfiguration plans.
- The LS Power Grid New York/NYPA Segment A double circuit project (Q#556) includes: retiring two Porter – Rotterdam 230 kV Lines #30 and #31; building two new 345 kV transmission lines from Edic 345 KV to New Scotland 345 kV; constructing a new Rotterdam 345 kV substation which loops in the existing Edic to New Scotland 345 kV transmission line; constructing a new Princetown 345 kV switchyard interconnecting the Rotterdam to New Scotland, and Edic to New Scotland 345 kV AC transmission lines.
- The NY Transco Segment B project (Q#543) includes: new Knickerbocker 345 kV substation between New Scotland 345 kV and Alps 345 kV stations and a new 345 kV line between Knickerbocker and Pleasant Valley; and new series compensation capacitor bank with bypass switching provision on the new Knickerbocker – Pleasant Valley 345 kV line at the proposed Knickerbocker 345 kV Switching Station.
- The RG&E Station 122 (Pannell Road) 345 kV relay replacement project is the upgrade of the relays PC1 and PC2 between the Station 122 345 kV substation and the Clay 345 kV substation.
- The Orange and Rockland Ramapo 345/138 kV transformer is an addition to the existing Ramapo facility.
- The New York Power Authority (NYPA) Moses – Adirondack 230 kV project is a replacement of approximately 78 miles of the Moses to Adirondack 230 kV circuits 1 and 2.
- The NYPA Niagara 230 kV project is the addition of a new 230 kV breaker.

The potential impacts of the system expansion plans listed above have been communicated to NYISO Operations Engineering for consideration in the annual review and update of the NYCA System Restoration Plan.

Local Rules Consideration of G.1 through G.3 (B.2 R1.2)

The NYSRC has adopted Local Reliability Rules that apply to New York City and Long Island zones to protect the reliable delivery of electricity for specific electric system characteristics and demographics relative to these zones. The NYISO requests information from the local Transmission Owners on changes in local system conditions that would impact the New York State BPS at the beginning of every year. The base conditions are described earlier in this report and summaries are included in the appendices, which illustrate the application of the following local rules to the system models used for this year's assessments:

- *G.1(R2) Operating Reserves/Unit Commitment, G.1(R3) Locational Reserves (New York City)*
    - Local Operating Reserve rules are considered in the development of the base case used for all reliability assessments.
- *G.2 Loss of Generator Gas Supply (New York City), G.3 Loss of Generator Gas Supply (Long Island)*
  - Specific loss of generator gas supply studies are performed by Con Edison and PSEG-Long Island and are reviewed by the NYISO. The planned system is expected to be compatible with local rules regarding loss of generator gas supply.
- *G.1(R) Thunderstorm Watch (New York City)*
    - Proposed facilities [10] included in this assessment may impact the Thunderstorm Watch contingency list due to substation reconfiguration and facility additions. The contingencies impacted by system facility changes will be evaluated before the proposed facilities are in-service.

Overview Summary of System Performance

Five assessments and two reviews were conducted for the 2020 CATR.

In the first assessment, power flow analysis was conducted to evaluate the thermal and voltage performance of the New York State BPTF for normal (or design) contingencies considering both N-1 and N-1-1 conditions, as defined by NPCC Directory #1 [1], and NYSRC Reliability Rules [2] planning criteria. The 2025 summer peak power flow analysis shows thermal violations on the BPTF system for N-1-1 and N-1-1-0 conditions. However, these issues are addressed with base case updates provided before the completion of the CATR. Also within the first assessment, stability analysis is conducted to evaluate the stability performance of the New York State BPTF for normal (or design) contingencies as defined in NPCC Directory #1 [1], and NYSRC Reliability Rules [2] planning criteria. The stability simulations show stability criteria violations on the BPTF for N-1 and N-1-1 conditions. However, these issues are addressed with base case updates provided before the completion of the CATR. Therefore, for this ATR no Corrective Action Plans are needed to address any steady state or dynamics criteria violations.

In the second assessment, power flow and stability analysis are conducted to evaluate the performance of the BPS for low probability extreme contingencies as defined in NPCC Directory #1 and NYSRC Reliability Rules. The power flow analysis results indicate that most of the extreme contingencies do not cause significant thermal or voltage violations over a widespread area. The stability analysis results indicate that the system remains stable for most extreme contingencies.

The third assessment evaluates the fault current duty at BPTF buses in the short circuit representation. No overdutied breakers are observed in this assessment.

The fourth assessment evaluates extreme system conditions, which have a low probability of occurrence (e.g., high peak load conditions resulting from extreme weather and the loss of fuel (gas) supply). For both the high peak load and loss of gas supply conditions, the power flow analysis results indicate that these system conditions do not cause thermal or voltage violations on the BPTF. With compensatory MVA considered in the 2025 90th percentile load dynamic case, all contingencies evaluated indicated a stable and damped response and no generator unit indicated an out-of-step condition other than by the fault clearing action. For the loss of gas case, the stability analysis results show that most contingencies are stable and damped. For instances where instabilities are observed, an evaluation of implementing a change to design or operating practices to address the issues was conducted. This evaluation concludes that about 400 MVA of dynamic reactive capability near the Oswego complex would be needed to meet dynamics reliability criteria.

The fifth assessment and other requirements specific to the NYSRC Reliability Rules include: System Restoration Assessment and Local Operation Area criteria. The planned system meets these NYSRC Reliability Rules.

A review of Special Protection Systems (SPS) evaluates impacts due to system changes. New York has added new SPS since the 2015 CATR. Some SPS have been retired since the 2015 CATR but these retirements have passed the NPCC SPS retirement evaluation. Changes in system conditions have not impacted the operation or classification of existing SPS as well as the classification of new SPS.

A review of exclusions to Directory #1 criteria evaluates impacts due to system changes. The NYCA has no existing exclusions to NPCC Basic Criteria and no requests for new exclusions have been made.

Conclusion

As the results of this ATR indicate, in consideration of the post-RNA base case updates, the planned bulk power transmission facilities, as planned through year 2025, conform to the applicable NPCC Directory #1 and NYSRC Reliability Rules. Additionally, the NYISO did not identify marginal conditions that warranted analysis beyond the five-year study period.

References

1. Northeast Power Coordinating Council, “NPCC Regional Reliability Reference Directory #1, Design and Operation of the Bulk Power System”, Version 3, dated September 9, 2020.
2. New York State Reliability Council, “Reliability Rules and Compliance Manual”, Version 45, dated July 17, 2020.
3. New York Independent System Operator, “Transmission Expansion and Interconnection Manual”, Attachment F: NYISO Transmission Planning Guideline #1-1 – Guideline for System Reliability Impact Studies, Version 4.1, dated December 1, 2020.
4. New York Independent System Operator, “Transmission Expansion and Interconnection Manual”, Attachment G: NYISO Transmission Planning Guideline #2-1 – Guideline for Voltage Analysis and Determination of Voltage-Based Transfer Limits, Version 4.1, dated December 1, 2020.
5. 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 4.1, dated December 1, 2020.
6. New York Independent System Operator, “Transmission Expansion and Interconnection Manual”, Attachment I: NYISO Transmission Planning Guideline #4-1 – NYISO Guideline for Fault Current Assessment, 4.1, dated December 1, 2020.
7. New York Independent System Operator, “Reliability Analysis Data Manual”, Version 4.0, dated July 10, 2019.
8. North American Electric Reliability Corporation, “Transmission System Planning Performance Requirements”, TPL-001-4.
9. New York Independent System Operator, “2015 Comprehensive Area Transmission Review of the New York State Bulk Power Transmission System”, Final Report, dated June 1, 2016.
10. New York Independent System Operator, “Load and Capacity Data, A Report by the New York Independent System Operator, Inc.”, Released April 2020.
11. Northeast Power Coordinating Council, “Classification of Bulk Power System Elements (Document A-10)”, dated March 27, 2020.
12. New York Independent System Operator, “Locational Minimum Installed Capacity Requirements Study for the 2020-2021 Capability Year”, dated January 8, 2020.
13. New York Independent System Operator, “Methodology for Assessment of Transfer Capability in the Near-Term Transmission Planning Horizon”, dated June 8, 2018.
14. 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 7.4, dated October 29, 2020.
15. New York Independent System Operator, “2020 Power Trends, The Vision for a Greener Grid”.
16. New York Independent System Operator, “Transmission and Dispatch Operations Manual”, Section 4.2.4 Process for Determining the Status of Series Reactors that are under ISO Operational Control, Version 4.0, dated December 1, 2020.
17. New York Independent System Operator, “2020 RNA Report”, dated November 2020.