2015 Comprehensive Area Transmission Review

Of the New York State Bulk Power Transmission System

(Study Year 2020)

DRAFT REPORT

April 1, 2016

Caution and Disclaimer

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Executive Summary

The New York Independent System Operator (NYISO) conducts an annual Area Transmission Review (ATR) of the New York State Bulk Power System (BPS) as required by the Northeast Power Coordinating Council (NPCC) and the New York State Reliability Council (NYSRC). The 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 North American Electric Reliability Corporation (NERC), NPCC Transmission Design Criteria, NYSRC Reliability Rules, and NYISO guidelines and procedures. Although this Comprehensive ATR (CATR) analyzed the BPTF, only BPS facilities are subject to NPCC Directory #1 and the NYSRC Reliability Rules.

This report comprises the 2015 NYISO CATR of the planned system for the year 2020. The 2010 CATR, approved by NPCC and NYSRC in June 2011, was the last Comprehensive Review. In 2011 and 2012, the NYISO completed Interim reviews; Intermediate Reviews were completed in 2013 and 2014.

Eight assessments are made for this CATR. Overall, the results are comparable to the 2010 CATR, which found the planned New York State BPS is in conformance with applicable NERC Reliability Standards, 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 2014 Base Case Development (BCD) library and the NYISO 2015 FERC 715 filing power flow models with updates according to the NYISO 2015 Load and Capacity data ("Gold Book"). The updated Local Transmission Plans (LTPs), provided by the Transmission Owners, are also incorporated into the CATR study models.

Changes to the five-year case for this review (2020) compared to the five-year case for the 2010 CATR (2015) include a 288 MW increase in load forecast and a decrease of approximately 1,916 MW in capacity resources.

The first assessment evaluates the transmission security of the planned system for year 2020. 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 2020 summer peak power flow analysis shows no thermal or voltage violations on the BPTF. 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 second assessment 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 2020 summer peak load case shows a stability criteria violation at the Huntley 230 kV substation. National Grid has identified a Corrective Action Plan to mitigate the stability violation observed at the Huntley 230 kV substation. The stability simulations show no issues for light load cases under N-1 and N-1-1 conditions.

The third assessment evaluates the fault duty at BPTF buses in the short circuit representation. Based on the short circuit system model, which includes updates based on the 2015 Gold Book, the analysis indicates that two buses with BPTF facilities may experience overdutied circuit breakers; however, these breakers are overdutied directly due to the proposed Berrians generation projects. Subsequent to the start of this study, the proposed Berrians generation projects have withdrew from the NYISO interconnection queue. Further analysis with the Berrians generation projects out of the study case shows the observed fault current at these substations are within the capability of the circuit breakers.

In the fourth 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 results are 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 fifth assessment evaluates extreme system conditions, which have a low probability of occurrence (e.g. high peak load conditions resulting from extreme weather and the loss of fuel (gas) supply). For both the high peak load and loss of gas supply conditions, the power flow analysis results indicate that these system conditions do not cause thermal or voltage violations on the BPTF; additionally, for the extreme system conditions evaluated (high peak load and loss of gas) the stability analysis results show that all contingencies are stable and damped.

The sixth assessment is a review of Special Protection Systems (SPSs). This review evaluates the designed operation and possible consequences of failure or misoperation of the SPS within the NYCA that are due to steady state or stability issues. There are no proposed additional SPSs and system conditions in the vicinity of existing SPSs have not changed significantly since the previous review. No changes to the classification of existing SPSs are requested in this review.

The seventh assessment evaluates the Dynamic Control Systems (DCS) within NYCA that are installed on the system or are being proposed. The DCS evaluation includes loss of large generator exciters, SVCs, FACTS, HVDC systems, and power system stabilizers. There is one proposed addition to the DCS in the NYCA (similar to the DCS identified in the 2010 CATR). The CPV Valley project includes an exciter and power system stabilizer (steam turbine only). The analysis shows no adverse impact for the loss of the exciter or power system stabilizer. The expected system conditions in the vicinity of existing DCS in NYCA have not changed significantly compared to the previous CATR; therefore, this assessment confirms the current classification of all DCS including the proposed CPV Valley DCS as Type III.

For the eighth assessment, the NYCA has no existing exclusions to NPCC Basic Criteria and makes no requests for new exclusions.

An assessment of issues specific to the NYSRC Reliability Rules is included in Section 9 of this report. The NYSRC requirements in this Section 9 include: System Restoration Assessment (B.2(R4) and Local Rules G.1 through G.3).

In conclusion, the 2015 CATR presents that the New York State Bulk Power Transmission Facilities, as planned (including Corrective Action Plans), through year 2020, conform to the applicable NERC Reliability Standards, 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 North American Electric Reliability Corporation (NERC) [7], Northeast Power Coordinating Council (NPCC) [1] and the New York State Reliability Council (NYSRC) [2]. This study also conforms to 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 Comprehensive ATR (CATR) analyzed the BPTF, only BPS facilities are subject to NPCC Directory #1 and the NYSRC Reliability Rules. The ATR may conduct additional analysis to address the Long-Term Transmission Planning Horizon (years six through ten) as needed to address identified marginal conditions that may have longer lead-time solutions.

NPCC, a regional council of theNERC, 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 Reviews".

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 than the NPCC Transmission Design Criteria [1] and the NERC transmission system planning standard [20]. 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 CATR at least every five years and to conduct either an Interim or Intermediate ATR in each of the years between CATRs, as appropriate. This assessment is conducted in accordance with the requirements for a Comprehensive Review, as described in NPCC Directory #1 [1]. The previous CATR of the New York State BPTF was performed in 2010 (approved June 1, 2011 and assessed the planned year 2015 system [8]. In 2011 and 2012 an Interim level ATR was performed by the NYISO, assessing the planned years 2016 and 2017 system, respectively. In 2013 and 2014 an Intermediate ATR was performed by the NYISO, assessing the planned years 2018 and 2019 system, respectively.

The 2015 CATR assessed the planned year 2020 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 2015 CATR is provided in Appendix A.

1.2 Facilities Included in this Review

The system representation for this transmission review is developed from the NPCC 2014 Base Case Development (BCD) library. The system representation for the New York Control Area (NYCA) is based on the NYISO 2015 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 2015 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 4,185 miles of 765, 500, 345, and 230 kV transmission. Only a few hundred miles of the 6,899 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 include 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 Owner 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. Since the previous CATR, A-10 evaluations have been performed in ATRs subsequent to the 2010 CATR on planned substations as well as existing substations with planned changes that also connect to existing BPS substations. 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 2010 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 2015 Gold Book [9] will be captured in future reviews.

Table 1.2.1 Changes in Bulk Power Transmission Facilities

Bulk Transmission:	2010 Comprehensive ATR:	2014 Intermediate ATR:	2015 Comprehensive ATR:
	Included/IS Date	Included/IS Date	Included/IS Date
Linden VFT Goethals 345 kV Substation Upgrade (Q#125)	Y/2011	Y/In-Service	Y/In-Service
Sherman Creek 345 kV Substation Upgrade (M29, Q#153)	Y/2011S	Y/In-Service	Y/In-Service
Patnode 230kV Substation (Q#161)	Y/2011S	Y/In-Service	Y/In-Service
Jordanville 230 kV Substation (Q#186)	Y/2011-Q4	N/Terminated	N/Terminated
Hudson Transmission Project HVdc (Q#206)	Y/2013	Y/In-Service	Y/In-Service
Ball Hill 230 kV Substation (Q#222)	Y/2011-Q4	N/Withdrawn	N/Withdrawn
Bayonne Energy Center Gowanus 345 kV Substation Upgrade (Q#232)	Y/2012-Q2	Y/In-Service	Y/In-Service
CPV Valley 345kV Substation (Q#251) Leeds-Hurley Series Compensation SDU	Y/2012-Q4 N/NA	Y/2016-05 Y/2018S	Y/2016-05 Y/2018S
South Ripley 230 kV Substation (Q#254)	Y/2011-Q4	N/Withdrawn	N/Withdrawn
Stony Creek 230 kV Substation (Q#263)	Y/NA	Y/In-Service	Y/In-Service
Stony Ridge 230 kV Substation (Q#289)	Y/2011S	Y/In-Service	Y/In-Service
Rochester Transmission Reinforcement 345 kV Substation (Q#339) (1)	N/NA	Y/2016W	Y/2019W
Con Edison Astoria Annex 345/138 kV Transformer	N/NA	Y/In-Service	Y/In-Service
Con Edison Rainey-Corona Transformer/Phase Shifter	N/NA	Y/2018S	Y/2019S
Con Edison Goethals-Linden 345 kV feeder separation	N/NA	Y/2016S	Y/2016S
NYPA Moses-Willis 230 kV Tower Separation	N/NA	Y/2014S	Y/In-Service
NYPA Marcy-Coopers Corners 345 kV series compensation	N/NA	Y/2016S	Y/2016S
NYPA Edic-Fraser 345 kV series compensation	N/NA	Y/2016S	Y/2016S
NYPA Fraser-Coopers Corners 345 kV series compensation	N/NA	Y/2016S	Y/2016S
NYSEG Watercure 345/230 kV Transformer	N/NA	Y/2015W	Y/2018S
NYSEG Coopers Corners 345 kV Shunt Reactor	N/NA	Y/2014W	Y/2015S
NYSEG Oakdale 345 kV Tower Separation	N/NA	Y/In-Service	Y/In-Service
NYSEG Oakdale 345/115/34.5 kV Transformer	N/NA	Y/2018 (1)	Y/2018S
NYSEG Wood St. 345/115 kV Transformer	N/NA	Y/2016S	Y/2020S
NYSEG Coopers Corners 345/115 kV Transformer	N/NA	Y/2018W	Y/2019S
NYSEG Fraser 345/115 kV Transformer	N/NA	Y/2019W	Y/2019S
NYSEG Gardenville 230/115 kV Transformer	N/NA	Y/2017S	Y/2017S
NYSEG/N. Grid Five Mile Rd 345 kV (New Substation)	N/NA	Y/2015S	Y/2015W
NYSEG Mainesburg (Q#394)	N/NA	Y/2015S	Y/2015S
RG&E Station 122 Station Upgrade (Transformers)	N/NA	N/NA	Y/2016W
N. Grid Eastover Rd 345 kV (New Substation)	N/NA	Y/2015S	In-Service
O&R Sugarloaf 345/138 kV (New Substation)	N/NA	Y/2016S	Y/2016S

Bulk Transmission:	2010 Comprehensive ATR:	2014 Intermediate ATR:	2015 Comprehensive ATR:
	Included/IS Date	Included/IS Date	Included/IS Date
Con Edison Feeder 76 Ramapo to Rock Tavern (Q#368)	N/NA	Y/2016S	Y/2016S
N. Grid Porter Reactors (1)	N/NA	N/NA	Y/2017W
N. Grid Clay – Lockheed Martin 115 kV reconductoring (1)	N/NA	N/NA	Y/2016W
N. Grid Clay – Dewitt 115 kV reconductoring (1)	N/NA	N/NA	Y/2017W
N. Grid Clay – Teall 115 kV reconductoring (1)	N/NA	N/NA	Y/2017W
N. Grid Clay-Woodard 115 kV (conductor clearance) (1)	N/NA	N/NA	Y/2015W

Notes:

(1) This Corrective Action Plan is identified in the 2014 ATR.

Table 1.2.2 Additions/Up-rates in Generation Facilities

Additions/Up-rates>20 MW	Size	2010 Comprehensive ATR:	2014 Intermediate ATR:	2015 Comprehensive ATR:
		Included/IS Date	Included/IS Date	Included/IS Date
AES St. Lawrence Wind Project (Q#166)	75.9	Y/2012F	N/Withdrawn	N/Withdrawn
Marble River I&II (Q#161,Q#171)	215.2	Y/2011F	Y/In-Service	Y/In-Service
Jordanville Wind Project (Q#186)	150	Y/2011W	N/Terminated	N/Terminated
Berrians I&II (Q#201, Q#224)	250	N/NA	Y/2017-06	Y/2017-10 (1)
Cape Vincent Wind Project (Q#207)	210	Y2012W	N/Withdrawn	N/Withdrawn
Noble Ellenberg II Windfield (Q#213)	21	Y2011W	N/Withdrawn	N/Withdrawn
Nine Mile Point Uprate (Q#216)	168	Y/2012-Q2	Y/In-Service	Y/In-Service
Ball Hill Wind Park (Q#222)	90	Y/2011W	N/Withdrawn	N/Withdrawn
Bayonne Energy Center (Q#232)	500	Y/2011S	Y/In-Service	Y/In-Service
Allegany Wind Project (Q#237)	72.5	Y/2011F	Y/2015-11	Y/2015-11
CPV Valley (Q#251)	677.6	Y/2010F	Y/2016-05	Y/2016-05
South Pier Improvement (Q#261)	103.7	Y/2012S	N/Withdrawn	N/Withdrawn
Stony Creek Wind Farm (Q#263)	94.4	Y/NA	Y/In-Service	Y/In-Service
Berrians GT III (Q#266)	250	Y/2012S	N/2016-06	Y/2019-01 (1)
Astoria Energy II (Q#308)	576	Y/2011S	Y/In-Service	Y/In-Service
Prattsburgh Wind Farm (Q#119)	78.2	N/NA	N/Withdrawn	N/Withdrawn
Roaring Brook Wind (Q#197)	78	N/NA	Y/2015-12	Y/2015-12
Taylor Biomass Energy (Q#349)	19	N/NA	Y/2015-12	Y/2017-02

Notes:

(1) After the start of the study, this facility elected to withdraw from the interconnection queue

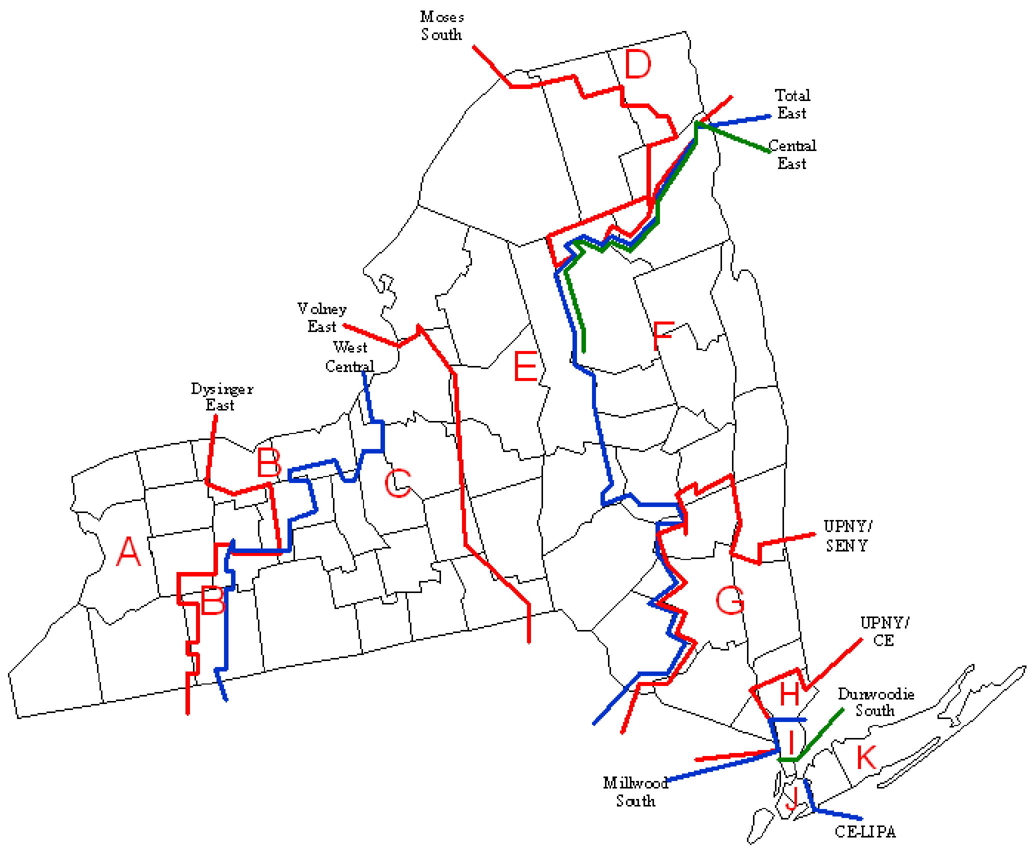
Table 1.2.3 Shutdowns/De-ratings in Generation Facilities

Shutdowns/De-ratings	Size	2010 Comprehensive ATR: Included/OS	2014 Intermediate ATR: Included/OS Date	2015 Comprehensive ATR: Included/OS Date
Greenidge 4	106.1	Y/2011-03	N/Retired 2012	N/Retired 2012
Westover 8	83.8	Y/2011-03	N/Retired 2012	N/Retired 2012
Ravenswood GT 3-4	31.7	Y/NA	N/Mothballed 2011	N/Mothballed 2011
Barrett#7	0	Y/NA	N/Retired 2011	N/Retired 2011
Far Rockway 4	105.1	Y/NA	N/Retired 2012	N/Retired 2012
Glenwood 4&5	229.2	Y/NA	N/Retired 2012	N/Retired 2012
Beebe GT	15	Y/NA	N/Retired 2012	N/Retired 2012
Binghamton Cogen	41.3	Y/NA	N/Retired 2012	N/Retired 2012
Astoria 2	177	Y/NA	N/Mothballed 2012	N/Mothballed 2012
Astoria 4	375.6	Y/NA	N/Mothballed 2012	N/Mothballed 2012
Dunkirk 1	75	Y/NA	N/Mothballed 2013	N/Mothballed 2013
Kensico Units #1, #2, #3	3	Y/NA	N/Retired 2012	N/Retired 2012
Montauk Units #2, #3, #4	6	Y/NA	N/Retired 2013	N/Retired 2013
Cayuga 1 & 2	308.2	Y/NA	N/Retired	N/Retired
Astoria GT 12	17.2	Y/NA	N/Retired	N/Retired
Astoria GT 13	17.1	Y/NA	N/Retired	N/Retired
Chateaugay Power	18.2	Y/NA	N/Mothballed 2013	N/Mothballed 2013
Station 9	14.3	Y/NA	N/Retired 2014	N/Retired 2014
Syracuse Energy ST1	11	Y/NA	N/Retired 2013	N/Retired 2013
Syracuse Energy ST2	63.9	Y/NA	N/Retired 2013	N/Retired 2013
Ravenswood 07	12.7	Y/NA	N/Mothballed 2014	N/Mothballed 2014

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, Sprain Brook-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 2020. New York does not use the firm transfer limit concept though transfer limit analysis is performed to ensure adequate capability.

Table 1.2.4 NYCA Scheduled Inter-Area Transfers

Region		Transaction (MW)
From	To	2020
NYCA	NE	90
NYCA	HQ	-1,090
NYCA	PJM and Others	-1,139
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 2010 CATR and the 2015 CATR. As shown in Table 1.2.5 the 2020 study year reserve margin is greater than the required Installed Reserve Margin (IRM) of 17% approved by the NYSRC for the 2015-2016 Capability Year [11].

Table 1.2.5 Load and Capacity Forecast

	Comprehensive Review: 2010 Forecast for Summer 2015	Comprehensive Review: 2015 Forecast for Summer 2020	Change From Previous CATR
Peak Load (MW)	34,021 (1)	34,309	288
Total Capacity (MW)	45,245 (2)	43,779 (3)	-1,466
Reserve Margin	33%	27%	-6

Notes:

(1) The 2015 forecast considers Alcoa and Reynolds industrial loads in-service in Zone D.

(2) This amount is derived from the NYISO 2010 Gold Book. It's the 2015 Total Resource Capability (43,581.2 MW), from Table V-2a plus Proposed Resource Additions (1,663.9 MW) from Table IV-1.

(3) 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. Steady State and Stability Conformance Assessment

2.1 Steady State and Stability Methodology

The analysis for the 2015 CATR is conducted in accordance with applicable NERC Reliability Standards [7], 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]. 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). In accordance with NERC Standard FAC-010, NPCC Directory #1 [1] defines the NYISO SOL methodology.

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 2020); (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 2020 cases in the 2014 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 2015 FERC 715 filing. Changes are made to the NYCA system representation to reflect the updates included in the NYISO 2015 Gold Book [9]. 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 study cases assume wind generation is unavailable.

For the 2015 CATR, the load is modeled as constant power in all NYCA zones except the Con Edison service territory. The Con Edison voltage-varying load model is used to model the 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 margin cases) are created from the 2020 summer peak load case. In the margin cases, the transfer levels of the interfaces in western, northern, and southeastern New York are at least 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 light load stability analysis case load level is approximately 50% of the summer peak load. The light load stability case assumes a wind generation dispatch of approximately 10% of the forecasted capability [9].

The extreme contingency steady state and stability cases are developed from their 2020 summer peak cases, respectively, with the intra-Area interface flows adjusted to be greater than the transfer levels expected to occur approximately 75% of the time on a load flow duration basis, 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 2020 summer peak load base case with the load increased to meet the forecast statewide coincident high peak load (i.e. 90th percentile load – approximately 36,645 MW), reflecting weather conditions expected to occur no more than once in 10 years.

The extreme system condition of a natural gas fuel shortage is more likely to occur during the winter peak demand period; therefore, the normal weather peak condition for this assessment (both steady state and stability) is the winter peak demand level (approximately 72% of the summer peak load). This fuel shortage study assumes all NYCA gas-only units, dual-fuel units that lack permits to burn oil, and other units that do not have the capability to burn their alternative fuel (such as those that do not store any in their tanks) are not available.

Table 2.1.1 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: 2010 Forecast for Summer 2015	Comprehensive Review: 2015 Forecast for Summer 2020	Direction
	MW Schedule	MW Schedule	
Ramapo PAR 1[1]	100	200	Toward NY
Ramapo PAR 2[1]	100	200	Toward NY
St. Lawrence PARs (L33/34)	0	0	-
Sandbar PAR (PV-20)	115	0	Toward VT
Goethals PAR (A2253)	334	334	Toward NY
Farragut PAR 1 (B3402)	333	333	Toward NY
Farragut PAR 2 (C3403)	333	333	Toward NY
Linden VFT	300	315	Toward NY
Hudson Transmission HVDC	660	320	Toward NY
Neptune HVDC	660	660	Toward NY
Cross Sound Cable HVDC	330	96	Toward NY
Northport PAR	100	0	Toward NY
Chateauguay HVDC	720	826	Toward NY
Blissville PAR[2]	0	0	-
Waldwick PAR 1[2]	345	345	Toward PJM
Waldwick PAR 2[2]	300	330	Toward PJM
Waldwick PAR 3[2]	355	325	Toward PJM

Notes:

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

(2) These PARS are not reported in the 2010 CATR.

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 given interface under evaluation. The thermal transfer limit analysis is performed on the 2020 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 2015 CATR 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 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.

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 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 open transmission interfaces (where applicable). 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 and West Central Interfaces' normal and emergency thermal transfer limits decreased compared to the 2010 CATR. The transfer limit difference is due to increased power flows on the 230 kV transmission from Niagara through Gardenville as a result of PJM generation retirements, new PJM substations which are fed primarily from the NYCA to PJM tie-lines, the Ramapo PAR schedule, and the reduced wind generation modeling assumption.

- The Volney East Interface normal and emergency transfer limits decreased compared to the 2010 CATR. The difference in transfer limitation is due to the Marcy South series compensation project [9], which improves the overall balance of power flow from upstate to downstate on the UPNY-SENY interface by increasing power flow to southeastern New York along the Marcy South path, which happens to limit Volney East. The Volney East interface is also reduced due to the decreased Hydro-Quebec import represented in the study case and the wind generation modeling assumption.

- The Moses South Interface normal and emergency transfer limits have decreased compared to the 2010 CATR. The transfer limitation difference for both normal and emergency criteria is due to the reduced Hydro-Quebec import represented in the study case.

- The Central East Interface normal and emergency thermal transfer limits decreased compared to the 2010 CATR. The transfer limitation difference is due to New England generation dispatch modeling assumptions causing increased power flow from New England to New York on the tie lines in the Capital zone and out to New England on the tie lines in the Hudson Valley zone (New England loop flow). As the New England loop flow is in the same direction as the generation shift across the limiting element, the transfer limit is reduced.

- The Total East Interface normal and emergency thermal transfer limits decreased compared to the 2010 CATR. The difference in transfer limitation is due to increased pre-loading on the limiting element due to the dispatch of the CPV Valley generation project combined with the reduced impedance due to the Marcy South series compensation project.

- The UPNY-SENY Interface normal and emergency thermal transfer limits decreased compared to the 2010 CATR. For this ATR, the schedule for the Ramapo PARs, which are defined as part of the UPNY-SENY interface, is approximately 400 MW (1,000 MW for the 2010 CATR). Accounting for the Athens Special Protection System[1] and the Marcy South series compensation project with CPV Valley modeled in-service, the difference in transfer limitation is due to the difference in the Ramapo PAR schedule (600 MW) and the New England loop flow.

- The UPNY-Con Edison Interface normal thermal transfer limit decreased while the emergency thermal transfer limit increased compared to the 2010 CATR. With the addition of the Rock Tavern-Sugarloaf-Ramapo 345 kV line, the previous limiting element for normal transfers is alleviated; however, the reduced impedance on this path exacerbates the loading on the 138 kV system in the same area which becomes limiting due to the generation shift created for the transfer. Also, the 600 MW decrease in the Ramapo PARs schedule reduces the measured normal transfer limit. The emergency transfer limit increase is mainly due to the addition of the Rock Tavern-Sugarloaf-Ramapo line, which diverts flow from the limiting constraint.

- The Long Island Import interface normal and emergency thermal transfer limits decreased compared to the 2010 CATR. The transfer limitation difference is due to a change in assumed flow on the Cross Sound HVDC Cable (CSC) (a difference of 235 MW).

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 dictate 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 limits decreased compared to the 2010 CATR. New England generation dispatch modeling assumptions (increasing generation in northern and western New England) result in increased power flow from New England to New York on the tie lines in the Capital zone and out to New England on the tie lines in the Hudson Valley zone. The transfer limitation difference is due to higher pre-transfer loading on lines in the Capital and Hudson Valley zones.

- The New England – New York Interface normal thermal transfer limit decreased compared to the 2010 CATR. The New England generation dispatch modeling assumptions (increasing generation in northern and western New England) increased pre-transfer loading on the limiting element resulting in a decrease in transfer limit. The emergency thermal transfer limit increased compared to the

[1] The Athens Special Protection System (SPS) was originally placed in operation in 2008 as a temporary solution to address the energy deliverability of Athens generation. The recently extended agreement between National Grid and Athens will maintain the Athens SPS in-service until 2023 or until the construction of a permanent physical reinforcement. For further information see FERC Docket No. ER13-822-000.

2010 CATR. The increase in transfer limit is due to increased pre-loading from Pleasant Valley – Long Mountain 345 kV which counteracts the generation shift from New England – New York, thus relieving the constraint identified in the 2010 CATR.

- The Ontario – New York Interface normal and emergency transfer limits increased compared to the 2010 CATR. The increase in transfer limit is due to only evaluating elements near the interface as binding on the interface. The transfer limit is dependent on the Niagara generation dispatch.

- The New York – PJM Interface normal and emergency thermal transfer limits increased compared to the 2010 CATR. This is due to in part by the change in the Linden Variable Frequency Transformer (VFT) schedule to direct 315 MW into PJM[2] when evaluating this transfer limit (zero flow in the 2010 CATR). In the 2010 CATR, the normal and emergency thermal transfer limits are identical due to base case pre-loading for the same element. The significant increase in emergency thermal transfer limit in this assessment is due to the change in the limiting facility and the difference between the normal and Short Term Emergency (STE) rating. The change in the limiting facility is also affected by the cancelation of the Ripley-Westfield wind project.

- The PJM – New York Interface normal and emergency thermal transfer limits decreased compared to the 2010 CATR. The HTP schedule in this ATR (320 MW in 2015; 605 MW in 2010) would decrease the PJM – New York thermal transfer limit compared to the 2010 CATR; however, the additional Watercure 345/230 kV transformer relieves the previous limitation identified in the 2010 CATR, increasing the thermal transfer limit thereby offsetting the decrease associated with the HTP schedule. The remaining decrease in transfer capability is primarily due to the generation changes in northern Pennsylvania which modifies the pre-loading on the free-flowing tie lines in western New York and the wind generation modeling assumption.

[2] Since the 2010 CATR, the Linden VFT has acquired injection rights into PJM.

Table 2.3.1 Normal Transfer Criteria Intra-Area Thermal Transfer Limits

Interface	2010 Comprehensive Review (Study Year 2015)	2015 Comprehensive Review (Study Year 2020)
Dysinger East	2,700 (1)	1,750 (2)(A)
West Central	1,425 (1)	400 (2)(A)
Volney East	4,600 (3)	4,125(4)
Moses South	2,475 (5)	2,350 (16)(B)
Central East	2,900 (6)	2,350 (6)
Total East	5,725 (7)	4,850 (17)
UPNY-SENY	5,250 (8)(C)	5,075 (15)(D)(E)
UPNY-Con Edison	5,375(9)(C)	4,950 (10)(E)(B)
Sprain Brook-Dunwoodie South	5,625 (11)(F)(G)	5,625(12)(F)(H)
Long Island Import	1,950 (13)(I)	1,700 (14)(J)

Notes:

1. **Wethersfield-Meyer 230** at 494 MW LTE rating for L/O Niagara-Rochester 345 and Rochester-Pannell 345
2. **Huntley-Sawyer 230 (80)** at 654 MW LTE rating for L/O Huntley-Sawyer 230 (79)
3. **Fraser-Coopers Corners 345** at 1404 MW LTE rating for L/O Porter-Rotterdam 230 and Marcy-Coopers Corners 345
4. **Fraser-Coopers Corners 345** at 1721 MW LTE rating for L/O Porter-Rotterdam 230 and Marcy-Coopers Corners 345
5. **Moses-Adirondack 230** at 386 MW LTE rating for L/O Chateauguay-Massena-Marcy 765
6. **New Scotland (77)-Leeds 345** at 1538 MW LTE rating for L/O New Scotland (99)–Leeds 345
7. **CPV Valley-Rock Tavern 345** at 1733 MW LTE rating for L/O Coopers Corners-Middletown Tap-Rock Tavern 345 and Rock Tavern-Roseton 345
8. **Leeds-Pleasant Valley 345** at 1538 MW LTE rating for L/O Athens-Pleasant Valley 345
9. **Rock Tavern-Ramapo 345** at 1990 MW LTE rating for L/O Roseton-E. Fishkill 345 and E. Fishkill 345/115
10. **Shoemaker-Chester 138** at 317 MW STE rating for L/O Rock Tavern-Ramapo 345 and Rock Tavern-Sugarloaf-Ramapo 345
11. **Mott Haven-Rainey 345** at 1196 MW STE rating for L/O Mott Haven-Rainey 345 Transformer 8W
12. **Dunwoodie-Mott Haven 345** at 786 MW Normal rating for pre-contingency loading
13. **Dunwoodie-Shore Rd. 345** at 877 MW LTE rating for L/O Sprain Brook-E.G.C. 345 and Sprain Brook-Academy 345/138
14. **Dunwoodie-Shore Rd. 345** at 962 MW LTE rating for L/O Sprain Brook-E.G.C. 345 and Sprain Brook-Academy 345/138
15. **Leeds-Pleasant Valley 345** at 1538 MW LTE rating for L/O CPV-Rock Tavern 345 and Coopers Corners – Middletown Tap - Rock Tavern 345
16. **Browns Falls-Taylorville 115** at 134 MW STE rating for L/O Chateauguay-Massena-Marcy 765
17. **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

A. Used Reliability Rules Exception Reference No. 13 – Post Contingency Flows on Niagara Project Facilities
B. Followed NYISO Emergency Operations Manual section 4.1.3 Followed NYISO Emergency Operations Manual section 4.1.3
C. Ramapo PAR1 and PAR2 are scheduled at 500 MW each into New York
D. Used Reliability Rules Exception Reference No. 23 – Generation Rejection at Athens
E. Ramapo PAR1 and PAR2 are scheduled at 80% of the RECO load (200 MW each)
F. Used Reliability Rules Exception Reference No. 20 – Post Contingency Flows on Underground Circuits
G. Dunwoodie North PAR1 and PAR2 are scheduled at 115 MW each into NYC
Dunwoodie South PAR1 and PAR2 are scheduled at 120 MW and 115 MW, respectively, 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
H. 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
I. E.G.C. PAR1 and PAR2 are scheduled at 315 MW each into Long Island
Lake Success and Valley Stream PARs are scheduled at 165 MW and 123 MW, respectively, into NYC
Neptune and CSC HVdc are scheduled at 660 MW and 330 MW, respectively, into Long Island
J. E.G.C. PAR1 and PAR2 are scheduled at 315 MW each into Long Island
Lake Success and Valley Stream PARs are scheduled at 165 MW and 123 MW, respectively, into NYC
Neptune and CSC HVdc are scheduled at 660 MW and 96 MW, respectively, into Long Island

Table 2.3.2 Emergency Transfer Criteria Intra-Area Thermal Transfer Limits

Interface	2010 Comprehensive Review (Study Year 2015)	2015 Comprehensive Review (Study Year 2020)
Dysinger East	2,775(1)	2,325 (2)
West Central	1,500 (1)	975 (2)
Volney East	5,450 (3)	4,400 (4)
Moses South	2,675 (5)	2,350 (6)(G)
Central East	3,200 (7)	2,650 (7)
Total East	5,975 (8)	5,100 (9)
UPNY-SENY	5,900 (10)(A)	5,300 (9)(B)
UPNY-Con Edison	5,925 (11)(A)	6,325 (12)(B)
Sprain Brook-Dunwoodie South	5,625 (13)(C)	5,625 (14)(D)
Long Island Import	2,675 (15)(E)	2,250 (16)(F)

Notes:

1. **Wethersfield-Meyer 230** at 430 MW Normal rating for pre-contingency loading
2. **Packard-Sawyer 230 (77)** at 704 MW STE rating for L/O Packard-Niagara 230, Packard-Sawyer 230 (78), and Packard 230/115
3. **Edic-Fraser 345** at 1195 MW STE rating for L/O Oakdale-Fraser 345
4. **Fraser-Coopers Corners 345** at 1793 MW STE rating for L/O Marcy-Coopers Corners 345
5. **Marcy 765/345** at 1971 MW STE rating for L/O Marcy 765/345
6. **Browns Falls-Taylorville 115** at 134 MW STE rating for L/O Chateauguay-Massena-Marcy 765
7. **New Scotland (77)-Leeds 345** at 1724 MW STE rating for L/O New Scotland (99)-Leeds 345
8. **CPV Valley-Rock Tavern 345** at 1793 MW STE rating for L/O Coopers Corners-Middletown Tap-Rock Tavern 345
9. **CPV Valley-Rock Tavern 345** at 1793 MW STE rating for L/O Coopers Corners-Middletown Tap 345
10. **Leeds-Pleasant Valley 345** at 1724 MW STE rating for L/O Athens-Pleasant Valley 345
11. **Roseton-East Fishkill 345** at 1935 MW Normal rating for pre-contingency loading
12. **Roseton-East Fishkill 345** at 1936 MW Normal rating for pre-contingency loading
13. **Mott Haven-Rainey 345** at 1196 MW STE rating for L/O Mott Haven-Rainey 345
14. **Dunwoodie-Mott Haven 345** at 786 MW Normal rating for pre-contingency loading
15. **Dunwoodie-Shore Road 345** at 599 MW Normal rating for pre-contingency loading
16. **Dunwoodie-Shore Road 345** at 687 MW Normal rating for pre-contingency loading

A. Ramapo PAR1 and PAR2 are scheduled at 500 MW each into New York

B. Ramapo PAR1 and PAR2 are scheduled at 80% of the RECO load (190 MW each)

C. Dunwoodie North PAR1 and PAR2 are scheduled at 115 MW each into NYC
Dunwoodie South PAR1 and PAR2 are scheduled at 120 MW and 115 MW, respectively, 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. Dunwoody 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

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 85 MW and 90 MW, respectively, into Long Island
Northport PAR scheduled at 286 MW into Long Island
Neptune and CSC HVdc are scheduled at 660 MW and 330 MW, respectively, into Long Island

F. E.G.C. PAR1 and PAR2 are scheduled at 315 MW each into Long Island
Lake Success and Valley Stream PARs are scheduled at 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

G. Followed NYISO Emergency Operations Manual section 4.1.3

Table 2.3.3 Normal Transfer Criteria Inter-Area Thermal Transfer Limits

Interface	2010 Comprehensive Review (Study Year 2015)	2015 Comprehensive Review (Study Year 2020)
New York – New England	1,425 (1)	1,125 (3)
New England – New York	2,025 (2)	1,500 (4)
New York – Ontario	1,600 (5)	1,600 (6)
Ontario – New York	1,725 (7)	1,850 (8)
New York – PJM	1,775 (9)(A)	2,475 (10)(B)
PJM – New York	3,400 (11)(C)	3,100 (12)(D)

Notes:

1. **Pleasant Valley-Long Mountain 345** at 1386 MW LTE rating for L/O Millstone Unit #3 and PV-20 OMS
2. **Pleasant Valley-Long Mountain 345** at 1382 MW LTE rating for L/O Millstone Unit #3 and PV-20 OMS
3. **Pleasant Valley-Long Mountain 345** at 1382 MW LTE rating for L/O Sandy Pond
4. **Reynolds Rd. 345/115** at 562 MW LTE rating for L/O Alps – New Scotland 345
5. **Niagara-PA27 230** at 460 MW LTE rating for L/O Niagara 345-Niagara2E 230 and Niagara-Beck B 345
6. **Niagara-PA27 230** at 460 MW LTE rating for L/O Niagara-Beck 345 (PA302)
7. **Niagara-Rochester 345** at 1501 MW LTE rating for L/O Somerset-Rochester 345
8. **Niagara-PA27 230** at 460 MW LTE rating for L/O Niagara-Beck 220 (PA301)
9. **South Ripley-Erie South 230** at 499 MW Normal rating for pre-contingency loading
10. **Huntley-Sawyer 230 (80)** at 654 MW LTE rating for L/O Huntley-Sawyer 230 (79)
11. **Watercure 345/230** at 520 LTE rating for L/O Watercure-Oakdale 345, Oakdale 345/115 Bank #2
12. **East Towanda-Hillside** 230 at 531 MW LTE rating for L/O Watercure-Mainesburg 345 (North Waverly-East Sayre 115 also tripped via overcurrent relay)

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

B. 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

C. 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 296 MW into NY
HTP is scheduled at 605 MW into NY

D. 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	2010 Comprehensive Review (Study Year 2015)	2015 Comprehensive Review (Study Year 2020)
New York – New England	2,000 (1)	1,725 (2)
New England – New York	2,350 (3)	2,700 (3)
New York – Ontario	1,900 (4)	1,900 (4)
Ontario – New York	1,875 (5)	2,200 (4)
New York – PJM	1,775 (6)(A)	2,575 (7)(B)
PJM – New York	3,500 (8)(C)	3,425 (9)(D)

Notes:

1. **Pleasant Valley-Long Mountain 345** at 1685 MW STE rating for L/O Millstone Unit #3
2. **Pleasant Valley-Long Mountain 345** at 1680 MW STE rating for L/O Sandy Pond
3. **Pleasant Valley-Long Mountain 345** at 1195 MW Normal rating for pre-contingency loading
4. **Niagara-PA27 230** at 400 MW Normal rating for pre-contingency loading
5. **Wethersfield-Meyer 230** at 430 MW Normal rating for pre-contingency loading
6. **South Ripley-Erie South 230** at 499 MW Normal rating for pre-contingency loading
7. **Dunkirk-South Ripley 230** at 475 MW STE rating for L/O Wayne-Handsome Lake 345
8. **Stolle Rd.-Pavement Rd. 115** at 179 MW STE rating for L/O Watercure-Homer City 345
9. **Hillside-East Towanda 230 (70)** at 636 MW STE rating for L/O Watercure-Mainesburg 345 (North Waverly-East Sayre 115 also tripped via overcurrent relay)

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

B. 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

C. 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 296 MW into NY
HTP is scheduled at 605 MW into NY

D. 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 the Siemens PTI PSS®E (Rev. 33) software in conjunction with the NYISO Voltage Contingency Analysis Procedure (VCAP) [4] 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 set of power flow cases with increasing transfer levels is created for each interface from the 2020 summer peak load case by applying generation shifts similar to those used for thermal transfer analysis. For each interface, the VCAP program 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 ensure that the most limiting contingencies for the modeled system are included in this analysis. The resultant contingencies evaluated include the most severe loss of reactive capability and increased impedance on the BPTF system.

For the 2015 CATR, the load is modeled as constant power in all NYCA zones except the Con Edison service territory. The Con Edison voltage-varying load model is used to model the Con Edison load in all cases.

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 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 Sprain Brook-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 Volney East voltage-constrained transfer limit decreased compared to the 2010 CATR. The difference in transfer limitation is due to the generation mothball/retirements in Western and Central New York, the wind generation modeling assumption, and an increased generation shift from Ontario as to stress the interface sufficiently.

The Central East voltage-constrained transfer limit decreased compared to the 2010 CATR. The difference in transfer limitation is due to the generation mothball/retirements in Western and Central New York, reduced Hydro Quebec import, and an increased generation shift from Ontario to stress the interface sufficiently.

The UPNY-SENY voltage constrained transfer limit decreased compared to the 2010 CATR. For this ATR, the schedule for the Ramapo PARs, which are defined as part of the UPNY-SENY interface, is approximately 400 MW (1,000 MW for the 2010 CATR). The difference in the Ramapo PAR schedule accounts for a 600 MW decrease in transfer limit. Accounting for the Athens Special Protection System[3] and the Marcy South series compensation project with CPV Valley modeled in-service, the difference in transfer limitation is due to the difference in the Ramapo PAR schedule (600 MW) and the New England loop flow.

[3] The Athens Special Protection System (SPS) was originally placed in operation in 2008 as a temporary solution to address the energy deliverability of Athens generation. The recently extended agreement between National Grid and Athens will maintain the Athens SPS in-service until 2023 or until the construction of a permanent physical reinforcement. For further information see FERC Docket No. ER13-822-000.

Table 2.4.1 Summary of Voltage Constrained Transfer Limits

Interface	2010 Comprehensive Review (Study Year 2015)	2015 Comprehensive Review (Study Year 2020)
Dysinger East	2,950 (2) 2,975 (1)	2,950 (3) 3,000 (4)
West Central	1,650 (2) 1,725 (1)	1,525 (3) 1,650 (4)
Volney East	5,025 (5)	4,300 (6) 4,400 (7)
Central East	3,175 (8) 3,225 (7)	2,650 (6) 2,725 (7)
UPNY-SENY	6,150 (9)(A)	5,850 (10)(B)(C) 5,875 (11)(B)(C)
UPNY-Con Edison	5,475 (13)(A)	5,550 (12)(B)(C) 5,625 (11)(B)(C)
Sprain Brook-Dunwoodie South	5,350 (13)(A)(D)	5,275 (14)(B)(C) 5,525 (11)(B)(C)

Notes:

1. 95% of PV nose occurs for L/O Ginna
2. Station 80 345 kV bus voltage post-contingency low limit for breaker failure at Station 80 345 kV (L/O Kintigh-Rochester 345 kV and Rochester-Pannell 345 kV)
3. Station 80 345 kV pre-contingency low limit
4. 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)
5. 95% of PV nose occurs for a stuck breaker at Edic 345 kV (L/O Fitzpatrick-Edic 345 kV and Edic-N. Scotland 345 kV)
6. Edic 345 kV pre-contingency low limit
7. 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)
8. Edic 345 kV bus voltage post-contingency low limit for breaker failure at Marcy 345 kV (L/O Volney-Marcy 345 kV and Edic-Marcy 345 kV)
9. Pleasant Valley 345 kV bus voltage post-contingency low limit for L/O Tower 34/42 (Coopers Corners-Rock Tavern 345 kV double ckt.)
10. Pleasant Valley 345 kV bus voltage pre-contingency low limit
11. 95% of PV nose occurs for L/O Tower 34/42 (CPV-Rock Tavern 345 kV and Coopers Corners-Rock Tavern 345 kV)
12. Millwood 345 kV bus voltage pre-contingency low limit
13. 95% of PV nose occurs for L/O Tower 67/68 (Ladentown-Bowline 345 kV double ckt.)
14. Dunwoodie 345 kV pre-contingency low limit

A. Ramapo PAR1 and PAR2 are scheduled at 500 MW each into NY

B. Ramapo PAR1 and PAR 2 are scheduled at 80% of the RECO load (201 MW each into NY)

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 NYC

D. Dunwoodie North PAR1 and PAR2 are scheduled at 115 MW each into NYC
Dunwoodie South PAR1 and PAR 2 are scheduled at 120 MW and 115 MW, respectively, 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 2014 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 2014 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 2020 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 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 ensures 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.

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 6,300 and 6,175 MW, respectively. The UPNY-SENY emergency thermal limit is more limiting at 5,300 MW and UPNY-Con Edison is voltage limited at 5,550 MW. This case has the Oswego Complex generation dispatched at an output of 5,170 MW and 1,250 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 5,170 MW and 1,250 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 at loaded at 2,940 MW and 6,300 MW, respectively. The Central East Interface limit is 2,650 MW (for both thermal and voltage). The UPNY-SENY interface is emergency thermal limit is more limiting at 5,300 MW.

The Western margin case is loaded to the following open interface levels: Dysinger East 2,590 MW, West Central 1,220 MW, Ontario-to-New York 1,440 MW, and HQ-to-New York 1,090 (Chateauguay HVdc 820 MW, Beauharnois 270 MW). The Dysinger East and West Central interfaces are thermally limited at 2,325 MW and 975 MW, respectively.

The Moses margin case has the Moses South open interface loaded to 2,910 MW, HQ-to-New York 2,040 MW (Chateauguay HVdc 1,000 MW, Beauharnois 1,040 MW), and the St. Lawrence L33/34 PARs scheduled at 200 MW each. The Moses South interface is thermally limited at 2,350 MW.

The 2020 light load case uses a load level of approximately 47% of the statewide coincident summer peak load. In this study case the Central East and Moses South open interface flows are 1,945 MW and 735 MW, respectively.

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 on 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 represent 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 transfers 10% above the more restrictive of the thermal emergency transfer limit or voltage transfer limit. In the 2010 CATR, Central East was stability limited at 2,900 MW but for this ATR the interface was limited at 2,650 (for both thermal and voltage) as explained in Sections 2.3.2 and 2.4.2.

The Huntley 230 kV substation has two 230 kV buses with a tie breaker. Each 230 kV has two radial generators (each generator is approximately 95 MW). For a 3-phase bus fault, the two units connecting into the faulted bus trip as part of the contingency; however, when simulating the fault using the slower 'B' protection scheme, the two other Huntley generating units lose synchronism and trip. The rest of the system is stable. National Grid has provided a Corrective Action Plan of decreasing the clearing time of the 'B' protection scheme. With the decreased clearing time, the units on the non-faulted bus do not lose synchronism. National Grid has scheduled the relay setting changes to be in effect by May 2016.

Considering the light load case, the results show the system response to be stable and damped for all design criteria contingencies.

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 2020 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 no observed thermal or 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 thermal or voltage violations on the New York State BPTF. 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 2020 summer peak load steady state results are provided in Appendix H.

2.6.4 Review of Corrective Action Plans Identified in the 2014 Intermediate ATR

The Clay-Lockheed Martin (#14) 115 kV line was observed to have N-1 and N-1-1 thermal violations in the 2014 Intermediate ATR [17]. The identified Corrective Action Plan in the 2014 Intermediate ATR [17] is to reconductor the transmission line by late 2017. According to the 2015 National Grid update to their

Local Transmission Plan [16], the reconductoring for this line has been completed and the observed violation is resolved.

The Clay 345/115 kV 1TR transformer was observed to have N-1-1 thermal violations in the 2014 Intermediate ATR [17]. The identified Corrective Action Plan in the 2014 Intermediate ATR [17] is the reconfiguration of the Clay 345 kV substation by mid-2016. With the Corrective Action Plan modeled in the study case, this violation is resolved. According to the 2015 National Grid update to their Local Transmission Plan [16], the planned reconfiguration and projected in-service time frame is late 2015.

The Clay-Woodard (#17) 115 kV line was observed to have N-1 and N-1-1 thermal violations in the 2014 Intermediate ATR [17]. The identified Corrected Action Plan in the 2014 Intermediate ATR [17] is to remove thermal restrictions associated with conductor clearance by late 2015. According to the 2015 National Grid update to their Local Transmission Plan [16], this plan has been completed and the observed violation is resolved.

The Clay-Oswego (#4) 115 kV line was observed to have N-1-1 thermal violations in the 2014 Intermediate ATR [17]. The identified Corrective Action Plan in the 2014 Intermediate ATR [17] is to remove thermal restrictions due to conductor clearance. According to the 2014 National Grid update to their Local Transmission Plan [15], this plan has been completed and the observed violation is resolved.

The Porter-Yahnundasis (#3) (Porter-Kelsey) 115 kV line was observed to have N-1-1 violations in the 2014 Intermediate ATR [17]. The identified Corrective Action Plan in the 2014 Intermediate ATR [17] is to install reactors on the Porter-Yahnundasis (#3) transmission line by late 2017. According to the 2015 National Grid update to their Local Transmission Plan [16], the planned installation date has been revised to summer 2018.

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. With the Corrective Action Plan identified for the Huntley substation identified in Section 2.6, these results confirm that the planned system meets the applicable reliability criteria; additionally, the application of design criteria contingencies show 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 Reliability Standards [7], NPCC Transmission Design Criteria [1] and NYSRC Reliability Rules [2]. Subsequent annual assessments will review the continuing need for the identified in the Corrective Action Plan. No marginal conditions were identified that warranted analysis beyond the five years.

Table 2.7.1 Transfer Limit Comparison

Interface	2010 Comprehensive Review (Study Year 2015)				2015 Comprehensive Review (Study Year 2020)			
	Normal (MW)		Emergency (MW)		Normal (MW)		Emergency (MW)	
Dysinger East	2,700	T	2,775	T	1,750	T	2,325	T
West Central	1,425	T	1,500	T	400	T	975	T
Volney East	4,600	T	5,025	VX	4,125	T	4,300	V
Moses South	2,475	T	2,675	T	2,350	T	2,350	T
Central East	2,900	S	2,900	S	2,350	T	2,650	T/V
Total East	5,725	T	5,975	T	4,850	T	5,100	T
UPNY-SENY	5,250	T	5,900	T	5,075	T	5,300	T
UPNY-Con Edison	5,375	T	5,475	VX	4,950	T	5,550	V
Sprain Brook-Dunwoodie South	5,350	VX	5,350	VX	5,275	V	5,275	V
Long Island Import	1,950	T	2,675	T	1,700	T	2,250	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

3.1 Methodology

The short circuit assessment evaluates the fault duty at BPS and other critical buses in the short-circuit representation. The fault duty is calculated using the ASPEN OneLiner® program following the NYISO guideline for Fault Current Assessment [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.

The lowest circuit breaker rating for each of the selected substations is obtained from the applicable transmission and generation owners. The rating is the nameplate symmetrical rating, the de-rated symmetrical value as determined by the 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 and de-rating for age are not considered by the NYISO in the analysis. In the ratings provided to the NYISO, the Transmission Owners may take into account the effects of these advanced circuit breaker rating techniques.

3.2 Description of the Fault Current Base Case

The NYISO statewide short circuit study case represents year 2020 (case dated May 29, 2015). The short circuit representation includes the modeling assumptions discussed in Section 1.2 of this report.

3.3 Results

The fault current assessment identifies overdutied circuit breakers at the Con Edison Astoria West 138 kV substation and the Con Edison Farragut 345 kV substation. Table 3.3.1 summarizes the results of the fault current assessment. Appendix J contains a complete list of the fault current assessment results. Appendix J contains a complete summary of fault current assessment results.

Table 3.3.1 2015 ATR Overdutied Circuit Breaker Summary

Substation	kV	Breaker ID
Astoria West	138	G1N, G2N
Farragut	345	-

Based on the planned generation and transmission facilities expected to be in-service and in consideration of the mitigation plans listed below, the analysis shows that the circuit breakers have the interrupting capability for the faults that they will be expected to interrupt.

Mitigation plans to resolve the overdutied circuit breakers are as follows. Subsequent annual assessments will review the continuing need for the Corrective Action Plans identified to resolve the violations observed on system facilities.

Astoria West 138 kV:

Circuit breakers G1N and G2N belong to the Astoria unit 3 plant feeders and are overdutied due to the planned addition of the Q201 Berrians GT project (Note: Q224 Berrians II reflects additional capability of the Q201 Berrians plant). However, after the start of this study, the Berrians GT I and II projects (Queue No. 201 and 224, respectively) withdrew from the NYISO interconnection queue. Further analysis with these generating units removed from the study case show no overdutied breakers at the Astoria West 138 kV substation; therefore, no Corrective Action Plan is required at this time.

Farragut 345 kV:

The circuit breakers at the Farragut 345 kV substation are overdutied due to the addition of the Q266 Berrians III project. However, after the start of this study, the Berrians III project (Queue No. 266) withdrew from the NYISO interconnection queue. Further analysis with this generating unit removed from the study case shows no overdutied breakers at the Farragut 345 kV substation; therefore, no Corrective Action Plan is required at this time.

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 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 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 to occur approximately 75% 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 for years 2014 and 2015 obtained from Markets and Operations (Power Grid Data for Interface Limits and Flows). For the West Central and Moses South interfaces, the historic 75th percentile transfer level is greater than the 2020 normal transfer limit; therefore, these interfaces are modeled to be less than the normal transfer limit.

Details of the study case are provided in Appendix E.

4.3 Extreme Contingency Analysis

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 60 extreme contingencies expected to produce more 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 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 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 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.

In April 2014, Levitan & Associates, Inc. (LAI) expanded upon prior research conducted for the NYISO to update the assessment of the adequacy of the natural gas infrastructure in regards to meeting the fuel delivery needs of the gas-fired generation in the NYCA [18]. Several potential gas-side contingencies are discussed in the LAI study, including those related to New York City or Long Island. New York City and Long Island are required by the NYSRC Local Reliability Rules G.2 and G.3 to be operated so that the loss of a single gas facility does not result in the loss of electric load on their respective systems. Periodic assessments are performed by the Transmission Owners and reviewed by the NYISO and NYSRC to ensure compliance with these rules.

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 supply.

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 contingency assessment is the same as discussed in Sections 2.5.1 and 2.6.1 of this report, respectively.

5.2 Extreme Weather Condition Analysis

5.2.1 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 5.2.1 provides a comparison of the baseline and 90th percentile forecast of the 2020 coincident summer peak load [9].

Table 5.2.1 2020 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	2,631	2,052	2,935	780	1,429	2,388	2,268	646	1,535	12,251	5,394	34,309
90th Percentile	2,826	2,204	3,152	838	1,535	2,595	2,465	718	1,706	12,762	5,844	36,645
Delta	195	152	217	58	106	207	197	72	171	511	450	2336

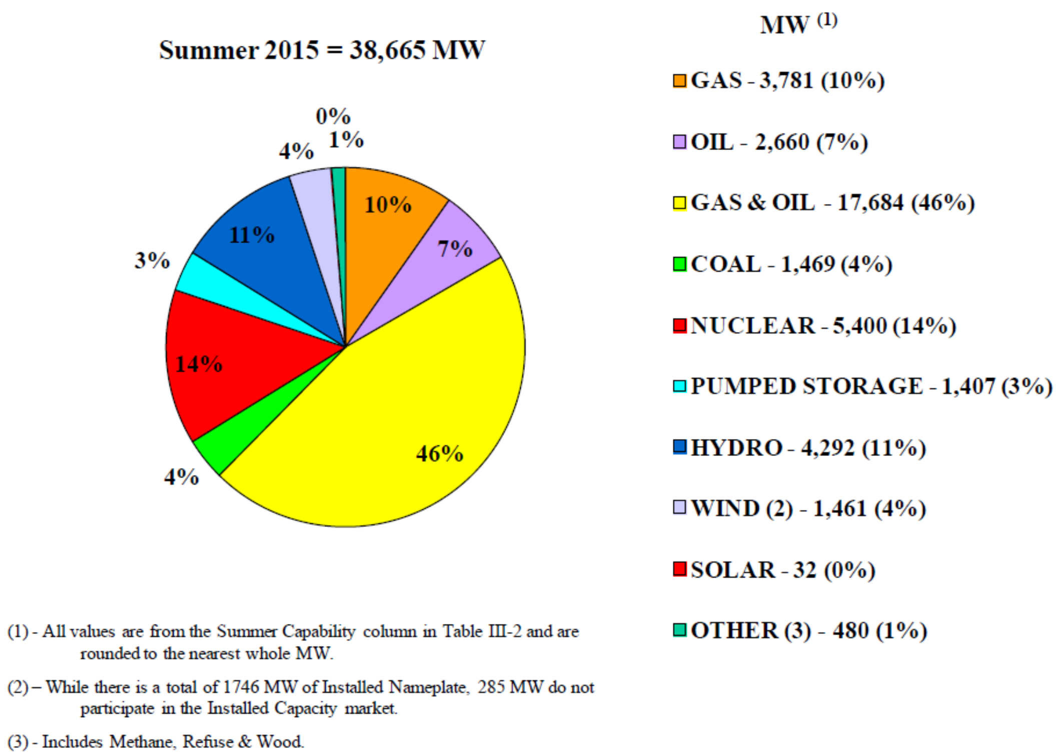
5.2.2 Analysis Results

The steady state analysis shows no thermal or voltage violations. 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.

5.3 Loss of Gas Supply Analysis

Natural gas-fired generation in NYCA is supplied by various networks of major gas pipelines [18]. NYCA generation capacity has a balance of fuel mix which provides operational flexibility and reliability. Several generation plants have dual fuel capability. Figure 5.3.1 presents the NYCA fuel mix presented in the NYISO 2015 Gold Book [9]. As indicated in Figure 5.3.1, 10% of the generating capacity is fueled by natural gas only, 46% by oil and natural gas, and the remaining is fueled by oil, coal, nuclear, hydro, wind, and other.

Figure 5.3.1 2015 NYCA Generation Capability by Fuel Type



5.3.1 Description of Study Case

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 a gas fuel shortage uses the winter peak demand level assuming that all NYCA gas-only units, dual-fuel units that lack permits to burn oil, and other units that do not have the capability to burn their alternative fuel (such as those that do not store any in their tanks) are not available. The total reduction in generating capacity is 10,003 MW. Table 5.3.1 provides a summary of the winter peak load and total capacity assuming the loss of gas supply. Details of the study case are provided in Appendix E.

Table 5.3.1 Loss of Gas Supply Winter Peak Load and Capacity Minus Gas Units

	Comprehensive Review: 2015 Forecast for Winter 2020
Peak Load (MW)	24,575
Total Capacity (MW) (1)	44,748
Loss of Gas Supply Capacity (MW)	10,003
Total Remaining Capacity (MW)	34,745

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.

5.3.2 Analysis Results

The steady state analysis shows no thermal or voltage violations. 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

The purpose of this review is to present need and utilization of Type I and Type II existing and planned Special Protection Systems (SPSs) as well as the validity of the classification of Type III SPSs, including any back-up or redundant systems. This review evaluates the designed operation and possible consequences of failure or misoperation of the SPS within the NYCA that are due to steady state or stability issues. A complete list of the NYCA SPSs is provided in Appendix M. The steady state study cases are the 2020 summer peak load discussed in Section 2.2 of this report. The stability study cases are the 2020 summer peak load margin cases described in Appendix E.

6.1.1 Methodology

The steady state and stability review of NYCA SPSs is performed using the Siemens PTI PSS®E Rev 33 software package. Each SPS was tested for several actions including correct operation, non-operation, and misoperation. The first was a test of the correct operation of the SPS. To evaluate the correct operation of an SPS, a fault or contingency is applied, including the cross-trip or generation rejection, to determine whether the action would help the system to remain stable. The next test was for the failure of the SPS to operate. To evaluate the non-operation of the SPS, a fault or contingency is applied without the cross-trip or generation rejection. The outcome of this test helps to determine the classification (Type I, II, or III) of the SPS. The final test is for the misoperation of the SPS. To evaluate the misoperation of the SPS, the cross-trip or generation rejection occurs without an initiating fault or contingency.

Inter-Area flow diagrams for the load flow cases used in this testing are included in Appendices D and M. The SPS Stability Simulation Summary Table in Appendix M indicates which power flow case is used for each SPS evaluation. Since the NYISO 2010 CATR, SPS-#40 (generation rejection at Oswego (Type II)) has been retired.

6.1.2 Analysis Results

The simulation of Type II SPS-#39, which trips the generation at Bowline for the loss of Y88 and W72 345 kV lines (an extreme contingency) shows a stable system response for the correct operation and misoperation of the SPS, but showed undamped oscillations for the failure of the SPS to operate. Based on the forecasted load and system conditions we do not anticipate an increase in utilization of this SPS or a change in the need for this SPS.

The simulation of the Type I SPS-#41, which cross-trips the Massena-Chateauguay (MSC-7040) line for loss of the Massena-Marcy line, was stable for correct operation and misoperation of the SPS but unstable for the failure to operate. Based on the forecasted load and system conditions we do not anticipate an increase in utilization of this SPS or a change in the need for this SPS.

The simulation of the Type I SPS-#43, which rejects generation at St. Lawrence for local design contingencies, was stable for correct operation, failure to operate, and misoperation. While the results for the conditions tested indicate that this SPS could be considered a Type III, no change in type is requested at this time. This SPS was tested for both a Moses South margin and Central East (CE) margin case, the CE case has the Chateauguay HVdc poles out of service. Based on the forecasted load and system conditions we do not anticipate an increase in utilization of this SPS or a change in the need for this SPS.

The simulation of the Type I SPS-#47, which rejects generation at St. Lawrence for a 115 kV fault on the Alcoa North bus, was stable for correct operation, failure to operate, and misoperation. Similar to SPS #43, this SPS could be considered a Type III but no change in type is requested at this time. This SPS was tested for both Moses South and Central East margin cases, the Central East case has the Chateauguay HVdc poles out of service. Based on the forecasted load and system conditions we do not anticipate an increase in utilization of this SPS or a change in the need for this SPS.

The simulation of the Type I SPS-#48, which limits the loading on Marcy 765/345 kV T1 for the loss of the Marcy, Massena, or Chateauguay 765 kV substations, shows intra-Area thermal overloads that propagate throughout the local area for the failure to operate; however, this SPS keys a Type-I SPS in Hydro Quebec. Based on the forecasted load and system conditions we do not anticipate an increase in utilization of this SPS or a change in the need for this SPS.

The simulation of the Type I SPS-#50, which rejects generation at Niagara for local design contingencies, is stable for correct operation, failure to operate and misoperation of the SPS following normal and extreme contingencies. While the results for the conditions tested indicate that this SPS could be considered a Type III, no change in type is requested at this time. Based on the forecasted load and system conditions we do not anticipate an increase in utilization of this SPS or a change in the need for this SPS.

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

A list of the SPSs along with the summary results of the Special Protection System analysis is included in Appendix M.

7. Review of Dynamic Control Systems

NPCC classifies Dynamic Control Systems (DCS) according to their function and impact of a misoperation on the BPS. NPCC Document C-33, "Procedure for Analysis and Classification of Dynamic Control Systems" [19] describes the procedure followed to determine the classification of the DCS. Existing, new or modified since last Comprehensive Review and proposed control systems in NYCA are listed in Tables 7.1 through 7.3. The generators whose excitation systems were tested represent the largest units in NYCA.

Type I DCS (those whose failure results in significant adverse impact outside the local area) should have functional redundancy, self-diagnostics, or support from another DCS. In the latter case, the two control systems are collectively considered to be a single Type I DCS. A DCS may only be classified as Type III if its failure, combined with the failure of any other Type III DCS, does not have inter-Area consequences. In order to simulate the faulty operation of the DCS, both automatic voltage regulators and power system stabilizers are modeled to be inoperative on two units in close proximity. For the SVC and STATCOM devices, two are deactivated and tested.

Table 7.1 Existing Dynamic Control Systems in NYCA

DYNAMIC CONTROL SYSTEM	TYPE
Chateauguay HVdc Controls CSP LVCL Bang-Ramp	 Type III Type III Type III
Chateauguay SVCs	Type III
Fraser SVC	Type III
Leeds SVC	Type III
Marcy STATCOM	Type III
Nine Mile Pt. #1 Exciter & PSS	Type III
Nine Mile Pt. #2 Exciter	Type III
Fitzpatrick Exciter	Type III
Oswego #5 & #6 Exciters	Type III
Ravenswood #3 Exciter	Type III
Indian Pt. #2 Exciter	Type III
Indian Pt. #3 Exciter	Type III
North End Exciter & PSS (Saranac Energy)	Type III
Independence Exciter & PSS	Type III
East River Exciter & PSS	Type III
NYPA Astoria CC Exciter & PSS	Type III

Table 7.2 Dynamic Control Systems in NYCA with Additions/Changes Since Last CATR

DYNAMIC CONTROL SYSTEM	TYPE
SCS Astoria Energy I Exciter & PSS	Type III
SCS Astoria Energy II Exciter & PSS	Type III
Kintigh/Somerset Exciter & PSS	Type III
Niagara Exciter & PSS	Type III
Lewiston Exciter & PSS	Type III
Moses St. Lawrence Exciter & PSS	Type III
NYPA Flynn Exciter & PSS	Type III
Linden VFT	Type III
Hudson Transmission HVdc	Type III
NEPTUNE HVdc	Type III

Table 7.3 Proposed Dynamic Control Systems in NYCA

DYNAMIC CONTROL SYSTEM	TYPE
CPV Valley Exciter & PSS (steam turbine only)	Type III

7.1.1 Methodology

NPCC Document C-33 [19] states that "Pre-contingency load flows chosen for this analysis should reflect reasonably stressed power transfer conditions within Areas, or area to Area". The study cases for the SPS testing adequately meet this criterion for the load flow conditioning for the DCS evaluation.

For the DCS evaluation, the study cases developed for the SPS evaluation sufficiently meet the criteria for the pre-contingency load flows. The DCS study cases include the following conditions:

- UPNY Margin Case: UPNY-SENY interface scheduled at 6,300 MW, Oswego Complex generation at 5,170 MW, and the Chateauguay HVDC poles out-of-service.
- Central East Margin Case: Central East interface scheduled at 2,915 MW, Oswego Complex generation at 5,170 MW, and the Chateauguay HVDC poles out-of-service.
- Moses South Margin Case: Moses South interface scheduled at 2,195 MW, MSC-7040 (HQ-NY) scheduled above 1,900 MW
- West Central Margin Case: Dysinger East interface scheduled at 2,600 MW, IESO-NY interface scheduled at 1,445 MW.

Generation levels and interface megawatt flows of these cases are provided in Appendix E. The case in which the system is stressed in close proximity to the device being tested is assigned to each device. Then the DCS was disabled and a fault is applied. Table N-1 of Appendix N lists all the DCS stability simulations with the device affected and the fault type. If all faults are stable, the control is considered to affect only the local area and is classified as Type III.

7.1.2 Analysis Results

None of the faults tested result in unstable system oscillations or have a significant adverse impact outside the local area; therefore, all DCS within the NYCA are deemed Type III.

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. Review of 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(R2) (Sections 2.3, 2.4, 2.5, 2.6, and 3), B.2(R3) (Section 4), B.2(R6) (Section 5), and B.R3 (Appendix C).

9.1 System Restoration Assessment (B.2(R4))

NYSRC Reliability Rules B-R2_R4 [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(R5))

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 years 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

Eight assessments are made for the 2015 Comprehensive ATR.

In the first assessment, power flow analysis are 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 or N-1-1 thermal or voltage 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). 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.

In the second assessment, stability analysis are 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 a stability criteria violation with the 2020 summer peak load case at the Huntley 230 kV substation. A 3-phase bus fault at one of the Huntley 230 kV buses causes the units at the other 230 kV bus to lose synchronism and trip. National Grid has provided a Corrective Action Plan to decrease the clearing time ‘B’ package. The estimated in-service date of this Corrective Action Plan is May 2016.

The stability simulations show no stability issues for the light load cases under N-1 and N-1-1 conditions.

The third assessment evaluates the fault duty at BPTF buses in the short circuit representation. The analysis shows no overdutied breakers with the Berrians generating units withdrawn from the interconnections queue.

In the fourth 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 fifth assessment evaluates extreme system conditions, which have a low probability of occurrence (e.g. loss of major fuel supply (such as gas) and high peak load conditions (i.e. 90^{th} percentile load forecast) resulting from extreme weather). Both extreme system condition study scenarios show no steady state thermal or voltage violations; additionally, the dynamic simulations show that all contingencies evaluated are stable, damped, and no generating unit lost synchronism other than by fault clearing action or special protection system response.

The sixth assessment is a review of SPSs in NYCA. The testing of the SPSs showed similar results to the previous CATR. There are no proposed additional SPSs and system conditions in the vicinity of existing SPSs have not changed significantly since the previous review. No changes to the classification of existing SPSs are requested in this review.

The seventh assessment is a review of the DCS. Since the previous CATR, there is one proposed addition to the DCS in the NYCA. The planned year 2020 system conditions in the vicinity of existing DCS in the NYCA have not changed significantly compared to the previous CATR; therefore, this assessment confirms the current classification of all DCS including the proposed CPV Valley DCS as Type III.

For the eighth assessment, the NYCA has no existing exclusions to NPCC Basic Criteria and makes not request for new exclusions.

11. Conclusion

The analysis in the 2015 CATR indicates that the New York State Bulk Power Transmission Facilities, as planned through the year 2020 (including Corrective Action Plans), conform to the reliability criteria described in applicable NERC Reliability Standards [7], NPCC Directory #1 and the NYSRC Reliability Rules. This assessment confirms that no additional upgrades are necessary to meet the performance requirements defined in NPCC Directory #1 and the NYSRC Reliability Rules.

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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.
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