2018 Intermediate Area Transmission Review

Of the New York State Bulk Power Transmission System (Study Year 2023)

A Report by the
New York Independent System Operator

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Table of Contents

List of Tables

List of Figures

Appendices

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 Intermediate ATR analyzed the BPTF, only BPS facilities are subject to NPCC Directory #1 and the NYSRC Reliability Rules.

This report comprises the second intermediate ATR submitted by the NYISO since the 2015 NYISO Comprehensive Area Transmission Review (CATR) was approved by the NPCC in June 2016.

Five assessments and three Reviews are made for this Intermediate ATR. Overall, the results are comparable to the 2015 CATR, which found the planned New York State BPS is in conformance with applicable NPCC Directory #1 and NYSRC Reliability Rules, and NYISO guidelines and procedures.

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 2018 ATR, the external area representations are from the 2017 ERAG MMWG series library cases. The New York Control Area (NYCA) system representation is from the NYISO 2018 FERC 715 filing power flow models with updates according to the NYISO 2018 Load and Capacity data ("Gold Book").

Changes to the five-year case for this review (2023) compared to the five-year case for the 2015 CATR (2020) include a 2,025 MW decrease in load forecast, a decrease of approximately 3,575 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 Empire State Line/Western New York Public Policy (WNYPP) project.

The first assessment evaluates the transmission security and stability of the planned system for year 2023. 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 in steady state. 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, NYSRC Reliability Rules, and NERC Transmission Planning (TPL) criteria. 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.

The 2023 summer peak power flow analysis shows no thermal or voltage violations on the BPTF. System adjustments are identified for each first level contingency (N-1-0) such that there are no post-contingency thermal and/or voltage violations following any second contingency (N-1-1). The 2023 summer peak load stability simulation shows no criteria violation for N-0, N-1 or N-1-1 conditions.

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 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. 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 to low voltage or thermal violations.

The third 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).

The high peak load condition for summer 2023 and the loss of gas for winter 2023 show no steady state or stability criteria violations.

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

The fifth assessment evaluates other requirements specific to the NYSRC Reliability Rules. The NYSRC requirements in this Section 9 include: System Restoration Assessment and Local Operation Area criteria. The planned system meets these NYSRC reliability rules.

The first review evaluates Special Protection Systems (SPS). New York has not added any new SPS since the 2015 CATR. Some SPS have been retired since the 2015 CATR but these retirements have gone through the NPCC SPS retirement evaluation and have been approved by NPCC. System conditions have not changed sufficiently to impact the operation or classification of existing SPS.

The second review evaluates Dynamic Control Systems (DCS). System conditions have not changed sufficiently to impact the operation or classification of previously reviewed DCS since the 2015 CATR.

The third review evaluates exclusions to Directory #1 criteria. The NYCA has no existing exclusions to NPCC Basic Criteria and makes no requests for new exclusions.

In conclusion, the 2018 Intermediate ATR determines that the New York State BPTF, as planned (including Corrective Action Plans), through year 2023, 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 [2], and NYISO guidelines and procedures [3]-[6]. Although this Intermediate ATR 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 six through ten) 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 an Intermediate Review, as described in NPCC Directory #1 [1]. The previous CATR of the New York State BPTF was performed in 2015, approved on June 1, 2016, and assessed the planned year 2020.

This 2018 Intermediate ATR assesses the planned year 2023 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].

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 2018 ATR, the external area representation is from the 2017 ERAG MMWG series library cases. The New York Control Area (NYCA) system representation is from the NYISO 2018 FERC 715 filing power flow models with updates according to the NYISO 2018 Load and 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 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 Intermediate ATR, seven substations were evaluated: (1) Bayonne 345 kV, (2) Cricket Valley 345 kV, New York Empire State Line Project 345kV ((3) Dysinger and (4) East Stolle 345 kV substations), (5) South Perry 230 kV, (6) Kings Highway 138 kV and (7) Ogdensburg 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 Table 1 reflect the changes in BPTF since the 2015 CATR. Proposed major changes generation projects included in the base case are listed in Table 2 and Table 3. Additional changes to transmission plans, generation additions/up-rates, or shutdowns/de-ratings that occurred following the publication of the NYISO 2018 Gold Book [10] will be captured in future reviews.

Table 1 Changes in the Bulk Power Transmission Facilities

Bulk Transmission	2015 Comprehensive ATR	2018 Intermediate 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/2020S
Rochester Transmission Reinforcement 345 kV Substation (Q#339)	Y/2019W	Y/2020W
Con Edison Rainey-Corona Transformer/Phase Shifter	Y/2019S	Y/2019S
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
NYSEG Watercure 345/230 kV Transformer	Y/2018S	Y/2019W
NYSEG Coopers Corners 345 kV Shunt Reactor	Y/2015S	Y/In-Service
NYSEG Gardenville 230/115 kV Transformer	Y/2017S	Y/2019W
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/2019W
N. Grid Clay – Teall 115 kV reconductoring	Y/2017W	Y/2019W
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 North Rockland (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	Y/2019S
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	Y/2021W
NYSEG Fraser 345/115 Transformer	N/A	Y/2021W
NYSEG Coopers Corners 345/115 Transformer	N/A	Y/2022S
NYSEG Wood St. 345/115 Transformer	N/A	Y/2022S
Cricket Valley Energy Center 345 kV Substation (Q#444)	N/A	Y/2019W

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

Additions/Up-rates	Queue	Size (MW)	2015 Comprehensive ATR	2018 Intermediate ATR
			Included/IS Date	Included/IS Date
Rochester Gas & Electric Station 2	338	6.3	N/2018-09	Y/2018-09
CPV Valley Energy Center	251	677.6	Y/2017-10	Y/In-Service
Copenhagen Wind	395	79.9	N/A	Y/2018-11
Taylor Biomass	349	19	N/A	Y/2021-04
Bethlehem Energy Center Uprate	403	72	N/2017-2018	Y/2017-2018
Cassadaga Wind	387	126	N/A	Y/2019-12
Arkwright Summit	421	78.4	N/A	Y/2018-10
Cricket Valley Energy Center II	444	1020	N/A	Y/2020-01
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
Bayonne Energy Center II	510	120.4	N/A	Y/In-Service
Ogdensburg	511	79	N/A	Y/2018-05
Riverhead Solar	477	20	N/A	Y/2018-10
Lyons Falls Mill Hydro	512	2.5	N/A	Y/2018-03

Notes:

1. The MW values noted in this table are summer value noted in the 2018 Gold Book Tables IV-1 and IV-2.

Table 3 Shutdowns/De-ratings in Generation[1]

Shutdowns/ De-ratings	Size (MW)	2015 Comprehensive ATR	2018 Intermediate 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	1018.5	In-Service	2020-04
Indian Point 3	1037.8	In-Service	2021-04
Selkirk 1	78.1	In-Service	2018-05
Selkirk 2	282.1	In-Service	2018-05

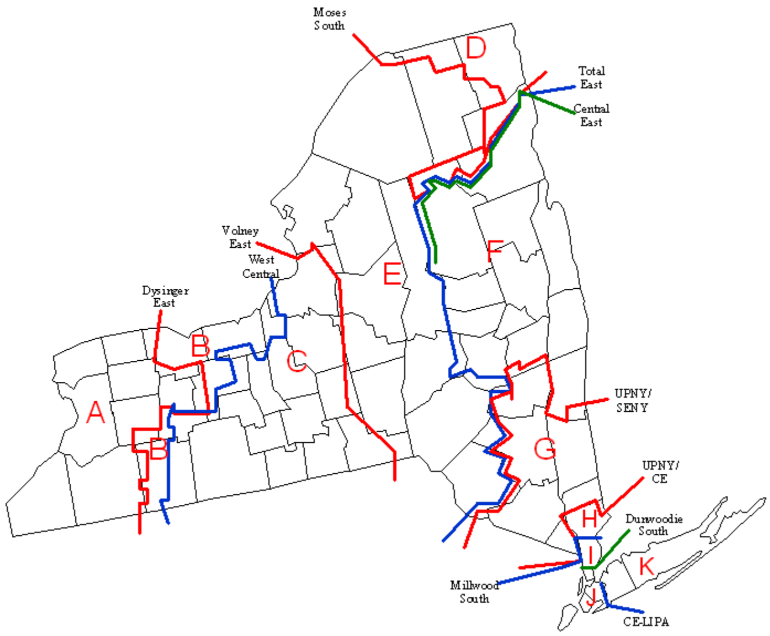
Notes:

1. The values noted in this table are from 2018 Gold Book Table IV-3, IV-4, and IV-5.

Interface Definitions

The NYISO monitors and evaluates the eleven major interfaces between the zones within the NYCA. Figure 1 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 1 NYCA Interfaces and LBMP Load Zones



Scheduled Transfers

Table 4 lists the NYCA scheduled inter-Area transfers modeled in all study cases between the NYCA and each neighboring system for study year 2023.

Table 4 NYCA Scheduled Inter-Area Transfers

Region		Transaction (MW)
From	**To**	**2023**
NYCA	NE	88
NYCA	HQ	-1110
NYCA	PJM and Others	-817
NYCA	Ontario	0

Load and Capacity

Table 5 provides a comparison of the load, capacity, and reserve margin between the 2015 CATR and the 2018 Intermediate ATR. As shown in Table 5 the 2023 study year reserve margin is greater than the required Installed Reserve Margin (IRM) of 18.2% approved by the NYSRC for the 2018-2019 Capability Year [12].

Table 5 Load and Capacity Forecast

Description	Comprehensive Review: 2015 Forecast for Summer 2020	Intermediate Review: 2018 Forecast for Summer 2023	Change From Previous CATR
Peak Load (MW)	34,309	32,284	-2,025
Total Capacity (MW)	43,779 (1)	40,198 (2)	-3,581
Reserve Margin	27%	24%	-3%

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 2018 Gold Book and represents the 2023 Total Resource Capability from Table V-2a plus changes in generation facilities changes included in this review

Steady State and Stability Conformance Assessment

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 2018 Intermediate ATR 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 [15].

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 2023);
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 Base Cases

The steady state power flow and stability models for evaluating the New York State BPTF performance are developed from 2017 ERAG MMWG series databases. The NYCA system representation is derived from the NYISO 2018 FERC 715 filing. Changes are made to the NYCA system representation to reflect the updates included in the NYISO 2018 Gold Book [10]. 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 2018 Intermediate ATR, 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 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 is confirmed through further analysis documented in this report.

Summer peak load stability margin transfer cases (West Central margin, Moses South margin, Central East margin, and UPNY margin cases) are created from the 2023 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 2023 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 2023 summer peak load base case with the load increased to meet the forecast statewide coincident high peak load (i.e. 90th percentile load – approximately 34,089 MW) [10], reflecting weather conditions expected to occur no more than once in 10 years.

Table 6 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.

Table 6 Scheduled on Inter-Area Controllable Devices

Location	Comprehensive Review:	Intermediate Review:
	2015 Forecast for Summer 2020[2]	2018 Forecast for Summer 2023[2]
	MW Schedule	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	-11
Farragut PAR 2 (C3403)[1]	333	-11
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 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 2023 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 2018 Intermediate ATR is provided in Appendix C.

The thermal transfer analysis monitors transmission facilities above 100 kV, including all New York State

BPTF elements under contingency conditions while shifting power across interfaces within NYCA and neighboring systems.

The thermal transfer analysis 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 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

Table 7 through Table 10 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 meets the applicable NERC [8], NPCC and NYSRC Reliability Rules [1]-[2] with respect to thermal ratings. The New York State BPTF transmission security is maintained by limiting power transfers according to the determined thermal constrained transfer limits. Explanations for changes in transfer limits of greater than 100 MW are provided below. Details regarding thermal transfer analysis results are provided in Appendix E.

- The Dysinger East and West Central Interface's normal and emergency thermal transfer limits do not show significant change when compared to the 2015 CATR; however, there have been significant changes to this portion of the system. The 2016 ATR observed a degradation in the Dysinger and West Central transfer limits due to the generation retirements that caused increased power flows on the 230 kV transmission system from Niagara through Gardenville (a transfer limit degradation was observed on Dysinger East normal and emergency transfer limits of 875 MW and 775 MW, respectively); however, the Empire State Line Project alleviates the burden placed on the 230 kV transmission system in Western New York (the Dysinger East normal and emergency transfer limits to increase by 850 MW and 1,050 MW, respectively, when compared to the 2016 ATR). The Dysinger East and West Central interfaces' transfer limits are sensitive to the Dysinger PAR schedule. For this assessment the Empire PAR was scheduled at 400 MW from the Dysinger 345 kV substation to the East Stolle 345 kV substation. No attempt was made to optimize the Dysinger PAR schedule for this assessment.
- The Central East Interface normal and emergency thermal transfer limits increased compared to the 2015 CATR. The increased transfer limits are due to generation retirements in the Capital area and dispatch patterns in ISO-New England that are impactful to the historical loop flow observed through the Capital and Hudson Valley regions between New York and New England.
- The UPNY-SENY Interface emergency thermal transfer limit increased compared to the 2015 CATR. The difference in transfer limitation is due to a combination of generation retirements and additions in the areas near the interface.
- The UPNY-ConEd Interface's normal and emergency thermal transfer limits increased compared to the 2015 CATR. 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 in the areas near the interface. Generation additions and shutdowns are noted in Tables 2 and 3 of this report, respectively.

When analyzing the inter-Area transfer limits, generation dispatch assumptions in neighboring areas can have 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 New York – New England normal and emergency transfer limits increased while the New England – New York normal and emergency transfer limits decreased. These changes in transfer limits are due the combination of generation retirements and additions in the areas near the interface as well as reduced New England loop flow. Generation additions and shutdowns are noted in Tables 2 and 3 of this report, respectively.
- The Ontario – New York normal and emergency transfer limits increased compared to the 2015 CATR. The changes in transfer limit are primarily due to the Empire State Line project in western New York.
- Changes in the New York – PJM and PJM – New York normal and emergency transfer limits are primarily due to the new methodology used for New York – PJM transfers as a result of the NYISO-PJM Joint Operating Agreement (JOA).

Table 7 Normal Transfer Criteria Intra-Area Thermal Transfer Limits

Interface	2015 Comprehensive Review	2018 Intermediate Review
	Study Year 2020	Study Year 2023
Dysinger East	1,750 (1)(A)	1,725 (2)(A)
West Central	400 (1)(A)	500 (2)(A)
Volney East	4,125 (3)	4,225 (3)
Moses South	2,350 (4)	2,300 (4)
Central East	2,350 (5)	2,725 (5)
Total East	4,850 (6)	4,850 (6)
UPNY-SENY	5,075 (7)(B)	4,975 (6)(B)
UPNY-ConEd	4,950 (8)(C)	6,875 (9)(D)
Sprain Brook-Dunwoodie South	5,625 (10)(C)(E)(F)	5,700 (10)(D)(E)
Long Island Import	1,700 (11)(G)	1,675 (12)(G)

Notes:

1. Huntley–Sawyer 230 (80) at 654 MW LTE rating for L/O Huntley–Sawyer 230 (79)
2. Niagara–Packard 230 (61) at 847 MW STE rating for L/O Niagara–Packard 230 (62) and Beck–Packard 230 (BP76)
3. Fraser–Coopers Corners 345(33) at 1721 MW LTE rating for L/O Porter–Rotterdam 230 (31) and Marcy–Coopers Corners 345(41)
4. Browns Falls–Taylorville 115 (3) at 134 MW STE rating for L/O Chateauguay–Massena–Marcy 765 (MSU-1)
5. New Scotland 77–Leeds 345 (93) at 1538 MW LTE rating for L/O New Scotland 99–Leeds 345 (94)
6. Dolson-Rock–Tavern 345 (DART44) at 1793 MW LTE rating for L/O Coopers Corners–Middletown Tap–Rock Tavern 345 (CCRT34) and Rock Tavern–Roseton 345 (311)
7. Leeds–Pleasant Valley 345 (92) at 1538 MW LTE rating for L/O CPV–Rock Tavern 345 (DART44) and Coopers Corners–Middletown Tap - Rock Tavern 345 (CCRT34)
8. Shoemaker–Chester 138 (27) at 317 MW STE rating for L/O Rock Tavern–Ramapo 345 (77) and Rock Tavern–Sugarloaf–Ramapo 345 (76)
9. Roseton–East Fishkill 345 (RFK305) at 2677 MW LTE rating for L/O Rock Tavern-Ramapo 345 (77), Rock Tavern–Sugarloaf–Ramapo (76), and Chester–Shoemaker 138 kV (27)
10. Dunwoodie–Mott Haven 345 (72) at 786 MW Normal rating for pre-contingency loading
11. Dunwoodie–Shore Rd. 345 (Y50) at 962 MW LTE rating for L/O Sprain Brook–E.G.C. 345 (Y49) and Sprain Brook–Academy 345/138 (M29)
12. Dunwoodie–Shore Rd. 345 (Y50) at 963 MW LTE rating for L/O Sprain Brook–E.G.C. 345 (Y49) and Sprain Brook–Academy 345/138 (M29)

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 (200 MW each)

D. Ramapo PARS are scheduled according to the NYISO and PJM joint operating agreement

E. Used Reliability Rules Exception Reference No. 20 – PSE&G Tie Feeders B3402 and C3403

F. Dunwoodie North PAR1 and PAR2 are scheduled at 115 MW each into NYC
Dunwoodie South PAR 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

G. E.G.C. PAR1 and PAR2 are scheduled at 315 MW each into Long Island
Lake Success and Valley Stream PARs are scheduled at 175 MW and 125 MW, respectively, into NYC
Neptune and CSC HVDC are scheduled at 660 MW and 96 MW, respectively, into Long Island

Table 8 Emergency Transfer Criteria Intra-Area Thermal Transfer Limits

Interface	2015 Comprehensive Review (Study Year 2020)	2018 Intermediate Review (Study Year 2023)
Dysinger East	2,325 (1)	2,600 (2)
West Central	975 (1)	1,375 (2)
Volney East	4,400 (3)	4,500 (3)
Moses South	2,350 (4)	2,300 (4)
Central East	2,650 (5)	3,050 (5)
Total East	5,100 (6)	5,225 (7)
UPNY-SENY	5,300 (6)(A)	5,475 (7)(B)
UPNY-ConEd	6,325 (8)(A)	9,175 (8)(B)
Sprain Brook-Dunwoodie South	5,625 (9)(A)(C)	5,700 (9)(B)
Long Island Import	2,250 (10)(D)	2,200 (11)(E)

Notes:

1. **Packard–Sawyer 230 (77)** at 704 MW STE rating for L/O Packard–Niagara 230 (61), Packard–Sawyer 230 (78), and Packard 230/115
2. **Packard–Sawyer 230 (77)** at 746 MW STE rating for L/O Packard–Sawyer 230 (78) reactor and Packard–Niagara 230 (61) and Packard 230/115 kV Transformer (XMFR 3)
3. **Fraser–Coopers Corners 345 (33)** at 1793 MW STE rating for L/O Marcy–Coopers Corners 345 (41)
4. **Browns Falls–Taylorville 115 (3)** at 134 MW STE rating for L/O Chateauguay–Massena–Marcy 765 (MSU-1)
5. **New Scotland 77–Leeds 345 (93)** at 1724 MW STE rating for L/O New Scotland 99–Leeds 345 (94)
6. **Dolson–Rock Tavern 345 (DART44)** at 1793 MW STE rating for L/O Coopers Corners–Middletown Tap 345 (CCRT34)
7. **Coopers Corners–Middletown 345 (34)** at 1793 MW STE rating for L/O Dolson–Rock Tavern 345 (44)
8. **Roseton–East Fishkill 345 (RFK305)** at 1936 MW Normal rating for pre-contingency loading
9. **Dunwoodie–Mott Haven 345 (72)** at 786 MW Normal rating for pre-contingency loading
10. **Dunwoodie–Shore Road 345 (Y50)** at 687 MW Normal rating for pre-contingency loading
11. **Glenwood-Shore Road 138 (365)** at 358 MW STE rating for L/O Sprainbrook – East Garden City 345 (Y49)

A. Ramapo PAR1 and PAR2 are scheduled at 80% of the RECO load (200 MW each)

B. Ramapo PARS are scheduled according to the NYISO and PJM joint operating agreement

C. 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 NY

D. 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

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 60 MW and 175 MW, respectively, into Long Island
Neptune and CSC HVDC are scheduled at 660 MW and 96 MW, respectively, into Long Island

Table 9 Normal Transfer Criteria Inter-Area Thermal Transfer Limits

Interface	2015 Comprehensive Review	2018 Intermediate Review
	(Study Year 2020)	(Study Year 2023)
New York – New England	1,125 (1)	1,725 (2)
New England – New York	1,500 (3)	1,000 (4)
New York – Ontario	1,600 (5)	1,650 (6)
Ontario – New York	1,850 (5)	2,025 (6)
New York – PJM	2,475 (5)(A)	2,675 (7)(C)
PJM – New York	3,100 (6)(B)	3,225 (8)(D)

Notes:

1. **Pleasant Valley–Long Mountain 345 (NE 398 NY)** at 1382 MW LTE rating for L/O Millstone Unit #3 and PV-20 OMS
2. **Cricket Valley–Long Mountain 345 (NE 398 NY)** at 1599 MW LTE rating for L/O Alps–Berkshire 345 kV (NE 393 NY), Berkshire–Northfield 345 kV (312), and Berkshire 245/115 kV transformer
3. **Reynolds Rd. 345/115kV** at 562 MW LTE rating for L/O Alps–New Scotland 345kV (2)
4. **Pleasant Valley–Cricket Valley 345** at 1382 MW LTE rating for L/O Pleasant Valley–Cricket Valley 345 kV
5. **Beck–Niagara 230 (PA27)** at 460 MW LTE rating for L/O Niagara–Beck 345kV (PA302)
6. **Beck–Niagara 230 (PA27)** at 460 MW LTE rating for L/O Niagara–Beck 345kV (PA301)
7. **Westover–Laurel Lake 115 kV** at 108 MW normal rating for pre-contingency loading
8. **Ramapo–Hopatcong 500 (5018)** at 1052 MW normal rating for pre-contingency loading

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

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

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

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

Table 10 Emergency Transfer Criteria Inter-Area Thermal Transfer Limits

Interface	2015 Comprehensive Review (Study Year 2020)	2018 Intermediate Review (Study Year 2023)
New York – New England	1,725 (1)	2,200 (2)
New England – New York	2,700 (3)	1,675 (4)
New York – Ontario	1,900 (5)	2,050 (6)
Ontario – New York	2,200 (3)	2,425 (6)
New York – PJM	2,575 (5)(A)	2,675 (7)(C)
PJM – New York	3,425 (6)(B)	3,225 (8)(D)

Notes:

1. **Pleasant Valley–Long Mountain 345 (NE 398 NY)** at 1680 MW STE rating for L/O Millstone Unit #3
2. **Cricket Valley–Long Mountain 345** at 1735 MW STE rating for L/O Millstone Unit #3
3. **Pleasant Valley–Long Mountain 345 (NE 398 NY)** at 1195 MW Normal rating for pre-contingency loading
4. **Pleasant Valley–Cricket Valley 345** at 1680 MW STE rating for L/O Pleasant Valley–Cricket Valley 345 kV
5. **Beck–Niagara 230 (PA27)** at 400 MW Normal rating for pre-contingency loading
6. **Beck–Niagara 230 (PA27)** at 558 MW STE rating for L/O Beck–Niagara 345 kV (PA 301)
7. **Westover–Laurel Lake 115 kV** at 108 MW normal rating for pre-contingency loading
8. **Ramapo–Hopatcong 500 (5018)** at1052 MW normal rating for pre-contingency loading

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

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

Voltage Transfer 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 2023 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 2023 peak load case. A set of power flow cases with increasing transfer levels is created for each interface from the 2023 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 ensure 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 2018 Intermediate ATR, 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 cure becomes infinite (i.e. vertical). Reaching the "nose" (which is the point of voltage collapse) occurs when reactive capability supporting the transfer of real power is exhausted. The region near the "nose" of the curve is generally referred to as the region of voltage instability.

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

The NYISO evaluates the voltage-constrained transfer limits for the Dysinger East, West Central, Volney East, Central East, UPNY-SENY, UPNY-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

Table 11 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 UPNY-SENY voltage-constrained transfer limit decreased compared to the 2015 CATR. The difference in transfer limitation is due to generation mothball/retirements in Western and Central New York resulting in increased generation shift from Ontario to stress the interface sufficiently, generation retirements and additions in the Hudson Valley region as well as reduced New England loop flow.
- The UPNY-ConEd voltage constrained transfer limit increased compared to the 2015 CATR. The difference in transfer limitation is caused by the non-renewal of the Con Edison and PSE&G Wheeling Agreement, generation retirements directly below the interface, and planned future generation directly above the interface.

Table 11 Summary of Voltage Constrained Transfer Limits

Interface	2015 Comprehensive Review	2018 Intermediate Review
	(Study Year 2020)	(Study Year 2023)
Dysinger East	2,950 (1) / 3,000 (2)	2,800 (3)
West Central	1,525 (1) / 1,650 (2)	1,550 (3)
Volney East	4,300 (4) / 4,400 (5)	4,400 (5)
Central East	2,650 (4) / 2,725 (5)	2,700 (6) / 2,725 (5)
UPNY-SENY	5,850 (7) / 5,875 (8)	5,650 (7) / 5,675 (8)
UPNY-ConEd	5,550 (9) / 5,625 (8)	7.375 (9) / 7,475 (8)
Sprain Brook-Dunwoodie South	5,275 (10) / 5,525 (11)	5,125 (12) / 5,500 (8)

Notes:

1. Station 80 345 kV pre-contingency low limit
2. 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)
3. 95% of PV nose occurs for L/O Somerset
4. Edic 345 kV pre-contingency low limit
5. 95% of PV nose occurs for L/O northern Marcy South double ckt. (L/O Marcy-Coopers Corners 345 kV and Edic-Fraser 345 kV)
6. Marcy 345 kV pre-contingency low limit
7. Pleasant Valley 345 kV bus voltage pre-contingency low limit
8. 95% of PV nose occurs for L/O Tower 34/42 (Dolson-Rock Tavern 345 kV and Coopers Corners-Rock Tavern)
9. Millwood 345 kV bus voltage pre-contingency low limit
10. Dunwoodie 345 kV pre-contingency low limit
11. 95% of PV nose occurs for L/O T:W89&W90
12. Sprainbrook 345 kV bus pre-contingency low limit

Stability Transfer and Transmission Security Analysis

Methodology

The dynamic data for this analysis are developed from the 2017 ERAG MMWG series databases. The New York Control Area (NYCA) system representation is from the NYISO 2018 FERC 715 filing power flow models with updates according to the NYISO 2018 Load and Capacity data ("Gold Book"). 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 ten 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 five 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, 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.

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. Table 12 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.

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 2023 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 2023 summer peak load stability base case, the NYISO created four NYCA margin cases (UPNY margin, Central East margin, West Central margin, and Moses South margin).

The UPNY-SENY and UPNY-ConEd open interfaces of the UPNY margin case are loaded at 6,291 and 8,230 MW, respectively. The UPNY-SENY emergency thermal limit is more limiting at 5,475 MW and UPNY-ConEd is voltage limited at 7,375 MW. This case has the Oswego Complex generation dispatched at an output of 5,339 MW and 1,289 MW of import from Hydro Quebec (supplied by Beauharnois hydro generation). The Chateauguay HVDC poles are taken out-of-service to exclude the dynamic benefit of the HVDC controls. The Ramapo PARs are scheduled at 134 MW each into New York.

The Central East margin case has the Oswego Complex generation dispatched at an output of 5,226 MW and 1,044 MW of import from Hydro Quebec (supplied by Beauharnois hydro generation) with the

Chateauguay HVDC poles out-of-service. The Central East open interfaces is loaded at 3,071 MW.

The Western margin case is loaded to the following open interface levels: Dysinger East 2,985 MW, West Central 1,800 MW, Ontario-to-New York 3,097 MW, and HQ-to-New York 1,845 (Chateauguay HVDC 866 MW, Beauharnois 984 MW).

The Moses margin case has the Moses South open interface loaded to 2,541 MW, HQ-to-New York 1845 MW (Chateauguay HVDC 866 MW, Beauharnois 984 MW), and the St. Lawrence L33/34 PARs scheduled at 150 MW each into New York.

Diagrams and descriptions of these cases are found in Appendix D.

Table 12 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 – New Scotland 345	Central East
Fraser – Gilboa 345	Total East
Leeds – Pleasant Valley 345	UPNY-SENY
E. Fishkill – Roseton 345	UPNY-Con Ed.

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 transfer limit or voltage transfer limit.

The stability analysis results show that the system response to all evaluated N-1-1 conditions is stable and damped.

This ATR demonstrates that the New York State BPTF meets the criteria for stability performance. The New York State BPTF transmission security is maintained by limiting power transfers according to the determined stability limits. The ATR 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. All stability analysis results and some representative plots are listed in Appendix G.

Assessment of Planning Transfer Capability

Table 13 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.

Table 13 Transfer Limit Comparison

Interface	2015 Comprehensive Review (Study Year 2020)				2018 Intermediate Review (Study Year 2023)			
	Normal (MW)		Emergency (MW)		Normal (MW)		Emergency (MW)	
Dysinger East	1,750	T	2,325	T	1,725	T	2,600	T
West Central	400	T	975	T	500	T	1,375	T
Volney East	4,125	T	4,300	V	4,225	T	4,400	V
Moses South	2,350	T	2,350	T	2,300	T	2,300	T
Central East	2,350	T	2,650	T/V	2,700	V	2,700	V
Total East	4,850	T	5,100	T	4,850	T	5,225	T
UPNY-SENY	5,075	T	5,300	T	4,975	T	5,475	T
UPNY-ConEd	4,950	T	5,550	V	6,875	T	7,375	V
Sprain Brook-Dunwoodie South	5,257	V	5,275	V	5,125	V	5,125	V
Long Island Import	1,700	T	2,250	T	1,675	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, NPCC Directory #1 [1], and NYSRC Reliability Rules [2] planning criteria.

Transmission security analysis evaluates the thermal and voltage performance of NYCA BPTF in response 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. 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, the loss of any critical transmission circuit, transformer, compensating device, generator, or single pole of an HVDC facility is first applied to the normal system condition (N-1-0) followed by allowable system adjustments to posture the system to be secure for all single events (N-1-1).

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. 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, or N-1-1 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.

For this assessment the transmission security analysis is performed on the system model for study year 2023 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, N-1-0 and N-1-1 conditions, the steady state analysis showed no observed thermal or voltage violations on the BPTF.

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 [17] 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 advance 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 2023 (case dated October 11, 2018 with the file name NYISO_SPRING_UPDATE_2023_REV8). 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 H.

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 evaluate the impact of extreme contingency events on the thermal loading and voltage performance of the NYCA transmission system. For this assessment, each element removed from service as part of the contingency or as a result of the contingency shall also be removed from service for the steady state analysis.

The extreme contingency steady state and stability analysis examines the post-contingency steady state conditions as well as stability, overload, 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. For this assessment, the NYCA transmission system facilities are evaluated against their Short-Term Emergency (STE) rating.

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 earlier in this report; however, the cases are modified by adjusting the intra-Area interface flows 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 during the time period June 1 – August 31, 2018[1]. Details of the study case are

[1] https://www.nyiso.com/power-grid-data

provided in Appendix D.

Extreme Contingency Analysis Results

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 D.

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. All 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 I.

Extreme Contingency Summary

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. This indicates that the strength of the planned interconnected power systems is not expected to deteriorate in the near future.

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 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 wind generation is unavailable.

Table 14 provides a comparison of the baseline and 90th percentile forecast of the 2023 coincident summer peak load [10].

Table 14 2023 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	2,742	1,971	2,747	713	1,253	2,258	2,129	666	1,435	11,194	5,176	32,284
90th Percentile	2,916	2,096	2,921	758	1,333	2,417	2,279	693	1,493	11,549	5,634	34,089
Delta	174	125	174	45	80	159	150	27	58	355	458	1,805

Extreme Weather Analysis Results

Under N-0 and N-1 conditions, the steady state analysis showed no observed thermal or voltage violations on the BPTF. For dynamic analysis, all contingencies evaluated are stable, damped, and no generating unit lost synchronism other than by fault clearing action or special protection system response. Details of the analysis results are reported in Appendix J.

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 2018 Gold Book [10] and 2018 Power Trends Report [16].

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 7,500 MW. Details of the study case are provided in Appendix J.

Loss of Gas Supply Analysis Results

The steady state analysis results show no steady state 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, the simulation shows an instance of a single line to ground fault near Marcy which is positively damped but has large oscillations through 10 seconds of simulation. Allowing the simulation to run through 60 seconds shows that the oscillation is positively damped. The cause of the oscillations over this length of time is a secondary mode of oscillation with a very small damping factor. While the results of this event do meet the established criteria for dynamics analysis, further analysis showed that additional power system stabilizers in units in the Oswego complex would greatly improve the observed damping concerns for this event.

Details of the analysis results are reported in Appendix J.

Review of Special Protection Systems

New York has not added any new SPS since the 2015 CATR. System conditions have not changed sufficiently enough to impact the operation or classification of existing SPS. It should be noted, however, New York has retired SPS since the 2015 CATR. These retired SPS have gone through the NPCC SPS retirement evaluation process.

Review of Dynamic Control Systems

System conditions have not changed sufficiently to impact the operation or classification of previously reviewed Dynamic Control Systems since the 2015 CATR.

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. The NYCA does not have any such exclusion at this time; therefore, 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 western New York Empire State Line Project is a new station planned to connect into the Niagara – Kintigh – Rochester 345 kV path. This project 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 Con Edison Rainey 345/138 kV transformer/PAR is an addition to the existing Rainey 345 kV substation. Additionally, the Rainey 345 kV substation has reconfiguration plans.
- The NYSEG South Perry 230 kV substation taps the existing 85/87 230 kV path between the Wethersfield and Meyer substations.
- 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.
- 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 Fraser 345/115 kV transformer is an addition to the existing Fraser facility. Additionally, the Fraser 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 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 three reviews were conducted for the 2018 Intermediate ATR.

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 summer peak load analysis indicates there are no thermal or voltage violations. By limiting power transfers consistent with the transfer limits reported in this review, the transmission security of the New York State BPTF will be maintained and projected demand will be supplied in accordance to NPCC Directory #1 [1], and NYSRC Reliability Rules [2] planning criteria.

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 no stability criteria violations for the cases evaluated under N-1 and N-1-1 conditions.

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. All contingencies 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). Overall, the extreme contingency system conditions are comparable to the previous CATR and no serious consequences are identified.

The third 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). Due to the generation surplus under loss of fuel supply conditions found in the 2015 CATR, no new analysis for the loss of fuel supply is performed for his Intermediate ATR. For the high peak load conditions, the power flow analysis results show no steady state or stability violations.

The fourth assessment evaluates the fault duty at BPTF buses in the short circuit representation. No new analysis was performed for the 2018 Intermediate ATR.

A review of Special Protection Systems evaluates impacts due to system changes. New York has not added any 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. System conditions have not changed sufficiently to impact the operation or classification of existing SPS.

A review of the Dynamic Control Systems (DCS) evaluates impacts due to system changes. System conditions have not changed sufficiently to impact the operation or classification of previously reviewed DCS since the 2015 CATR.

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.

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.

Conclusion

The analysis in the 2018 Intermediate ATR indicates that the New York State Bulk Power Transmission Facilities, as planned through the year 2023 conform to the reliability criteria described in applicable NPCC Directory #1 and the 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 2, dated September 30, 2015.
2. New York State Reliability Council, "Reliability Rules and Compliance Manual", Version 43, dated May 11, 2018.
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 3.0, dated June 30, 2017.
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 3.0, dated June 30, 2017.
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 3.0, dated June 30, 2017.
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, 3.0, dated June 30, 2017.
7. New York Independent System Operator, "Reliability Analysis Data Manual", Version 3.2, dated December 1, 2016.
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, 2015.
10. New York Independent System Operator, "Load and Capacity Data, A Report by the New York Independent System Operator, Inc.", Released April 2018.
11. Northeast Power Coordinating Council, "Classification of Bulk Power System Elements (Document A-10)", dated December 1, 2009.
12. New York Independent System Operator, "Locational Minimum Installed Capacity Requirements Study Covering the New York Control Area for the 2018-2019 Capability Year", dated January 18, 2018.
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 June 29, 2018.
15. New York Independent System Operator, "Methodology for Determining System Operating Limits for the Planning Horizon," July 1, 2016.
16. New York Independent System Operator, "2018 Power Trends, New York's Dynamic Power Grid 2018"
17. 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 August 29, 2018.