2016 Intermediate Area Transmission Review

Of the New York State Bulk Power Transmission System
(Study Year 2021)

FINAL REPORT

June 1, 2017

Caution and Disclaimer

1. Table of Contents

1. Introduction 1

1.1 Background 1

1.2 Facilities Included in this Review 2

1.2.1 Interface Definitions 5

1.2.2 Scheduled Transfers 6

1.2.3 Load and Capacity 6

2. Steady State and Stability Conformance Assessment 7

2.1 Steady State and Stability Methodology 7

2.2 Description of Steady State and Stability Base Cases 7

2.3 Thermal Transfer Analysis 10

2.3.1 Methodology 10

2.3.2 Analysis Results 11

2.4 Voltage Transfer Analysis 17

2.4.1 Methodology 17

2.4.2 Analysis Results 18

2.5 Stability Analysis 20

2.5.1 Methodology 20

2.5.2 Analysis Results 22

2.6 Transmission Security Analysis 23

2.6.1 Methodology 23

2.6.2 N-1 Analysis Results 24

2.6.3 N-1-1 Analysis Results 24

2.6.4 Review of Corrective Action Plans Identified in the 2015 Comprehensive ATR 25

2.7 Summary of Study Results Demonstrating Conformance 25

3. Fault Current Assessment 26

4. Extreme Contingency Assessment 27

4.1 Methodology 27

4.2 Description of Steady State and Stability Study Cases 27

4.3 Extreme Contingency Analysis 28

4.4 Extreme Contingency Summary 29

5. Extreme System Condition Assessment 29

5.1 Methodology 29

5.1.1 Description of Study Cases 29

5.2 Extreme Weather Condition Analysis Results 30

6. Review of Special Protection Systems 30

7. Review of Dynamic Control Systems 30

8. Review of Exclusions from NPCC Basic Criteria 30

9. Review of Additional NYSRC Requirements 31

9.1 System Restoration Assessment (B.2_R1.3 (assessment 5)) 31

9.2 Local Rules Consideration of G.1 through G.3 (B.2_R1.2) 31

10. Overview Summary of System Performance 32

11. Conclusion 33

REFERENCES AND BIBLOGRAPHY 34

Table of Tables

Table 1.2.1 Changes in Bulk Power Transmission Facilities 3
Table 1.2.2 Additions/Up-rates in Generation Facilities 4
Table 1.2.3 Shutdowns/De-ratings in Generation Facilities 4
Table 1.2.4 NYCA Scheduled Inter-Area Transfers 6
Table 1.2.5 Load and Capacity Forecast 6
Table 2.2.1 Schedules on Inter-Area Controllable Devices 9
Table 2.3.1 Normal Transfer Criteria Intra-Area Thermal Transfer Limits 13
Table 2.3.2 Emergency Transfer Criteria Intra-Area Thermal Transfer Limits 14
Table 2.3.3 Normal Transfer Criteria Inter-Area Thermal Transfer Limits 15
Table 2.3.4 Emergency Transfer Criteria Inter-Area Thermal Transfer Limits 16
Table 2.4.1 Summary of Voltage Constrained Transfer Limits 19
Table 2.5.1 Stability Analysis First Element Outages (N-1-0) 22
Table 2.7.1 Transfer Limit Comparison 26
Table 5.1.1 2021 Baseline and 90th Percentile Coincident Summer Peak Load Delta by Zone (MW) 29
Table 5.2.1 90th Percentile Summer Peak Load Analysis Thermal Overload Summary 30

Table of Figures

Figure 1.2.1 NYCA Interfaces and LBMP Load Zones 5

Appendices

A. Scope
B. Facilities Included in This Review
C. A-10 Classification of Bulk Power System Elements
D. Definition of Transmission Interfaces
E. Description of Power Flow and Stability Cases
F. Thermal Transfer Analysis
G. Voltage Transfer Analysis
H. Transmission Security Analysis
I. Stability Analysis
J. Extreme Contingency Assessment
K. Extreme System Condition Assessment

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 Bulk Power Transmission Facilities (BPTF), as defined in this review, includes all of the facilities designated by the NYISO to be part of the BPS as defined by NPCC and the NYSRC; additional non-BPS facilities are also included in the BPTF. The purpose of this assessment is to demonstrate conformance with the applicable NPCC Transmission Design Criteria and NYSRC Reliability Rules. The ATR is prepared in accordance with NYSRC procedures; and NYISO guidelines and procedures. 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 first 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 Transmission Design Criteria, NYSRC Reliability Rules, and NYISO guidelines and procedures.

The system representations used in this transmission review are developed based on the NPCC 2015 Base Case Development (BCD) library and the NYISO 2016 FERC 715 filing power flow models with updates according to the NYISO 2016 Load and Capacity data ("Gold Book").

Changes to the five-year case for this review (2021) compared to the five-year case for the 2015 CATR (2020) include a 754 MW decrease in load forecast, a decrease of approximately 2,700 MW in capacity resources, and the non-renewal of the 1000 MW wheeling agreement between Con Edison and the Public Service Electric and Gas (PSE&G).

The first assessment evaluates the transmission security of the planned system for year 2021. In accordance with NPCC Transmission Design Criteria and the NYSRC Reliability Rules, transmission security analysis evaluates the steady state thermal and voltage performance of the New York State BPTF in response to a single contingency from the normal system condition (N-1) as well multiple contingencies with system adjustments (N-1-1). To evaluate the impact of a single contingency from the normal system condition (N-1), all design criteria contingencies are evaluated including: single element, common structure, stuck breaker, generator, bus, and HVDC facilities contingencies. N-1-1 analysis evaluates the ability of the system to meet design criteria after a critical element has already been lost, following allowable system adjustments.

Considering N-1-1 conditions, to ensure compliance with the NPCC Transmission Design Criteria and NYSRC Reliability Rules, the analysis is performed with single element contingencies as the first contingency (N-1-0); the second contingency (N-1-1) includes all design criteria contingencies evaluated under N-1 conditions.

The 2021 summer peak power flow analysis shows four thermal and no voltage violations on the BPTF. A terminal upgrade project at Gardenville/Stolle substations to mitigate the Gardenville - Stolle violation has already been placed in-service, a terminal upgrade project at Pannell substation to mitigate the Clay – Pannell violations is scheduled to be in-service by 2019, and a station reconfiguration project at Oakdale substation to remove the Oakdale transformer violation is scheduled to be in-service before winter 2021. For those projects not in-service, the Transmission Owner will use Interim Operating measures to maintain reliability. A generation project at Greenidge scheduled to return to service in 2017 would also help mitigate the Oakdale overload until the project is in-service. Except for these four thermal violations, system adjustments are identified for each first contingency (N-1-0) such that there are no post-contingency thermal and/or voltage violations following any second contingency (N-1-1).

The first assessment also evaluates the stability of the New York State BPTF for normal (or design) contingencies as defined in the NPCC Transmission Design Criteria and NYSRC Reliability Rules. The 2021 summer peak load stability simulation shows no issues for 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 focus of the extreme contingencies tested were those areas that have material changes since the 2015 CATR. These areas are in the western part of the New York control area and in the southeast part of the state due to the non-renewal of a 1000 MW wheeling agreement. 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, an extreme contingency may result in a loss of local load within an area due to low voltage or first-swing instability of isolated generators. In all of the evaluated cases and conditions tested, the affected area is confined to the New York Control Area (NYCA) system.

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 this Intermediate ATR. For the high peak load conditions, the power flow analysis results indicate that these system conditions cause two thermal and no voltage violations on the BPTF. The stability analysis for the extreme system condition evaluated (high peak load) results show that all contingencies are stable and damped.

The fourth assessment evaluates the fault current duty at BPTF buses in the short circuit representation. The bulk of system changes from the 2015 CATR are generation retirements. Accordingly, short circuit current values are not expected to be as severe. For this reason, no new analysis is performed to evaluate the fault duty at BPTF buses for the 2016 Intermediate ATR.

A review of Special Protection Systems (SPS) 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 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.

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 makes no requests for new exclusions.

The fifth assessment and other requirements specific to the NYSRC Reliability Rules are included in Section 9 of this report. The NYSRC requirements in this Section 9 include: System Restoration Assessment (B.2_R1.3 – Assessment 5) and Local Operation Area (B.2_R1.2 (Local Rules G.1 through G.3)). The planned system meets these NYSRC reliability rules.

In conclusion, the 2016 Intermediate ATR determines that the New York State Bulk Power Transmission Facilities, as planned (including Corrective Action Plans), through year 2021, conform to the applicable NPCC Transmission Design Criteria and NYSRC Reliability Rules.

1. Introduction

1.1 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) [1] and the New York State Reliability Council (NYSRC) [2]. This study is prepared in accordance with NYSRC procedures; and NYISO guidelines and procedures [3]-[6]. The Bulk Power Transmission Facilities (BPTF), as defined in this review, includes all of the facilities designated by the NYISO to be part of the BPS as defined by NPCC; additional non-BPS facilities are also included in the BPTF. 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) as 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 Transmission 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 [7] 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 Transmission 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 system [8].

The 2016 Intermediate ATR assessed the planned year 2021 system. The modeled 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 [8]. The scope of the 2016 Intermediate ATR is provided in Appendix A.

1.2 Facilities Included in this Review

The system representation for this transmission review is developed from the NPCC 2015 Base Case Development (BCD) library. The system representation for the New York Control Area (NYCA) is based on the NYISO 2016 FERC 715 filing power flow models with transmission system, generation, and load changes made to the NYCA system including existing and planned facilities. The system representation for the NYCA reflects the conditions reported in the NYISO 2016 Load and Capacity Data report ("Gold Book") [9].

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 list of New York State BPTF is documented in Appendix B. The remaining non-BPTF 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 [10] 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, only one substation was assessed. The results of the A-10 testing and the list of BPS facilities are documented in Appendix C.

The transmission plans shown in Table 1.2.1 reflect the changes since the 2015 CATR. Proposed major generation projects included in the base case are listed in Table 1.2.2 and Table 1.2.3. Additional changes to transmission plans, generation additions/up-rates, or shutdowns/de-ratings that occurred following the publication of the NYISO 2016 Gold Book [9] will be captured in future reviews.

Table 1.2.1 Changes in Bulk Power Transmission Facilities

Bulk Transmission:	**2015 Comprehensive ATR:**	**2016 Intermediate ATR:**
	Included/IS Date	**Included/IS Date**
CPV Valley 345kV Substation (Q#251) Leeds-Hurley Series Compensation SDU	Y/2016-05 Y/2018S	Y/2017-10 Y/2018S
Rochester Transmission Reinforcement 345 kV Substation (Q#339) (1)	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/2016S
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/2018S
NYSEG Coopers Corners 345 kV Shunt Reactor	Y/2015S	Y/In-Service
NYSEG Gardenville 230/115 kV Transformer	Y/2017S	Y/2017S
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/2017S
O&R Sugarloaf 345/138 kV (New Substation)	Y/2016S	Y/2016S
Feeder 76 Ramapo to Rock Tavern (Q#368)	Y/2016S	Y/2016S
N. Grid Porter Reactors	Y/2017W	Y/2018S
N. Grid Clay – Lockheed Martin 115 kV reconductoring	Y/2016W	Y/In-Service
N. Grid Clay – Dewitt 115 kV reconductoring	Y/2017W	Y/2017W
N. Grid Clay – Teall 115 kV reconductoring	Y/2017W	Y/2017W
N. Grid Clay-Woodard 115 kV (conductor clearance)	Y/2015W	Y/In-Service
N. Grid Packard – Huntley 77/78 Series Reactors	N/2016S	Y/2016S
N. Grid Eastover Road 230/115 kV Transformer	N/2017S	Y/2017S
O&R North Rockland (New Station)	N/2018S	Y/2018S

Table 1.2.2 Additions/Up-rates in Generation Facilities

Additions/Up-rates	**Size**	**2015 Comprehensive ATR:**	**2016 Intermediate ATR:**
		Included/IS Date	**Included/IS Date**
Bethlehem Energy Center	11.9	N/2017-2018	Y/2017-2018
Rochester Gas & Electric Station 2	6.3	N/2018-09	Y/2018-09
CPV Valley Energy Center	677.6	Y/2017-10	Y/2017-10

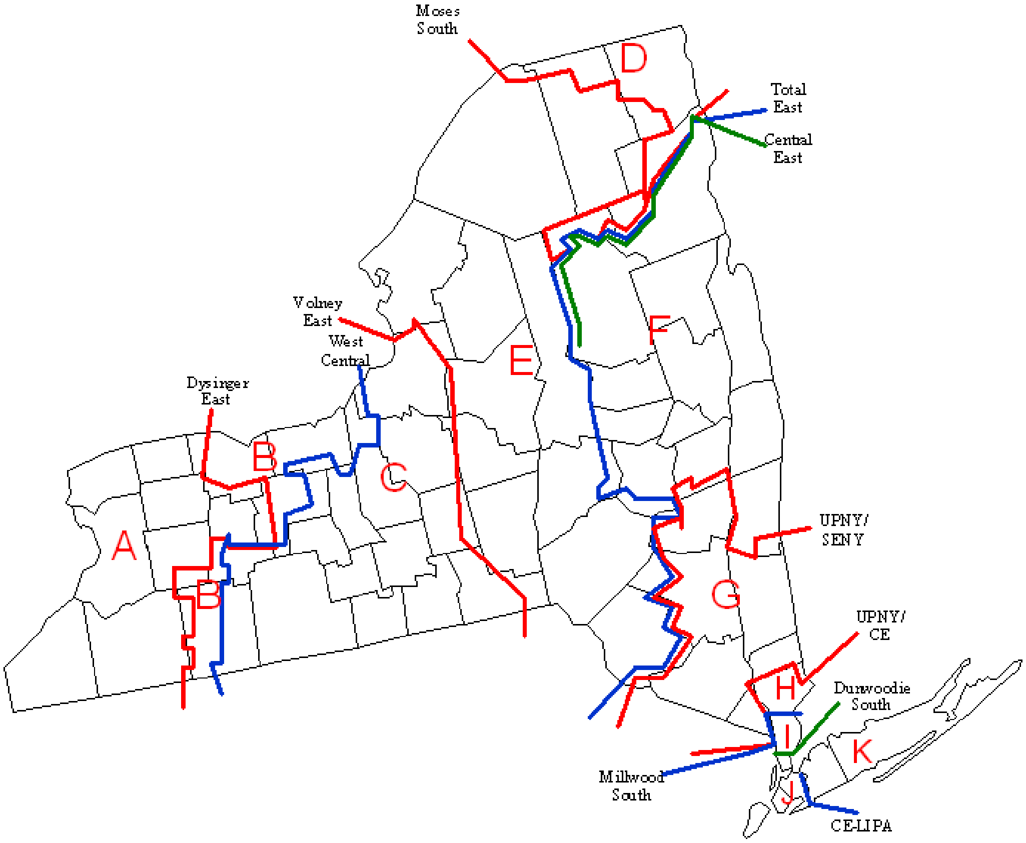
Table 1.2.3 Shutdowns/De-ratings in Generation Facilities

Shutdowns/De-ratings	**Size (MW)**	**2015 Comprehensive ATR:**	**2016 Intermediate ATR:**
		Included/OS Date	**Included/OS Date**
Niagara Bio-gen	39.7	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
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
Cayuga 1	150.1	2017-07	2017-07
Cayuga 2	150.4	2017-07	2017-07
Fitzpatrick 1	852.9	In-service	2017-01
Ginna	581.4	In-service	2017-04
Ravenswood 04	12.9	In-service	2016-04
Ravenswood 05	15.5	In-Service	2016-04
Ravenswood 06	12.6	In-Service	2016-04

1.2.1 Interface Definitions

The NYISO monitors and evaluates the eleven major interfaces between the zones within the NYCA. Figure 1.2.1 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-Con Edison, 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 D.

Figure 1.2.1 NYCA Interfaces and LBMP Load Zones



1.2.2 Scheduled Transfers

Table 1.2.4 lists the NYCA scheduled inter-Area transfers modeled in all study cases between the NYCA and each neighboring system for study year 2021.

Table 1.2.4 NYCA Scheduled Inter-Area Transfers

Region		Transaction (MW)
From	**To**	**2021**
NYCA	NE	90
NYCA	HQ	-1,090
NYCA	PJM and Others	-1,135
NYCA	Ontario	0

1.2.3 Load and Capacity

Table 1.2.5 provides a comparison of the load, capacity, and reserve margin between the 2015 CATR and the 2016 Intermediate ATR. As shown in Table 1.2.5 the 2021 study year reserve margin is greater than the required Installed Reserve Margin (IRM) of 17.5% approved by the NYSRC for the 2016-2017 Capability Year [11].

Table 1.2.5 Load and Capacity Forecast

	Comprehensive Review: 2015 Forecast for Summer 2020	Intermediate Review: 2016 Forecast for Summer 2021	Change From Previous CATR
Peak Load (MW)	34,309	33,555	-754
Total Capacity (MW)	43,779 (1)	41,048 (2)	-2731
Reserve Margin	27%	22%	-5

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 2016 Gold Book and represents the 2021 Total Resource Capability from Table V-2a

2. Steady State and Stability Conformance Assessment

2.1 Steady State and Stability Methodology

The analysis for the 2016 Intermediate ATR is conducted in accordance with NPCC Transmission Design Criteria [1] and NYSRC Reliability Rules [2]. 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 FAC-013 methodology [12]. 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 [14].

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 2021); (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]-[5].

2.2 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 the NPCC BCD libraries. Most of the relevant system representations are taken from the 2021 cases in the 2015 NPCC BCD library. The PJM system representation is derived from the PJM Regional Transmission Expansion Plan (RTEP) planning process. The NYCA system representation is derived from the NYISO 2016 FERC 715 filing. Changes are made to the NYCA system representation to reflect the updates included in the NYISO 2016 Gold Book [9]. Any extended planned outages 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 2016 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 Con Edison load in all cases. As a conservative planning assumption, demand response is not considered to be available.

As part of the base case development process, AC contingency 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 or Phase Angle Regulator (PAR)) are made to satisfy the NPCC Transmission Design Criteria [1] and NYSRC Reliability Rules [2]. 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 Con Edison margin cases) are created from the 2021 summer peak load case. In the margin cases, the transfer levels of the interfaces in western, northern, and southeastern New York are at least 200MW or 10% 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 2021 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 2021 summer peak load base case with the load increased to meet the forecast statewide coincident high peak load (*i.e.* 90th percentile load – approximately 35,960 MW)[9], reflecting weather conditions expected to occur no more than once in 10 years.

Table 2.2.1 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 E.

Table 2.2.1 Schedules on Inter-Area Controllable Devices

Location	**Comprehensive Review: 2015 Forecast for Summer 2020**	**Intermediate Review: 2016 Forecast for Summer 2021**	**Direction**
	MW Schedule	**MW Schedule**	
Ramapo PAR 1[1]	200	200	Toward NY
Ramapo PAR 2[1]	200	200	Toward NY
St. Lawrence PARs (L33/34)	0	0	-
Sandbar PAR (PV-20)	0	0	-
Goethals PAR (A2253)[2]	334	0	Toward NY
Farragut PAR 1 (B3402)[2]	333	0	Toward NY
Farragut PAR 2 (C3403)[2]	333	0	Toward NY
Linden VFT	315	315	Toward NY
Hudson Transmission HVDC	320	320	Toward NY
Neptune HVDC	660	660	Toward NY
Cross Sound Cable HVDC	96	96	Toward NY
Northport PAR	0	0	-
Chateauguay HVDC	826	826	Toward NY
Blissville PAR	0	0	-
Waldwick PAR 1[2]	345	0	Toward PJM
Waldwick PAR 2[2]	330	0	Toward PJM
Waldwick PAR 3[2]	325	0	Toward PJM

Notes:

(1) Ramapo PAR 1 and PAR 2 are scheduled at 80% of the RECO load.

(2) These PARS are scheduled to 0 MW due to the non-renewal of the Con-Edison Wheeling Agreement.

2.3 Thermal Transfer Analysis

2.3.1 Methodology

Thermal transfer limit analysis is performed using the Siemens PTI PSS® MUST program utilizing the linear First Contingency Incremental Transfer Capability (FCITC) Calculation activity by shifting generation across the interface under evaluation. The thermal transfer limit analysis is performed on the 2021 summer peak load base case in accordance with the NYISO methodology for Assessment of Transfer Capability in the Near-Term Transmission Planning Horizon [12]. A listing of NYCA intra-Area and inter-Area interface definitions used for the 2016 Intermediate ATR is provided in Appendix D.

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

The thermal transfer analysis includes over 1,000 contingencies consistent with NPCC and NYSRC Design Criteria [1]-[2]. 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 H.

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

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

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

2.3.2 Analysis Results

Tables 2.3.1, 2.3.2, 2.3.3, and 2.3.4 summarize the normal and emergency thermal transfer limits determined for the NYCA intra-Area and inter-Area transmission interfaces (where both open and closed interface definitions exist, the open interface limits are reported in the table). The assessment of thermal Transfer Capability demonstrates that the New York State BPTF system meets the applicable NERC [7], NPCC and NYSRC Reliability Rules [1]-[2] 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. Explanations for changes in transfer limits of greater than 100 MW are provided below. Details regarding thermal transfer analysis results are provided in Appendix F.

- The Dysinger East Interface’s normal and emergency thermal transfer limits decreased compared to the 2015 CATR. The transfer limit difference resulted from increased power flows on the 230 kV transmission system from Niagara through Gardenville as a result of generation retirements in Western New York.

- The West Central interface’s normal and emergency thermal transfer limits decreased compared to the 2015 CATR. The flows across the interface have changed direction so that rather than a West to East flow, it is now an East to West flow. This causes the transfer limit to have a negative number. This reduced capability is due to a generation retirements in the Western and Rochester areas.

- The Volney East Interface normal and emergency transfer limits decreased compared to the 2015 CATR. The reduction in transfer limits is due to the planned retirement of the Fitzpatrick Nuclear Plant. One of the two 345kV transmission lines leaving the Fitzpatrick Nuclear Plant is directly on the Volney East Interface.

- The Moses South Interface normal and emergency transfer limits have decreased compared to the 2015 CATR. The transfer limitation difference for both normal and emergency transfers is due to an increase in pre-shift loading on 115 kV transmission in the transfer area. This increase in pre-shift loading is caused by an increased dispatch for hydro-generation units in the north.

- The Total East Interface normal and emergency thermal transfer limits increased compared to the 2015 CATR. The difference in transfer limitation is due to reduced pre-loading on the limiting element due the non-renewal of the Con-Edison PSE&G Wheeling Agreement.

- The UPNY-SENY Interface normal thermal transfer limit increased compared to the 2015 CATR. The difference in transfer limitation is due to reduced pre-loading on the limiting element due to generation retirements.

- The UPNY-Con Edison Interface normal thermal transfer limit increased while the emergency thermal transfer limit decreased compared to the 2015 CATR. With the non-renewal of the Con-

Edison PSE&G Wheeling Agreement, pre-shift flows over transmission elements that are historically limiting for normal thermal transfers increased; while the emergency thermal transfer limit decreased due to increased pre-shift flows on transmission elements that are not historically limiting for emergency transfers.

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 Interface normal and emergency thermal transfer limit increased compared to the 2015 CATR. The reduced New England interface loop flow resulted in an increase in transfer limit.

- The New England – New York Interface normal and emergency thermal transfer limit decreased compared to the 2015 CATR. The reduced New England interface loop flow resulted in a decrease in transfer limit.

- The New York - Ontario Interface emergency transfer limits increased compared to the 2015 CATR. The increase in transfer limit is due to generation retirements in the area and the addition of reactors on the 230kV system.

- The New York – PJM Interface normal and emergency thermal transfer limits decreased compared to the 2015 CATR. This decrease resulted from increased loading on the 115kV transmission caused by generation retirements in Western New York.

- The PJM – New York Interface emergency thermal transfer limits decreased compared to the 2015 CATR. This is due to increased loading on the 115kV transmission caused by generation retirements in Western New York.

Table 2.3.1 Normal Transfer Criteria Intra-Area Thermal Transfer Limits

Interface	2015 Comprehensive Review (Study Year 2020)	2016 Intermediate Review (Study Year 2021)
Dysinger East	1,750 (1)(A)	875 (2)(A)
West Central	400 (1)(A)	-975 (2)(A)
Volney East	4,125 (3)	3,575 (3)
Moses South	2,350 (4)	2,125 (4)
Central East	2,350 (5)	2,250 (5)
Total East	4,850 (6)	5,550 (6)
UPNY-SENY	5,075 (7)(B)	5,200 (7)(B)
UPNY-Con Edison	4,950 (8)(C)	5,850 (9)(C)(E)
Sprain Brook-Dunwoodie South	5,625(10)(C)(D)(F)	5,550 (11)(C)(D)(F)
Long Island Import	1,700 (12)(G)	1,700 (12)(G)

Notes:

1. **Huntley-Sawyer 230 (80)** at 654 MW LTE rating for L/O Huntley-Sawyer 230 (79)
2. **Packard – Sawyer 230 (77)** at 644 MW LTE rating for L/O Huntley – Sawyer 230 (78) and Packard – Sawyer 230 (78) and Packard – Niagara 230 (62) and Packard 230/115 kV Transformer (XMFR 3)
3. **Fraser-Coopers Corners 345** at 1721 MW LTE rating for L/O Porter-Rotterdam 230 and Marcy-Coopers Corners 345
4. **Browns Falls-Taylorville 115** at 134 MW STE rating for L/O Chateauguay-Massena-Marcy 765
5. **New Scotland - Leeds 345 (77)** at 1538 MW LTE rating for L/O New Scotland (99)–Leeds 345
6. **CPV Valley-Rock Tavern 345** at 1793 MW LTE rating for L/O Coopers Corners-Middletown Tap-Rock Tavern 345 and Rock Tavern-Roseton 345
7. **Leeds-Pleasant Valley 345** at 1538 MW LTE rating for L/O CPV-Rock Tavern 345 and Coopers Corners – Middletown Tap - Rock Tavern 345
8. **Shoemaker-Chester 138** at 317 MW STE rating for L/O Rock Tavern-Ramapo 345 and Rock Tavern-Sugarloaf-Ramapo 345
9. **Buchanan – Millwood 345 (97)** at 1974 MW STE rating for Buchanan – Millwood 345 345 (98) and Buchanan – Millwood 138kV
10. **Dunwoodie-Mott Haven 345** at 786 MW Normal rating for pre-contingency loading
11. **Dunwoodie-Mott Haven 345** at 926 MW LTE rating for L/O Dunwoodie-Mott Haven 345 (72)
12. **Dunwoodie-Shore Rd. 345** at 962 MW LTE rating for L/O Sprain Brook-E.G.C. 345 and Sprain Brook-Academy 345/138

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. Used Reliability Rules Exception Reference No. 20 – PSE&G Tie Feeders B3402 and C3403
E. Used Reliability Rules Exception Reference No. 8 Post Contingency Flow on Buchanan-Millwood W97 or W98
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 2.3.2 Emergency Transfer Criteria Intra-Area Thermal Transfer Limits

Interface	2015 Comprehensive Review (Study Year 2020)	2016 Intermediate Review (Study Year 2021)
Dysinger East	2,325 (1)	1,550 (2)
West Central	975 (1)	-300 (2)
Volney East	4,400 (3)	3,850 (3)
Moses South	2,350 (4)	2,125 (4)
Central East	2,650 (5)	2,550 (5)
Total East	5,100 (6)	5,675 (6)
UPNY-SENY	5,300 (6)(A)	5,300 (7)(A)
UPNY-Con Edison	6,325 (8)(A)	5,875 (9)(A)
Sprain Brook-Dunwoodie South	5,625 (10)(A)(B)	5,650 (10)(A)(B)
Long Island Import	2,250 (11)(C)	2,200 (11)(C)

Notes:

1. **Packard-Sawyer 230 (77)** at 704 MW STE rating for L/O Packard-Niagara 230, 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) and Packard – Niagara 230 (61) and Packard 230/115 kV Transformer (XMFR 3)
3. **Fraser-Coopers Corners 345** at 1793 MW STE rating for L/O Marcy-Coopers Corners 345
4. **Browns Falls-Taylorville 115** at 134 MW STE rating for L/O Chateauguay-Massena-Marcy 765
5. **New Scotland (77)-Leeds 345** at 1724 MW STE rating for L/O New Scotland (99)-Leeds 345
6. **CPV Valley-Rock Tavern 345** at 1793 MW STE rating for L/O Coopers Corners-Middletown Tap 345
7. **Leeds-Pleasant Valley 345** at 1724 MW STE rating for L/O Athens-Pleasant Valley 345
8. **Roseton-East Fishkill 345** at 1936 MW Normal rating for pre-contingency loading
9. **Buchanan – Millwood 345 (97)** at 1974 MW STE rating for Buchanan – Millwood 345 345 (98)
10. **Dunwoodie-Mott Haven 345** at 786 MW Normal rating for pre-contingency loading
11. **Dunwoodie-Shore Road 345** at 687 MW Normal rating for pre-contingency loading

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

Table 2.3.3 Normal Transfer Criteria Inter-Area Thermal Transfer Limits

Interface	**2015 Comprehensive Review (Study Year 2020)**	**2016 Intermediate Review (Study Year 2021)**
New York – New England	1,125 (1)	1,475 (1)
New England – New York	1,500 (2)	1,350 (2)
New York – Ontario	1,600 (3)	1,700 (3)
Ontario – New York	1,850 (4)	1,925 (4)
New York – PJM	2,475 (5)(A)	1,875 (7)(A)
PJM – New York	3,100 (6)(B)	3,175 (8)(B)

Notes:

1. **Pleasant Valley-Long Mountain 345** at 1382 MW LTE rating for L/O Millstone Unit #3 and PV-20 OMS
2. **Reynolds Rd. 345/115kV** at 562 MW LTE rating for L/O Alps – New Scotland 345kV
3. **Beck – Niagara (PA27) 230 kV** at 460 MW LTE rating for L/O Niagara-Beck 345kV (PA302)
4. **Beck – Niagara (PA27) 230 kV** at 460 MW LTE rating for L/O Niagara-Beck 345kV (PA301)
5. **Huntley-Sawyer 230 (80)** at 654 MW LTE rating for L/O Huntley-Gardenville 230 (Line 79)
6. **East Towanda-Hillside 230kV** at 531 MW LTE rating for L/O Watercure-Mainesburg 345 & North Waverly-East Sayre 115 (North Waverly-East Sayre 115 tripped via overcurrent relay)
7. **Packard - Niagara 115kV (192)** at 352 MW STE rating for L/O Packard - Niagara 115kV (191) & Niagara – Lockport 115kV (102)
8. **N. Waverly – E. Sayre** at 108 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

Table 2.3.4 Emergency Transfer Criteria Inter-Area Thermal Transfer Limits

Interface	2015 Comprehensive Review (Study Year 2020)	2016 Intermediate Review (Study Year 2021)
New York – New England	1,725 (1)	2,100 (1)
New England – New York	2,700 (2)	2,475 (9)
New York – Ontario	1,900 (3)	2,200 (4)
Ontario – New York	2,200 (3)	2,300 (3)
New York – PJM	2,575 (5)(A)	2,200 (7)(A)
PJM – New York	3,425 (6)(B)	3,175 (8)(B)

Notes:

1. **Pleasant Valley-Long Mountain 345kV** at 1680 MW STE rating for L/O Millstone Unit #3
2. **Pleasant Valley-Long Mountain 345kV** at 1195 MW Normal rating for pre-contingency loading
3. **Beck – Niagara (PA27) 230 kV** at 400 MW Normal rating for pre-contingency loading
4. **Beck – Niagara (PA27) 230 kV** at 558 MW STE rating for L/O Beck – Niagara (PA 301) 345 kV
5. **Dunkirk-South Ripley 230kV** at 444 MW STE rating for L/O Wayne-Handsome Lake 345kV
6. **East Towanda-Hillside 230kV (70)** at 636 MW STE rating for L/O North Waverly-Sayre 115kV & Watercure-Mainesburg 345kV (North Waverly-East Sayre 115kV tripped via overcurrent relay)
7. **Packard - Niagara 115kV (192)** at 352 MW STE rating for L/O Packard - Niagara 115kV (191)
8. **N. Waverly – E. Sayre** at 108MW Normal rating for pre-contingency loading
9. **Reynolds Rd. 345/115kV** at 775 MW STE rating for L/O Alps – New Scotland 345kV

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

2.4 Voltage Transfer Analysis

2.4.1 Methodology

Voltage-constrained transfer limit analysis is performed using PowerGEM TARA software considering specific bus voltage limits (i.e. OP-1 buses) [13]. The OP-1 bus voltage limit criteria include specific minimum and maximum voltage limits for pre-contingency and post-contingency conditions. The required post-contingency voltage is typically within 5% of nominal.

A voltage transfer case is created from the summer 2021 peak load case. A set of power flow cases with increasing transfer levels is created for each interface from the 2021 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 [7], NPCC and NYSRC Design Criteria contingencies [1]-[2]. The applied contingencies are modeled to simulate the removal of all elements that the protection system or other automatic controls would disconnect without operator intervention. Selection of these contingencies is based on an assessment of cumulative historical power system analysis, actual system events, and planned changes to the system; additionally, all design criteria contingencies consistent with NPCC and NYSRC criteria are screened to provide that the most limiting contingencies for the modeled system are included in this analysis. The resulting contingencies evaluated include the most severe loss of reactive capability and increased impedance on the BPTF system.

For the 2016 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 Con Edison load in all cases.

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

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

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

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

2.4.2 Analysis Results

Table 2.4.1 provides a summary of the voltage-constrained transfer limits. The assessment of voltage Transfer Capability demonstrates that the New York State BPTF system meets the applicable NERC [7], NPCC and NYSRC Reliability Rules [1]-[2] with respect to voltage performance. The New York State BPTF system security is maintained by limiting power transfers according to the determined voltage-constrained transfer limits. 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 G.

- The Dysinger East, West Central, Volney East, Central East, and UPNY-SENY voltage-constrained transfer limit decreased compared to the 2015 CATR. The difference in transfer limitation is due to the generation mothball/retirements in Western and Central New York and an increased generation shift from Ontario as to stress the interface sufficiently.

- The UPNY-Con Edison and Sprainbrook-Dunwoodie South voltage constrained transfer limit increased compared to the 2015 CATR. The difference in transfer limitation is caused by increased pre-loading of the interfaces due to the non-renewal of the Con Edison PSE&G Wheeling Agreement and a decreased load forecast in the transfer limit area.

Table 2.4.1 Summary of Voltage Constrained Transfer Limits

Interface	2015 Comprehensive Review (Study Year 2020)	2016 Intermediate Review (Study Year 2021)
Dysinger East	2,950 (2) 3,000 (3)	2,225 (1)
West Central	1,525 (2) 1,650 (3)	475 (1)
Volney East	4,300 (4) 4,400 (5)	2,925 (1)
Central East	2,650 (4) 2,725 (5)	2,000 (1)
UPNY-SENY	5,850 (6)(A) 5,875 (7)(A)	5,575 (6)(A) 5,700 (9)(A)
UPNY-Con Edison	5,550 (8)(A) 5,625 (7)(A)	6,250 (8)(A) 6,425 (9)(A)
Sprain Brook-Dunwoodie South	5,275 (10)(A) 5,525 (9)(A)	6,025 (11)(A) 6,250 (9)(A)

Notes:

1. 95% of PV nose occurs for L/O Sandy Pond DC
2. Station 80 345 kV pre-contingency low limit
3. 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)
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. Pleasant Valley 345 kV bus voltage pre-contingency low limit
7. 95% of PV nose occurs for L/O Tower 34/42 (CPV-Rock Tavern 345 kV and Coopers Corners-Rock
8. Millwood 345 kV bus voltage pre-contingency low limit
9. 95% of PV nose occurs for L/O T:W89&W90
10. Dunwoodie 345 kV pre-contingency low limit
11. Sprainbrook 345 kV bus pre-contingency low limit

A. 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

2.5 Stability Analysis

2.5.1 Methodology

The dynamic data for this analysis is developed from the NPCC 2015 BCD library. This 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 in the NPCC 2015 BCD library is comprised of 100% constant impedance for both active and reactive power load for the NYCA and New England areas. The real power load models used for the other Planning Areas are: constant current (power varies with the voltage magnitude) for Hydro Quebec, New Brunswick, MRO, RFC, SERC, and SPP; 50% constant current/50% constant impedance for Ontario, Nova Scotia, and Cornwall; and 90% constant current/10% constant impedance for FRCC. The reactive load is modeled as constant impedance for FRCC, MRO, RFC, SERC, SPP, and all NPCC areas except Hydro Quebec, which uses a 13% constant current and 87% constant impedance.

Starting with the 2021 summer peak load stability base case, the NYISO created four NYCA margin cases (UPNY margin, Central East margin, West Central margin, and Moses South margin). The margin cases are used to evaluate the stability performance of the NYCA system against normal design criteria contingencies to evaluate if the interfaces are restricted by a stability constraint (*i.e.* stability transfer limit). The simulated contingencies are listed Appendix I. For each margin case, the power flow on the affected interfaces are tested at a value of at least 200 MW or 10% above the more restrictive of the emergency thermal or voltage transfer limit. If there are no stability violations at this margin transfer level, this testing provides that the stability limit is higher than the emergency thermal or voltage transfer level.

The methodology for this 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 of 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 of 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 UPNY-SENY and UPNY-Con Edison open interfaces of the UPNY margin case are loaded at 6,175 and 6,660 MW, respectively. The UPNY-SENY emergency thermal limit is more limiting at 5,350 MW and UPNY-Con Edison is voltage limited at 5,900 MW. This case has the Oswego Complex generation dispatched at an output of 4,462 MW and 1,464 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 200 MW each into New York.

The Central margin case has the Oswego Complex generation dispatched at an output of 4,462 MW and 1,091 MW of import from Hydro Quebec (supplied by Beauharnois hydro generation) with the Chateauguay HVdc poles out-of-service. The Central East and UPNY-SENY open interfaces of the Central margin case is loaded at 2,550 MW and 5,750 MW, respectively. The Central East Interface limit is 2,000 MW (for voltage collapse). The UPNY-SENY interface emergency thermal limit is more limiting at 5,300 MW.

The Western margin case is loaded to the following open interface levels: Dysinger East 1,775 MW, West Central -52 MW, Ontario-to-New York 875 MW, and HQ-to-New York 1,093 (Chateauguay HVdc 823 MW, Beauharnois 270 MW). The Dysinger East and West Central interfaces are thermally limited at 1,550 MW and -300 MW for emergency transfer conditions, respectively.

The Moses margin case has the Moses South open interface loaded to 2,375 MW, HQ-to-New York 1,763 MW (Chateauguay HVdc 823 MW, Beauharnois 940 MW), and the St. Lawrence L33/34 PARs scheduled at 0 MW each. The Moses South interface emergency thermal limit is more limiting at 2,125 MW.

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

The stability analysis evaluates over 150 design criteria stability contingencies, consistent with NPCC and NYSRC Design Criteria contingencies [1]-[2], 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 system. 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 I.

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 after a critical element has already been lost, following 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 2.5.1 lists the first element 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 system as well as a reduced capability to transfer power between the various NYCA zones. The second contingencies (N-1-1) are the normal design criteria contingencies.

Table 2.5.1 Stability Analysis First Element Outages (N-1-0)

Contingency	Interface
Rochester-Pannell 345 kV	West Central
Edic-New Scotland 345 kV	Central East
Fraser-Gilboa 345 kV	Central East
Marcy-Coopers Corners 345 kV	Central East
E. Fishkill-Roseton 345 kV	UPNY-SENY
Leeds-Pleasant Valley 345 kV	UPNY-SENY
Marcy-Massena 765 kV	Moses South
Ravenswood #3 Generation	UPNY-Con Edison

2.5.2 Analysis Results

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

2.6 Transmission Security Analysis

2.6.1 Methodology

The analysis for transmission security includes an evaluation of the impact of a single contingency from the normal system condition (N-1) as well as multiple contingencies with system adjustments (N-1-1) in accordance with NPCC Transmission Design Criteria [1] and NYSRC Reliability Rules [2]. AC contingency analysis is performed on the NYCA BPTF to evaluate the thermal and voltage performance under NPCC and NYSRC design criteria contingencies, with the inclusion of neighboring systems design criteria contingencies, as appropriate, using the Siemens PTI PSS®E and PowerGEM TARA programs.

The transmission security analysis is performed on the system model for study year 2021 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 includes over 1,000 contingencies within NYCA that are expected to produce a more severe system impact on the BPTF. The contingencies include the most severe loss of reactive capability and increased impedance on the BPTF system. Neighboring system design criteria contingencies are also included, as appropriate. 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 list of contingencies is provided in Appendix H.

In accordance with NPCC Transmission Design Criteria [1] and NYSRC Reliability Rules [2], to evaluate the impact of a single contingency from the normal system condition (N-1), all design criteria contingencies are evaluated including: single element, common structure, stuck breaker, generator, bus fault, and HVDC contingencies. To evaluate the impact of multiple contingencies from the normal system condition (N-1-1), the BPTF elements are evaluated with single element contingencies (*e.g.* generator, transmission circuit, transformer, series or shunt compensating device, or HVDC pole) evaluated as the first contingency (N-1-0); the second contingency includes (N-1-1) includes all design criteria contingencies evaluated under N-1 conditions.

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-1 thermal violation occurs when the power flow on the monitored facility is greater than the applicable post-contingency rating. An N-1-0 thermal violation occurs when the power flow cannot be adjusted to below the normal rating following the first contingency. An N-1-1 thermal violation occurs when the monitored element cannot be secured to the applicable post-contingency rating for the second contingency.

An N-1, N-1-0, or N-1-1 voltage violation occurs on an OP-1 designed bus when the voltage is outside of the listed voltage limits [13]. OP-1 designated buses are elements of the NYISO Secured Transmission System monitored by the NYISO as a system representation to ensure adequate system voltage.

2.6.2 N-1 Analysis Results

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

2.6.3 N-1-1 Analysis Results

Under N-1-1 conditions, there are four observed thermal violations and no voltage violations on the BPTF. System adjustments are identified for each N-1 and N-1-1 contingency pair such that there are no post-contingency voltage violations on the New York State BPTF. Worst case thermal overloads are listed in table 2.6.1.

Table 2.6.1 2021 Summer Peak Load N-1-1 Thermal Overload Summary

Zone	Owner	Monitored Element	Normal Rating (MVA)	LTE Rating (MVA)	STE Rating (MVA)	2021 Flow (%)	First Contingency	Second Contingency
C	NYSEG	Oakdale 345/115kV 2TR	428	556	600	106.1	Packard – Huntley (#77) 230kV	Oakdale 345kV Stuck Breaker
A	NYSEG	Gardenville – Stolle (#66) 230kV	474	478	478	108.6	Packard – Huntley (#77) 230kV	Packard 345kV Stuck Breaker
B/C	RGE	Clay – Pannell (#1) 345kV	1195	1195	1195	104.1	Gardenville – Stolle (#66) 230kV	Clay 345kV Stuck Breaker
B/C	RGE	Clay – Pannell (#2) 345kV	1195	1195	1195	104.3	Gardenville – Stolle (#66) 230kV	Clay 345kV Stuck Breaker

The Corrective Action Plan for the Oakdale overload is the Oakdale 345/115kV 3rd transformer and 345kV reconfiguration project. The in-service date for this project is Winter 2021. The Corrective Action Plan for the Gardenville – Stolle (#66) 230kV line overload is terminal upgrades that will increase the rating greater than the overload amount; this project is already in-service. The Corrective Action Plan for the Clay – Pannell (PC1 and PC2) 345kV line overloads are terminal upgrades that will increase each line rating greater than the overload amount. The in-service date for this project is 2019. For those projects not in-service, the Transmission Owner will use Interim Operating measures to maintain reliability. A generation project at Greenidge scheduled to return to service in 2017 would also help mitigate the Oakdale overload until the project is in-service. Based on the conditions modeled in the cases, the results indicate that sufficient ten-minute reserve, PAR control, HVdc control, and reactive power resources are available within the NYCA to allow the projected demand to be supplied. The complete N-1 and N-1-1 2021 summer peak load steady state results are provided in Appendix H.

2.6.4 Review of Corrective Action Plans Identified in the 2015 Comprehensive ATR

The 2015 comprehensive ATR showed need for a Corrective Action Plan to address the loss of synchronization of two Huntley generating units for a 3-phase bus fault. Due to the retirement of the Huntley generating facility, this Corrective Action Plan is no longer necessary.

2.7 Summary of Study Results Demonstrating Conformance

Table 2.7.1 provides a summary of the normal and emergency transfer limits for the open transmission interfaces used in the NYISO transmission planning studies defined in Appendix D of this report. These results confirm that the planned system meets the applicable reliability criteria; additionally, the application of design criteria contingencies shows no loss of a major portion of the system or unintentional separation of a major portion of the system. By limiting power transfers consistent with the transfer limits reported in this review, the security of the New York State BPTF will be maintained and projected demand will be supplied in accordance with NPCC Transmission Design Criteria [1] and NYSRC Reliability Rules [2]. Subsequent annual assessments will review the continuing need for the identified Corrective Action Plans. The NYISO did not identify marginal conditions that warranted analysis beyond the five year study period.

Table 2.7.1 Transfer Limit Comparison

Interface	2015 Comprehensive Review (Study Year 2020)				2016 Intermediate Review (Study Year 2021)			
	Normal (MW)		Emergency (MW)		Normal (MW)		Emergency (MW)	
Dysinger East	1,750	T	2,325	T	875	T	1,550	T
West Central	400	T	975	T	-975	T	-300	T
Volney East	4,125	T	4,300	V	2,925	VX	2,925	VX
Moses South	2,350	T	2,350	T	2,125	T	2,125	T
Central East	2,350	T	2,650	T/V	2,000	VX	2,000	VX
Total East	4,850	T	5,100	T	5,550	T	5,675	T
UPNY-SENY	5,075	T	5,300	T	5,200	T	5,300	T
UPNY-Con Edison	4,950	T	5,550	V	5,900	T	5,900	T
Sprain Brook-Dunwoodie South	5,275	V	5,275	V	5,550	T	5,650	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

3. Fault Current Assessment

System condition changes from the 2015 CATR consisted mainly of generation retirements. The fault duty at BPTF buses in the short circuit representation is expected to be no worse than the 2020 peak load model used in the 2015 CATR. For this reason, no new analysis is performed to evaluate the fault duty at BPTF buses for the 2016 Intermediate ATR.

4. Extreme Contingency Assessment

4.1 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 contingency is simulated to evaluate the New York State BPTF transient stability, voltage, and thermal response in accordance with NPCC Transmission Design Criteria [1], NYSRC Reliability Rules, and NYISO planning and operation practices [3]-[5].

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 contingency conditions. This procedure requires that 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 power flow 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 is evaluated against their Short-Term Emergency (STE) rating.

4.2 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 Section 2.2; 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 – September 1 for 2015 obtained from Markets and Operations (Power Grid Data for Interface Limits and Flows). For the Dysinger East, West Central, Moses South, and Central East interfaces, the historic 75th percentile transfer level is greater than the 2021 normal transfer limit; therefore, these interfaces are modeled to be less than the normal transfer limit. For the UPNY-Con Edison and Sprainbrook-Dunwoodie South interfaces, the removal of the Con Edison and PSE&G Wheeling Agreement caused interface flows that significantly exceed the 75th percentile value. For these two interfaces, flows were modeled to be less than the normal transfer limit and greater than the 75th percentile value.

Details of the study case are provided in Appendix E.

4.3 Extreme Contingency Analysis

The focus of the extreme contingencies tested were those areas that have material changes since the 2015 CATR. These areas are in the western part of the New York control area and in the southeast part of the state due to the non-renewal of a 1000 MW wheeling agreement. Steady state and stability extreme contingencies are considered very low probability events. Extreme contingencies for the NYCA are developed in conformance with the NPCC Transmission System Planning Performance Requirements [1]. For this study, over 25 extreme contingencies expected to have severe system impacts in Western New York and areas affected by the Con-Edison Wheeling Agreement non-renewal 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 system. The list of extreme contingencies is provided in Appendix K.

Extreme contingencies for the NYCA are developed in conformance to NPCC Transmission Design Criteria [1] and NYSRC Reliability Rules [2]. Details of the extreme contingency power flow and stability analysis are provided in Appendix K. The details of the analysis results are classified as Critical Energy Infrastructure Information and are not discussed in the body of this report.

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 power flow and stability analysis are provided in Appendix K.

4.4 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 [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.

5. Extreme System Condition Assessment

NPCC Directory #1 [1] and the NYSRC Reliability Rules [2] 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. 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.

5.1 Methodology

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 extreme the Extreme System Condition Assessment is the same as discussed in Sections 2.5.1 and 2.6.1 of this report, respectively.

5.1.1 Description of Study Cases

The extreme weather steady state and stability study cases are derived from the system representation derivation discussed in Section 2.2; 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 5.1.1 provides a comparison of the baseline and 90th percentile forecast of the 2021 coincident summer peak load [9].

Table 5.1.1 2021 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	2,697	2,011	2,874	555	1,374	2,414	2,294	660	1,545	11,761	5,370	33,555
90th Percentile	2,904	2,166	3,098	597	1,481	2,636	2,503	736	1,723	12,266	5,850	35,960
Delta	207	155	224	42	107	222	209	76	178	505	480	2,405

5.2 Extreme Weather Condition Analysis Results

The steady state analysis identified two thermal violations and no voltage violations. Table 5.2.1 provides a summary of the observed thermal overloads. The thermal overloads listed below are relieved upon completion of the Gardenville – Stolle upgrade and Oakdale 345 re-configure projects described in section 2.6.3 of this report.

Table 5.2.1 90th Percentile Summer Peak Load Analysis Thermal Overload Summary

Zone	Owner	Monitored Element	Normal Rating (MVA)	LTE Rating (MVA)	STE Rating (MVA)	2021Flow (%)	Contingency (kV)
C	NYSEG	Oakdale 345 – Oakdale 115 (BK2)	428	556	600	109	SB Oakdale 345
A	NYSEG	Gardenville – Stolle (66) 230	474	478	478	105	Tower 77 & 78 345

For the 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 L.

6. 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.

7. 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.

8. 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.

9. Additional NYSRC Requirements

This section addresses additional requirements specific to NYSRC Reliability Rules [2] that are not addressed in other sections of this report. Previous sections of this report have addressed NYSRC Reliability Rules B.2 R1.3 and R1.4 (except system expansion) through B.1(R1) (Sections 2.3, 2.4, 2.5, and 2.6), B.1(R2) (Section 4), B.1(R3) (Section 5), and B1.R4 (Section 3).

9.1 System Restoration Assessment (B.2_R1.3 (assessment 5))

NYSRC Reliability Rules B.2-R1.2 [2] requires the NYISO to evaluate the impact of system expansion or reconfiguration plans on the NYCA System Restoration Plan:

- 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 RG&E has a planned reconfiguration to the existing Pannell 345 kV station (Station 122).
- 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 Stoney Ridge 230 kV substation has a planned addition of a capacitor bank.
- The NYSEG Fraser 345/115 kV transformer is an addition to the existing Fraser facility.
- The National Grid has a planned reconfiguration to the exiting Clay 345 kV substation.

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.

9.2 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 in Section 2.2 of 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(R4) Thunderstorm Watch (New York City)

Proposed facilities [9] 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.

10. Overview Summary of System Performance

Five assessments and three reviews were conducted for the 2016 Intermediate ATR.

In the first assessment, power flow analysis were 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 and the NYSRC Reliability Rules.. The summer peak load analysis indicates there are no N-1 thermal or voltage violations. The summer peak load analysis under N-1-1 conditions showed four thermal overloads and no voltage violations; all observed thermal overloads are mitigated by projects due to be in service by winter 2021. For all other BPTF facilities, system adjustments are identified for each first contingency (N-1-0) such that there are no post-contingency thermal and/or voltage violations following any second contingency (N-1-1). 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 to NPCC Directory #1 and the NYSRC Reliability Rules.

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 and the NYSRC Reliability Rules. 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 indicate that these system conditions cause two thermal and no voltage violations on the BPTF. Projects planned to be in service after the study year resolves the observed thermal overloads. The stability analysis for the extreme system condition evaluated (high peak load) shows that all contingencies are stable and damped.

The fourth assessment evaluates the fault duty at BPTF buses in the short circuit representation. No new analysis was performed for the 2016 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 are included in Section 9 of this report. The NYSRC requirements in this Section 9 include: System Restoration Assessment (B.2_R1.3 – Assessment 5) and Local Operation Area (B.2_R1.2 (Local Rules G.1 through G.3)). The planned system meets these NYSRC reliability rules.

11. Conclusion

The analysis in the 2016 Intermediate ATR indicates that the New York State Bulk Power Transmission Facilities, as planned through the year 2021 (including Corrective Action Plans), conform to the reliability criteria described in applicable NPCC Directory #1 and the NYSRC Reliability Rules.

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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 38, dated September 09, 2016.
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 Section 2.4.2 Impact on System performance and Transfer Limits, Version 2.1, dated October, 2015.
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 2.1, dated October, 2015.
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 2.1, dated October, 2015.
6. New York Independent System Operator, “Transmission Expansion and Interconnection Manual”, Attachment I: NYISO Transmission Planning Guideline #4-1 – Guideline for Fault Current Assessment, Version 2.1, dated October, 2015.
7. North American Electric Reliability Corporation, “Transmission System Planning Performance Requirements”TPL-001-4.
8. 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.
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10. Northeast Power Coordinating Council, “Classification of Bulk Power System Elements (Document A-10)”, dated December 1, 2009.
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12. New York Independent System Operator, “Methodology for Assessment of Transfer Capability in the Near-Term Transmission Planning Horizon”, dated May 20, 2013.
13. 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 6.21, dated July 13, 2016.
14. New York Independent System Operator, “Methodology for Determining System Operating Limits for the Planning Horizon,” July 1, 2016.