2013 Intermediate Area Transmission Review

Of the New York State Bulk Power Transmission System (Study Year 2018)

FINAL REPORT

June 4, 2014

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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 Transmission Facilities (BPTF), as required by the Northeast Power Coordinating Council (NPCC) and the New York State Reliability Council (NYSRC). The purpose of the assessment is to demonstrate conformance with the applicable North American Electric Reliability Corporation (NERC) Reliability Standards; NPCC Transmission Design Criteria; NYSRC Reliability Rules; and NYISO criteria, rules, and procedures. This report comprises the first Intermediate ATR submitted by the NYISO since the 2010 Comprehensive ATR (CATR) was approved by NPCC in June 2011. In 2011 and 2012 an interim level ATR was performed by the NYISO. The 2013 Intermediate ATR is conducted for the Near-Term (years one through five) Transmission Planning Horizon, assessing the planned year 2018 system.

Eight assessments are made for this Intermediate Review. Overall, the results are comparable to the 2010 CATR which found the planned New York State BPTFs are in conformance with the applicable NERC Reliability Standards; NPCC Transmission Design Criteria; NYSRC Reliability Rules; and NYISO criteria, rules, and procedures.

The system representation used in this transmission review is developed based on the NPCC 2012 Base Case Development (BCD) library and the NYISO 2013 FERC 715 filing power flow model updated with the NYISO 2013 Load and Capacity Data.

Changes in this review as compared to the 2010 CATR include a 1082 MW increase in load forecast and a decrease of approximately 2660 MW in capacity resources. The updated Local Transmission Plans are also incorporated into the Intermediate ATR base case.

In the first and second assessments, power flow and stability analyses are conducted to evaluate the thermal, voltage and stability performance of the New York State BPTF for normal (or design) contingencies as defined in the NERC Reliability Rules, NPCC Transmission Design Criteria, and the NYSRC Reliability Rules. The BPTF, as defined in this review, includes all of the facilities designated by the NYISO to be part of the Bulk Power System (BPS) as defined by the NPCC; additional non-BPS facilities are also included in the BPTF. The power flow analysis indicates there is one thermal overload on Clay-Lockheed Martin 115 kV (line 14) and one low voltage issue at Porter 115 kV. Corrective Action Plans are in-place to mitigate the issue. The stability simulations show no stability issues for the studied peak load conditions.

As part of the first assessment, power flow analyses are conducted to evaluate the performance of the New York State BPTF for N-1-1 contingencies. NPCC and NYSRC Design Criteria apply after any critical generator, transmission circuit, transformer, series or shunt compensating device or HVdc pole has already been lost, assuming that the Planning Coordinator Area generation and power flows are adjusted before the next contingency by the use of ten-minute reserve and where available, phase angle regulator control and HVdc control. Corrective actions are identified for each first contingency (N-1) such that there were no post-contingency thermal and voltage violations following any second contingencies (N-1-1). In performing the N-1-1 evaluations, the National Grid Porter 115 kV station, Porter-Kelsey 115 kV (line 3), Clay-Lockheed Martin 115 kV (line 14), and the Orange and Rockland new North Rockland 345/138 kV substation transformer require mitigation plans. For those facilities that are new, the mitigation plans will be in-place before the facilities are placed in-service. For existing facilities, Corrective Action Plans are in-place to mitigate the issue.

The third assessment evaluated the fault duty at select critical buses in the short-circuit representation. The analysis indicates three buses with BPTF facilities may experience over-dutied breakers for the conditions tested. These were at Porter 230 kV, Porter 115 kV, and at Astoria West 138 kV. The owners of these over-dutied breakers are responsible for making the necessary facility upgrades as part of their internal planning and compliance processes.

In the fourth assessment, power flow and stability analyses are conducted to evaluate the performance of the BPS for low probability extreme contingencies as defined in the NPCC Directory #1 and NYSRC Reliability Rules. The stability analysis results indicate that the interconnected power system is stable for the extreme contingencies tested and for the system conditions tested. The power flow analysis results indicate, in all cases, the extreme contingencies do not cause significant thermal or voltage problems over a widespread area for the system conditions tested. 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 evaluated the extreme system conditions, which have a low probability of occurrence (e.g. loss of gas supply and high load conditions resulting from extreme weather). Under extreme weather conditions (e.g., 90/10 load forecast), the thermal overloads identified in the baseline analysis are aggravated by higher load. The following are new thermal/voltage BPTF violations for which sufficient corrective actions could not be identified: National Grid Niagara – Packard – Huntley 230 kV (Zone A); NYSEG Oakdale 345/115 kV (Zone C); and National Grid Leeds – Pleasant Valley 345 kV corridor (Zones F & G). For the tested loss of gas supply condition, no significant new thermal or voltage issues are found on the BPTF; however, there is one stability contingency with an undamped response.

The sixth assessment is a review of Special Protection Systems (SPS). New York has not added nor changed any Type 1 SPS nor planned any new Type 1 SPS since the 2010 CATR. System conditions have not changed sufficiently to impact the operation or classification of existing SPS.

The seventh assessment is a review of the Dynamic Control Systems (DCS). System conditions have not changed sufficiently to impact the operation or classification of previously reviewed DCS since the 2010 CATR.

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 topics covered in Section 9 include: System Restoration Assessment B-R5 and Local Rules Consideration I-R1 through I-R5.

In conclusion, the analyses presented in the 2013 Intermediate ATR found that the New York State BPTF, as planned through the year 2018, is in conformance with the applicable NERC Reliability Standards; NPCC Transmission Design Criteria; NYSRC Reliability Rules; and the NYISO criteria, rules, and procedures.

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 Transmission Facilities (BPTF), as required by the Northeast Power Coordinating Council (NPCC) and the New York State Reliability Council (NYSRC). The purpose of the assessment is to demonstrate conformance with the applicable North American Electric Reliability Corporation (NERC) Reliability Standards; NPCC Transmission Design Criteria; NYSRC Reliability Rules; and NYISO criteria, rules, and procedures [1]-[6]. The 2013 Intermediate ATR is conducted for the Near-Term Transmission Planning Horizon (Year One through five), assessing the planned year 2018 system. 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.

In the NYISO 2012 Reliability Needs Assessment (RNA) [7], the NYISO identified that additional resources are needed over the 10-year study period in order for the New York Control Area (NYCA) to comply with the Applicable Reliability Criteria [1]-[6] beginning in 2013, based on transmission security needs, and by 2020 based on resource adequacy needs. As a result, the NYISO requested market-based, regulated backstop, and alternative regulated solutions to the Reliability Needs, which are discussed in the 2012 Comprehensive Reliability Plan [8]. For the 2013 ATR, the solutions to the near-term Reliability Needs discussed in the 2012 CRP [8], which are also listed in the 2013 Load and Capacity Data [9] as Firm Projects, are incorporated into the system model.

NERC is the Electric Reliability Organization (ERO) certified by the Federal Energy Regulatory Commission (FERC) to establish and enforce reliability standards for the bulk power system. NERC develops and enforces reliability standards such as TPL-001-0.1, TPL-002-0b, TPL-003-0b, and TPL-004-0a (NERC Transmission Planning (TPL) Reliability Standards) [1], which regional councils adopt to establish their regional reliability standards.

NPCC, a regional council of NERC, has established Regional Reliability Reference Directory #1 the “Design and Operation of the Bulk Power System” [2] which describes the Transmission Design Criteria that apply to each Area. These criteria are consistent with or more stringent than the NERC TPL Reliability Standards [1]. As part of its 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 the NPCC requirements for the annual ATR is outlined in NPCC Directory #1 [2] “Appendix B - Guidelines and Procedures for NPCC Area Transmission Reviews”.

The NYSRC has established rules for planning and operating the New York State Bulk Power System [3]. The NYSRC Reliability Rules [3] are consistent with and in certain cases are more specific than the NERC Reliability Standards [1] and the NPCC Transmission Design Criteria [2]. The process for compliance with the NYSRC requirements for the annual ATR is outlined in

NYSRC Reliability Rules [3] Section VII, "NYSRC Procedure for New York Control Area Transmission Reviews".

The Guidelines and Procedures for NPCC Area Transmission Reviews require each Area to conduct a Comprehensive Area Transmission Review (CATR) at least every five years and either an Interim or Intermediate ATR in each of the years between CATRs, as appropriate. This assessment is conducted in accordance with the requirements for an Intermediate Review, as described in the NPCC Directory #1 [2]. The previous Comprehensive Review of the New York State BPTF was performed in 2010 (approved June 1, 2011) and assessed the planned year 2015 system [10]. In 2011 and 2012 an interim level ATR was performed by the NYISO, assessing the planned years 2016 and 2017 systems, respectively. The 2013 Intermediate ATR assessment of the planned year 2018 system includes an updated forecast of system conditions, including a number of proposals for new, retired or cancelled generation, and transmission facilities in NYCA since the previous CATR [10]. The scope of 2013 Intermediate ATR is provided in Appendix A.

1.2. **Facilities Included in this Review**

The system representation for this transmission review is developed from the NPCC 2012 Base Case Development (BCD) library. The representation for the NYCA is based on the NYISO 2013 FERC 715 filing power flow model with transmission system and load changes made to the NYCA system including existing and planned facilities. The representations reflect the conditions reported in the NYISO 2013 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 4,172 miles of 765, 500, 345, and 230 kV transmission. Only a couple hundred miles of the 6,833 miles of 138 and 115 kV transmission is also considered to be part of the New York State BPS. Also included in New York State BPS are a number of large generating units (generally 300 MW or larger). As part of this review, the NYISO and the New York State Transmission Owners perform simulations in accordance with the NPCC Classification of Bulk Power System Elements (Document A-10) methodology [11] to determine any change in BPS status to existing or planned facilities. The results of A-10 testing and the list of BPS facilities are documented in Appendix N.

The New York State BPTF defined in this review include all facilities designated by the NYISO to be part of the BPS as defined by the NYSRC and NPCC, as well as other transmission facilities that are relevant to planning the New York transmission system. The remaining sub-transmission facilities that are not classified as BPTF are evaluated by the local Transmission Owner and coordinated through the NYISO Local Transmission Planning Process. The list of New York State BPTF is documented in Appendix B.

The transmission plans shown on Table 1.2.1 reflect changes since the 2010 CATR. Additional changes to transmission plans that occurred following publication of the NYISO 2013 Load and Capacity Data [9] will be captured in future reviews. Proposed major generation projects included in the base case are listed in Table 1.2.2 and Table 1.2.3. The Cayuga Operating Company, LLC provided notice of its intent to mothball the approximately 300 MW Cayuga generating plant in July 2012. At the time of the notice, a study determined that certain transmission reinforcements would be needed prior to mothballing the plant. The New York

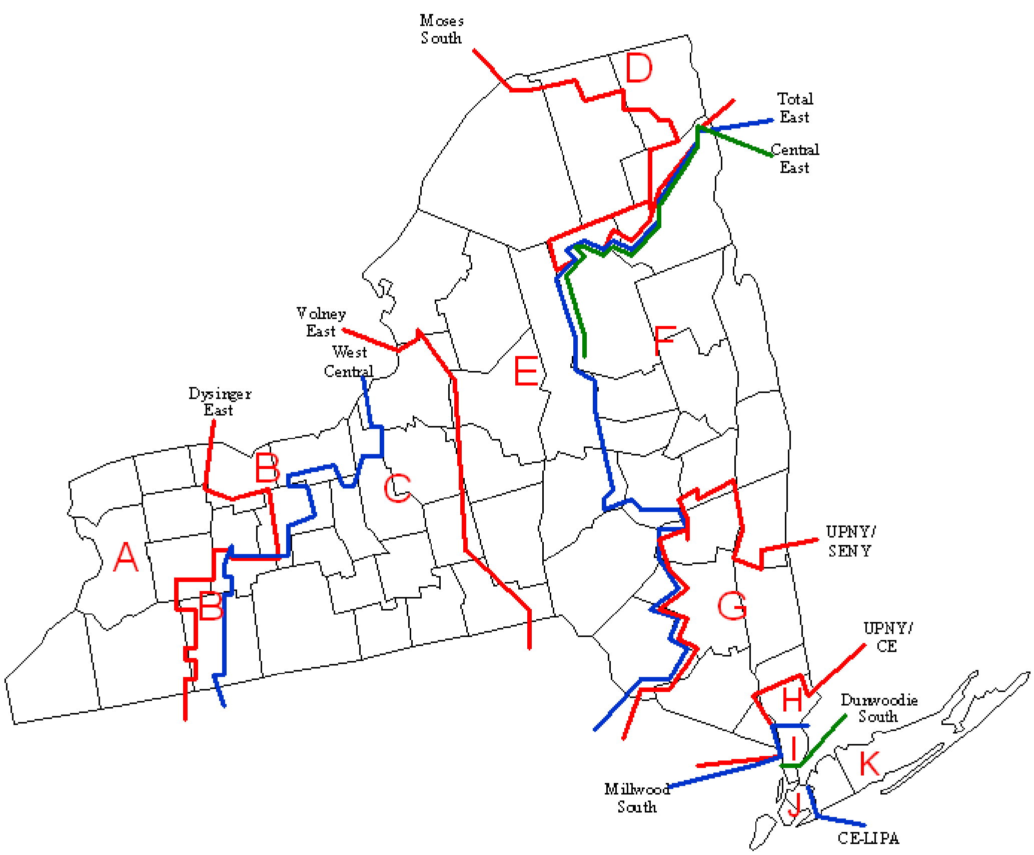
State Public Service Commission approved a Reliability Support Services Agreement between Cayuga Operating Company, LLC and New York State Electric and Gas Corporation to provide for its continued operation. The transmission reinforcements needed prior to mothballing the Cayuga plant are not listed as Firm projects in the 2013 Gold Book [9]; therefore, the Cayuga units are left in-service for this ATR pending further developments.

Also, it should be noted that for this study, the Dunkirk generation plant is assumed to be mothballed [9]; however, in December 2013 an agreement was reached between National Grid and NRG Energy to repower the Dunkirk plant by Fall 2015.

1.2.1. Interface Definitions

The NYISO monitors and evaluates the eleven major interfaces between 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), Hydro-Quebec, ISO-New England, and PJM. The planning interfaces are described in Appendix E.

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 the base case between the NYCA and neighboring systems. New York does not use the firm transfer concept though transfer limit analysis is performed to ensure adequate capability.

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 2013 Intermediate ATR system forecast. The 2013 Intermediate ATR system forecast for NYCA generating facilities (existing or under construction) in 2018 was 37,944 MW. This Intermediate ATR also includes an additional 844.2 MW of proposed generation projects and 2,239 MW of net capacity transactions from external areas. The corresponding installed capacity for the 2018 summer is 42,585 MW, including Special Case Resources (SCRs, or demand response) of 1,558 MW. The reserve margin is 21.3%, which is above the required Installed Reserve Margin (IRM) of 17.0% approved by NYSRC for the 2013-2014 Capability Period. Additionally, the 2013 Intermediate ATR incorporates 1,516 MW of energy efficiency into the summer peak load while the 2010 forecast for 2015 incorporated 1,675 MW.

Table 1.2.1 Changes in Bulk Power Transmission Facilities

	2010 CATR: Forecast for Summer 2015	2012 Interim ATR: Forecast for Summer 2014	2013 Intermediate ATR: Forecast for Summer 2018
Bulk Transmission:	**Included/IS Date**	**Included/IS Date**	**Included/IS Date**
Linden VFT Goethals 345 kV Substation Upgrade (Q#125)	Y/ 2011	Y/ 2014S	Y/ 2014S
Sherman Creek 345 kV Substation (M29, Q#153)	Y / 2011S	Y/ In-Service	Y/ In-Service
Patnode 230 kV Substation (Q#161)	Y/ 2011S	Y/ 2012F	Y/ In-Service
Jordanville 230 kV Substation (Q#186)	Y/ 2011-Q4	N/ Cancelled	N/ Cancelled
Hudson Transmission Project HVdc (Q#206)	Y/ 2013	Y/ 2013	Y/ In-Service
Ball Hill 230 kV Substation (Q#222)	Y/ 2011-Q4	Y/ 2014-Q1	Y/ 2014-Q1
Bayonne Energy Center Gowanus 345 kV Substation Upgrade (Q#232)	Y/ 2012-Q2	Y/ 2012-05	Y/ In-Service
CPV Valley 345 kV Substation (Q#251)	Y/ 2012-Q4	Y/ 2016-05	N/ 2016-05
South Ripley 230 kV Substation (Q#254)	Y/ 2011-Q4	N/ Cancelled	N/ Cancelled
Stony Creek 230 kV Substation (Q#263)	Y/ NA	Y/ 2012-12	Y/ 2013-11
Stony Ridge 230 kV Substation (Q#289)	Y/ 2011S	Y/ In-Service	Y/ In-Service
Cricket Valley Energy Center 345 kV Substation (Q#310)	N/ NA	Y/ 2015-09	N/ 2016-07
Rochester Transmission Reinforcement 345 kV Substation (Q#330)	N/ NA	Y/ 2016F	Y/ 2016W
Con Edison Astoria Annex 345/138kV transformer	N/ NA	Y/ 2012S	Y/ In-Service
Con Edison Rainey-Corona Transformer/Phase Shifter	N/ NA	N/ NA	Y/ 2018S
NYPA Moses-Willis 230 kV Tower Separation	N/ NA	Y/ 2013-12	Y/ 2013W
NYSEG Watercure 345/230kV Transformer	N/ NA	Y/ 2013S	Y/ 2015W
NYSEG Coopers Corners 345kV Shunt Reactor	N/ NA	Y/ 2014F	Y/ 2014W
NYSEG Oakdale 345 kV tower separation	N/ NA	Y/ 2012-06	Y/ In-Service
NYSEG South Perry 230 kV (New Station)	N/ NA	N/ NA	Y/ 2015S
NYSEG Wood St.345/115 kV Transformer	N/ NA	N/ NA	Y/ 2016S
NYSEG Coopers Corners 345/115 kV Transformer	N/ NA	N/ NA	Y/ 2016S
NYSEG Fraser 345/115 kV Transformer	N/ NA	N/ NA	Y/ 2016S
NYSEG Gardenville 230/115 kV Transformer	N/ NA	N/ NA	Y/ 2017S
NYSEG/N. Grid 5 Mile Rd 345 kV (New Substation)	N/ NA	N/ NA	Y/ 2015S
N. Grid Eastover Rd 345 kV (New Substation)	N/ NA	N/ NA	Y/ 2015S
N. Grid Clay 345/115 kV Transformer	N/ NA	N/ NA	Y/ 2015S
O&R North Rockland 345kV (New Substation)	N/ NA	N/ NA	Y/ 2018S

Table 1.2.2 Additions/Uprates in Generation Facilities

Additions/Uprates > 20 MW:	***Size***	***2010 CATR: Forecast for Summer 2015***	***2012 Interim ATR: Forecast for Summer 2017***	***2013 Intermediate ATR: Forecast for Summer 2018***
		Included/IS Date	***Included/IS Date***	***Included/IS Date***
Moresville Energy Wind Project (Q#152) [1]	99	N/ NA	N/ Cancelled	N/ Cancelled
AES St. Lawrence Wind Project (Q#166) [1]	75.9	Y/ 2012F	Y/ 2013-09 Reduced to 75.9MW	Y/ 2014-12
Alabama Ledge Wind Project (Q#169) [1]	79.8	N/ NA	Y/ 2013-10	N/ Withdrawn
Marble River I & II (Q#161, Q#171) [1]	215.2	Y/ 2011F	Y/ 2012-10 Reduced to 215.2MW	Y/ In-Service
Jordanville Wind Project (Q#186) [1]	150	Y/ 2011W	N/ Cancelled	N/ Cancelled
Arkwright Wind Project (Q#198) [1]	79.8	N/ NA	Y/ 2013-09	N/ Withdrawn
Berrians I & II (Q#201, Q224)	250	N/ NA	Y/ 2014-06	N/ 2014-06
Cape Vincent Wind Project (Q#207) [1]	210	Y/ 2012W	Y/ 2013-09	Y/ 2014-12
Noble Ellenberg II Windfield (Q#213) [1]	21	Y/ 2011W	Y/ NA	N/ Withdrawn
Nine Mile Point Uprate (Q#216)	168	Y/ 2012-Q2	Y/ 2012-06	Y/ In-Service
Ball Hill Wind Park (Q#222) [1]	90	Y/ 2011W	Y/ 2014-Q1	Y/ 2014-Q1
Bayonne Energy Center (Q#232)	500	Y/ 2011S	Y/ 2012-05	Y/ In-Service
Allegany Wind Project (Q#237) [1]	72.5	Y/ 2011F	Y/ 2013-08	Y/ 2014-09
CPV Valley (Q#251)	677.6	Y/ 2010F	Y/ 2016-05 Increased to 677.6MW	N/ 2016-05
Ripley-Westfield Wind Project (Q#254) [1]	124.2	Y/ NA	N/ Cancelled	N/ Cancelled
South Pier Improvement (Q#261)	103.7	Y/ 2012S	N/ Cancelled	N/ Cancelled
Stony Creek Wind Farm (Q#263) [1]	94.4	Y/ NA	Y/ 2012-12 Increased to 94.4MW	Y/ 2013-11
Berrians GT III (Q#266)	250	Y/ 2012S	Y/ 2016-06 Reduced to 250MW	N/ 2016-06
Astoria Energy II (Q#308)	576	Y/ 2011S	Y/ In-service	Y/ In-Service
Cricket Valley Energy Center (Q#310)	1019.9	N/ NA	Y/ 2015-09 Increased to 1019.9MW	N/ 2016-07
Prattsburgh Wind Farm	78.2	N/ NA	N/ NA	Y/ 2013-12
Roaring Brook Wind	78	N/ NA	N/ NA	Y/ 2015-12

Note:

1 – For wind plants, 10% of their nameplate rating counts towards their seasonal capability rating for the 2010 CATR. For the 2012 Interim ATR and 2013 Intermediate ATR, 100% of their nameplate rating counts towards their seasonal rating.

Table 1.2.3 Shutdowns/Deratings in Generation Facilities[1]

Shutdowns/Deratings:	***Size***	***2010 CATR: Forecast for Summer 2015***	***2012 Interim ATR: Forecast for Summer 2017***	***2013 Intermediate ATR: Forecast for Summer 2018***
		Included/OS Date	***Included/OS Date***	***Included/OS Date***
Greenidge 4	106.1	Y/ 2011-03	N/ Retired	N/ Retired 2012
Westover 8	83.8	Y/ 2011-03	N/ Retired	N/ Retired 2012
Ravenswood GT 3-4	31.7	Y/ NA	N/ Mothballed	N/ Mothballed 2011
Barrett#7	0	Y/ NA	N/ Retired	N/ Retired 2011
Far Rockaway 4	105.1	Y/ NA	N/ Retired	N/ Retired 2012
Glenwood 4 & 5	229.2	Y/ NA	N/ Retired	N/ Retired 2012
Beebee GT	15	Y/ NA	N/ Retired	N/ Retired 2012
Binghamton Cogen	41.3	Y/ NA	N/ Retired	N/ Retired 2012
Astoria 2	177	Y/ NA	N/ Mothballed	N/ Mothballed 2012
Astoria 4	375.6	Y/ NA	N/ Mothballed	N/ Mothballed 2012
Gowanus 1 & 4	264.9	Y/ NA	N/ 2012	Y/ NA
Astoria GT 10	16.7	Y/ NA	N/ Mothballed	N/ Mothballed 2012
Astoria GT 11	19	Y/ NA	N/ Mothballed	N/ Mothballed 2012
Dunkirk 1	75	Y/ NA	N/ 2012	N/ Mothballed 2013
Dunkirk 2	75	Y/ NA	N/ 2012	N/ 2015
Dunkirk 3	185	Y/ NA	N/ 2012	N/ Mothballed 2012
Dunkirk 4	185	Y/ NA	N/ 2012	N/ Mothballed 2012
Danskammer Units 1 – 6	493.6	Y/ NA	Y/ NA	N/ 2013
Niagara Bio-Gen	51	Y/ NA	Y/ NA	N/ Mothballed 2013
Kensico Units #1, #2, #3	3	Y/ NA	Y/ NA	N/ Retired 2012
Montauk Units #2, #3, #4	6	Y/ NA	Y/ NA	N/ Retired 2013

Notes:

1 Generating units that issued a repowering notice after the issuance of the 2013 Load and Capacity Data are not modeled as in-service in this study

Table 1.2.4 NYCA Scheduled Inter-Area Transfers

Region		Transaction
From	To	
NYCA	NE	84 MW
NYCA	HQ	-1380 MW
NYCA	PJM and Others	-1147 MW
NYCA	Ontario	0 MW

Table 1.2.5 Load and Capacity Forecast

	Comprehensive Review: 2010 Forecast for Summer 2015	Intermediate Review: 2013 Forecast for Summer 2018	Change From Previous CATR
Peak Load (MW)	34,021 (1)	35,103	1082
Total Capacity (MW)	45,245 (2)	42,585 (3)	-2660
Reserve Margin	33%	21%	-12%

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 Load and Capacity Data. It's the 2015 Total Resource Capability (43,581.2 MW), from Table V-2a in NYISO 2010 Load and Capacity Data, plus Proposed Resource Additions (1,663.9 MW) from Table IV-1 in NYISO 2010 Load and Capacity Data.
3. This amount is derived from the NYISO 2013 Load and Capacity Data and represents the 2018 Total Resource Capability (41741.3 MW), from Table V-2a in the NYISO 2013 Load and Capacity Data, plus net resource changes (844.2) from Tables IV-1, IV-2, and IV-3 in the NYISO 2013 Load and Capacity Data. Only the proposed generator additions that have completed the class year facilities study are included from Table IV-1. Wind generation capacity is based on 100% of the nameplate rating.

2. Study Results Demonstrating Conformance

2.1. Study Methodology

The analysis for the 2013 Intermediate ATR is conducted in accordance with NERC Reliability Standards [1], NPCC Transmission Design Criteria [2], NYSRC Reliability Rules [3], and NYISO planning and operation practices [4]-[6], [12], [15]. The NYISO follows specific guidelines regarding the NYISO methodology for evaluating the performance of the New York State BPTF, which conform to NPCC Directory #1 "Appendix B – Guidelines and Procedures for NPCC Area Transmission Reviews" and NYSRC Reliability Rules. Guidelines specific to transfer limits, voltage, and stability analysis are found in the NYISO Transmission Expansion and Interconnection Manual [4]-[6]. This Assessment of Transfer Capability respects all known planning horizon System Operating Limits (SOLs). In accordance with NERC Standard FAC-010, NPCC Directory #1 [2] defines the NYISO SOL methodology.

The procedure used 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 period of study (in this case, the year 2018); (2) develop various power flow base 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 transient stability analysis to determine whether or not the performance of the New York State BPTF as modeled meets applicable Reliability Standards [1]-[6].

2.2. Description of Base Cases

The 2013 Intermediate ATR is performed for selected demand levels over the range of forecast system demand representations of the year 2018. Under these conditions, the study demonstrates system performance including critical system conditions such as stability margin transfers and extreme weather as required by the NPCC.

The base cases for evaluating New York State BPTF performance are developed from NPCC BCD libraries. Most of the relevant system representations are taken from the year 2018 cases in the 2012 NPCC BCD library. The PJM system representation is derived from the PJM Regional Transmission Expansion Plan (RTEP) planning process. The NYCA representation is derived from the NYISO 2013 FERC 715 filing. Changes are made to the NYCA system to reflect the updates included in the NYISO 2013 Load and Capacity Data [9]. There are no planned outages in the NYCA for 2018; therefore, all facilities are assumed in-service. Generation is dispatched to match load plus system losses while respecting transmission security.

As part of the base case development process, AC contingency analysis is performed on the base cases using Siemens PTI PSS®MUST. If thermal or voltage limit violations on the New York State BPTF are identified, generation dispatch or phase angle regulator (PAR) adjustments are made to satisfy the NERC Table I Category A, B, and C contingencies [1]; NPCC; and NYSRC Design Criteria contingencies. This analysis is confirmed through further thermal, voltage, and stability analysis performed in the following sections.

Summer peak stability margin transfer cases (Western margin, Moses margin, Central margin, UPNY margin cases) are created from the 2018 summer peak load base 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 [6].

The extreme contingency base case is developed from the 2018 summer peak load base case by reducing the NYCA load to approximately 80% of the summer peak value and 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 base case for the extreme weather system condition is developed from the 2018 summer peak load base case with the load increased to meet the extreme weather forecast statewide coincident peak load (approximately 37,721 MW), reflecting weather conditions expected to occur no more than once in ten years (90/10 summer peak load level).

The base case for the extreme condition of a natural gas fuel shortage is more likely to occur during the winter peak demand period; therefore, the base case model for a gas fuel shortage uses the winter peak demand level (approximately 70% of the summer peak load) assuming that the NYCA gas-only units and dual-fuel units that lack permits to burn oil are not available.

Table 2.2.1 summarizes the power flow schedules of the inter-area controllable-ties in the base case. Diagrams and descriptions of the base cases utilized in criteria testing can be found in Appendix D.

Table 2.2.1 Schedules on Inter-Area Controllable Devices

Location	2010 CATR Forecast for Summer 2015 MW Schedule	2013 Intermediate ATR Forecast for Summer 2018 MW Schedule	Direction
Ramapo PAR 1[1]	100	190	Toward NY
Ramapo PAR 2[1]	100	190	Toward NY
St. Lawrence PARs (L33/34)	0	0	
Sandbar PAR (PV-20)	115	0	Toward VT
Farragut PAR 1 (B3402)	333	333	Toward NY
Farragut PAR 2 (C3403)	333	333	Toward NY
Goethals PAR (A2253)	334	334	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	330	Toward NY
Northport PAR	100	0	Toward NY
Chateauguay HVdc	720	911	Toward NY
Blissville PAR[2]	0	25	Toward NY
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 PAR2 are scheduled to 80% of the RECO load

2 These PARs are not reported in the 2010 CATR

2.3. Thermal Analysis

2.3.1. Methodology

In accordance with the NYISO methodology for Assessment of Transfer Capability in the Near-Term Transmission Planning Horizon [15], 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. All NYCA tie lines with neighboring systems are monitored as appropriate. A listing of the NYCA inter-Area and intra-Area interface definitions used for the 2013 Intermediate ATR is provided in Appendix E.

Approximately 900 contingencies are evaluated including single element, common structure, stuck breaker, generator, multiple element, and DC contingencies. All contingencies studied are consistent with the applicable NERC Category A, B, and C contingencies and NPCC and NYSRC Design Criteria contingencies [1]-[3]. Phase angle regulators (PARs) maintain their scheduled power flow pre-contingency but are fixed at their corresponding pre-contingency angle in the post-contingency solution. The monitored elements include the facilities with base voltage above 100 kV and all New York State BPTF elements.

Thermal transfer limits are sensitive to the base case load and generation conditions, generation selection utilized to create the transfers, PAR schedules, and inter-area power transfers. No attempts are made to optimize transfer limits; therefore, these sensitivities are not considered during thermal transfer analysis.

To determine the Transfer Capability, the generation resources in 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 a deterministic summer peak power flow analysis and may not be applicable for use in probabilistic resource adequacy analysis.

2.3.2. Analysis Results

Tables 2.3.2, 2.3.3, 2.3.4, and 2.3.5 summarize the normal and emergency thermal transfer criteria limits determined for the NYCA intra-area and inter-area open transmission interfaces (where applicable). Details regarding the thermal analysis results are provided in Appendix F. The assessment of Transfer Capability demonstrates the New York State BPTF system meets the applicable NERC TPL Reliability Category A, B, and C standards [1] with respect to thermal ratings. New York State BPTF system security is maintained by limiting power transfers according to the determined thermal constrained transfer limits.

- The Dysinger East and West Central Interfaces' normal and emergency thermal transfer limits decreased compared to the 2010 CATR. The transfer limitation difference is due to increased power flows on the 230 kV transmission from Niagara through Gardenville as a result of the Dunkirk generation mothball, PJM generation retirements, generation redispatch, and new PJM substations which are fed primarily from the NYCA to PJM tie-lines.

- The Volney East Interface normal and emergency thermal transfer limits decreased compared to the 2010 CATR. The transfer limitation difference is due in part to the change in assumed status of the proposed CPV Valley combined-cycle plant which interconnects to the Coopers Corners – Rock Tavern 345 kV line. Since the CPV Valley project is not dispatched in the model, there is no opposing flow against the west-to-east and north-to-south flows typically constraining on the Marcy South corridor.

- The Moses South Interface normal and emergency thermal transfer limits have no significant change compared to the 2010 CATR.

- 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. This flow is achieved with VT Yankee modeled in-service. These modeling assumptions result in higher pre-contingency loading on the Central East limiting element, thus reducing the thermal transfer limit.

- The Total East Interface normal thermal transfer limits decreased and the emergency thermal limits increased compared to the 2010 CATR. The transfer limitation difference for both normal and emergency criteria is due to the Danskammer plant being out-of-service, the change in assumed status of the proposed CPV Valley combined-cycle plant, and New England generation dispatch modeling assumptions. The emergency limit increased while the normal limit decreased is due to the difference in the LTE and STE ratings for New Scotland-Leeds (186 MW) compared to CPV-Rock Tavern (60 MW).

- The UPNY-SENY Interface normal and emergency thermal transfer limits decreased compared to the 2010 CATR. The transfer limitation difference is due to the Danskammer plant being out-of-service, reduction in Bowline generation [9], changes in New England generation dispatch modeling assumptions, not modeling the proposed CPV Valley combined-cycle plant in-service, and sensitivity of the interface to the Ramapo PAR schedule. The schedule for the Ramapo PARs is approximately 400 MW (compared to 1000 MW in the 2010 CATR), which accounts for a 600 MW decrease in the measured transfer. Although the Athens Special Protection System (SPS) is modeled in-service for this 2013 Intermediate ATR, the generation reductions have a greater impact than the SPS, resulting in a net reduction in the transfer limit[1].

- The UPNY-Con Edison Interface normal and emergency thermal transfer limits decreased compared to the 2010 CATR. The transfer limitation difference is due to the Danskammer plant being out-of-service, reduction in Bowline generation [9], and sensitivity of the interface to the Ramapo PAR schedule.

- The Sprain Brook Dunwoodie-South Interface normal and emergency thermal transfer limits have no significant change compared to the 2010 CATR.

- The Long Island Import Interface Normal Transfer Limit has no significant change compared to the 2010 CATR. The change in LTE ratings is offset by the schedule reduction on the Northport-Norwalk Harbor Cable (NNC). The Emergency Transfer Limit decreased due to the reduction in schedule on the NNC from 100 MW in the 2010 CATR to 0 MW in this assessment.

When analyzing inter-area transfer limits, generation dispatch assumptions in neighboring areas can have significant impacts. 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 the 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

[1] The Athens 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.

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

- The New York – Ontario Interface normal thermal transfer limit decreased compared to the 2010 CATR. The transfer limitation difference is due to the modeling of stuck breaker contingencies in the Ontario system. The New York – Ontario emergency thermal transfer limit has no significant change compared to the 2010 CATR.

- The Ontario – New York Interface normal transfer limit has no significant change from the 2010 CATR; however, the emergency transfer limit 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. The mothball of Dunkirk generation relieved the previous binding constraint moving the limiting element north of Dunkirk away from the interface. The mothball of Dunkirk and the change in the Linden Variable Frequency Transformer (VFT) schedule to direct 315 MW into PJM[2] (zero flow in the 2010 CATR) both contributed to the increased normal and emergency thermal transfer limits. 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 STE rating.

- The PJM – New York Interface normal and emergency thermal transfer limits did not change significantly compared to the 2010 CATR despite changes in modeling assumptions. The HTP schedule in this ATR (320 MW in 2013; 605 MW in 2010), the mothball of the Dunkirk generation, the Ripley-Westfield wind project cancellation, and the PJM substation additions would collectively decrease the PJM – New York thermal transfer limit compared to the 2010 CATR. However, for this 2013 ATR, an additional Watercure 345/230 kV transformer relieves the previous limitation identified in the 2010 CATR, increasing the thermal transfer limit.

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

Table 2.3.2 Normal Transfer Criteria Intra-Area Thermal Transfer Limits

Interface	2010 Comprehensive Review (Study Year 2015)	2013 Intermediate Review (Study Year 2018)
Dysinger East	2700 (1)	1275 (2)(A)(B)
West Central	1425 (1)	-125 (2)(A)(C)
Volney East	4600 (3)	3625 (3)
Moses South	2475 (4)	2500 (4)(D)
Central East	2900 (5)	2475 (5)
Total East	5725 (6)	5500 (5)
UPNY-SENY	5250 (7)(G)	5125 (8)(E)(H)
UPNY-Con Edison	5375 (9)(G)	4775 (10)(H)
Sprain Brook Dunwoodie-South	5625 (11)(F)(I)	5675 (12)(F)(I)
Long Island Import	1950 (13)(J)	1950 (14)(J)

Notes:

1. **Wethersfield-Meyer 230** at 494 MW LTE rating for L/O Niagara-Rochester 345 and Rochester-Pannell 345
2. **Sawyer-Huntley 230** (Line 80) at 654 MW LTE rating for L/O Huntley-Gardenville 230 (Line 79)
3. **Fraser-Coopers Corners 345** at 1404 MW LTE rating for L/O Porter-Rotterdam 230 and Marcy-Coopers Corners 345
4. **Moses-Adirondack 230** at 386 MW LTE rating for L/O Chateauguay-Massena-Marcy 765
5. **New Scotland (Bus 77)-Leeds 345** at 1538 MW LTE rating for L/O New Scotland (Bus 99)–Leeds 345
6. **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
7. **Leeds-Pleasant Valley 345** at 1538 MW LTE rating for L/O Athens-Pleasant Valley 345
8. **Leeds-Pleasant Valley 345** at 1724 MW STE 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. **Rock Tavern-Ramapo 345** at 1990 MW LTE rating for L/O Roseton-E. Fishkill 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

A. Used Reliability Rules Exception Reference No. 13 – Post Contingency Flows on Niagara Project Facilities

B. Used NYISO Emergency Operations Manual Procedure for Relief of Potential Overloads on Non-Secured Facilities; otherwise, the limiting element would be 650 MW for Meyer-S. Perry 115 at 104 MW STE for L/O Meyer-S. Perry 230

C. Used NYISO Emergency Operations Manual Procedure for Relief of Potential Overloads on Non-Secured Facilities; otherwise, the limiting element would be -775 MW for Meyer-S. Perry 115 at 104 MW STE for L/O Meyer-S. Perry 230

D. Used Reliability Rules Exception Reference No. 12 – Post Contingency Flow on Marcy Transformer T2

E. Used Reliability Rules Exception Reference No. 23 – Generation Rejection at Athens

F. Used Reliability Rules Exception Reference No. 20 – Post-Contingency Flows on Underground Circuits

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

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

I. 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

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 330 MW, respectively, into Long Island

Table 2.3.3 Emergency Transfer Criteria Intra-Area Thermal Transfer Limits

Interface	2010 Comprehensive Review (Study Year 2015)	2013 Intermediate Review (Study Year 2018)
Dysinger East	2775 (1)	1925 (2)
West Central	1500 (1)	500 (2)
Volney East	5450 (3)	4450 (4)
Moses South	2675 (5)	2625 (5)
Central East	3200 (6)	2800 (6)
Total East	5975 (7)	6200 (6)
UPNY-SENY	5900 (8)(A)	5125 (8)(B)
UPNY-Con Edison	5925 (9)(A)	5275 (10)(B)
Sprain Brook Dunwoodie-South	5625 (11)(C)	5675 (12)(C)
Long Island Import	2675 (13)(D)	2475 (14)(E)

Notes:

1. **Wethersfield-Meyer 230** at 430 MW Normal rating for pre-contingency loading
2. **Sawyer-Packard 230** (Line 77) at 704 MW STE rating for L/O Packard-Niagara 230, Packard-Sawyer 230, 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 1207 MW Normal rating for pre-contingency loading
5. **Marcy 765/345** at 1971 MW STE rating for L/O Marcy 765/345
6. **New Scotland (Bus 77)-Leeds 345** at 1724 MW STE rating for L/O New Scotland (Bus 99) – Leeds 345
7. **CPV Valley-Rock Tavern 345** at 1793 MW STE rating for L/O Coopers Corners-Middletown Tap-Rock Tavern 345
8. **Leeds-Pleasant Valley 345** at 1724 MW STE rating for L/O Athens-Pleasant Valley 345
9. **Roseton-East Fishkill 345** at 1935 MW Normal rating for pre-contingency loading
10. **Rock Tavern-Ramapo 345** at 2144 MW STE rating for L/O Roseton-E. Fishkill 345
11. **Mott Haven-Rainey 345** at 1196 MW STE rating for L/O Mott Haven-Rainey 345
12. **Dunwoodie-Mott Haven 345** at 786 MW Normal rating for pre-contingency loading
13. **Dunwoodie-Shore Road 345** at 599 MW Normal rating for pre-contingency loading
14. **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 NYC

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

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 87 MW and 88 MW, respectively, into Long Island
Neptune and CSC HVdc are scheduled at 660 MW and 330 MW, respectively, into Long Island

Table 2.3.4 Normal Transfer Criteria Inter-Area Thermal Transfer Limits

Interface	2010 Comprehensive Review (Study Year 2015)	2013 Intermediate Review (Study Year 2018)
New York – New England	1425 (1)	900 (2)
New England – New York	2025 (3)	1650 (3)
New York – Ontario	1600 (4)	1475 (5)
Ontario – New York	1725 (6)	1775 (7)
New York – PJM	1775 (8)(A)	1975 (9)(B)
PJM – New York	3400 (10)(C)	3500 (11)(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 Sandy Pond HVdc
3. **Reynolds Rd. 345/115** at 562 MW LTE rating for L/O Alps – New Scotland 345
4. **Niagara-PA27 230** at 460 MW LTE rating for L/O Niagara 345-Niagara2E 230 and Niagara-Beck B 345
5. **Niagara-PA27 230** at 460 MW LTE rating for Beck breaker failure (DT302)
6. **Niagara-Rochester 345** at 1501 MW LTE rating for L/O Somerset-Rochester 345
7. **Niagara-PA27 230** at 460 MW LTE for L/O Niagara to Beck 345 (PA301)
8. **South Ripley-Erie South 230** at 499 MW Normal rating for pre-contingency loading
9. **Sawyer-Huntley 230** (Line 80) at 654 MW LTE rating for L/O Huntley-Gardenville 230 (Line 79)
10. **Watercure 345/230** at 520 LTE rating for L/O Watercure-Oakdale 345, Oakdale 345/115 Bank #2
11. **Dunkirk-South Ripley 230** at 530 MW LTE rating for L/O 5 Mile Rd.-Farmers Valley 345, Stolle Rd-5 Mile Rd. 345, and 5 Mile Rd. 345/115 (Falconer – Warren is assumed as out-of-service)

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 2.3.5 Emergency Transfer Criteria Inter-Area Thermal Transfer Limits

Interface	2010 Comprehensive Review (Study Year 2015)	2013 Intermediate Review (Study Year 2018)
New York – New England	2000 (1)	1475 (2)
New England – New York	2350 (3)	2825 (4)
New York – Ontario	1900 (5)	1900 (5)
Ontario – New York	1875 (6)	2125 (5)
New York – PJM	1775 (7)(A)	2450 (8)(B)
PJM – New York	3500 (9)(C)	3575 (10)(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 HVdc
3. **Pleasant Valley-Long Mountain 345** at 1195 MW Normal rating for pre-contingency loading
4. **Reynolds Rd. 345/115** at 755 MW STE rating for L/O New Scotland-Alps 345
5. **Niagara-PA27 230** at 400 MW Normal rating for pre-contingency loading
6. **Wethersfield-Meyer 230** at 430 MW Normal rating for pre-contingency loading
7. **South Ripley-Erie South 230** at 499 MW Normal rating for pre-contingency loading
8. **Sawyer-Huntley 230** (Line 80) at 755 MW STE rating for L/O Huntley-Gardenville 230 (Line 79)
9. **Stolle Rd.-Pavement Rd. 115** at 179 MW STE rating for L/O Watercure-Homer City 345
10. **Erie South-4 Mile** at 584 MW STE for L/O 5 Mile Rd.-Farmers Valley (Falconer – Warren is assumed as out-of-service)

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 Analysis

2.4.1. Methodology

Voltage-constrained transfer limit analysis is performed using the Siemens PTI PSS®E (Rev. 32) software in conjunction with the NYISO Voltage Contingency Analysis Procedure (VCAP) [5] considering the voltage limit criteria [13]. The voltage limit criteria specify minimum and maximum voltage limits at key New York State buses. 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 2018 summer peak load base case by applying generation shifts similar to those used for the thermal analysis. For each interface, the VCAP program evaluated the system response to the set of most severe contingencies which are applicable to Table 1 for NERC Category B and C contingencies and NPCC transmission design criteria. Selection of these contingencies is based on an assessment of cumulative historical power system analysis, actual system events, and analysis of planned changes to the system.

For the 2013 Intermediate ATR analysis, load is modeled as constant power in all NYCA zones except the Con Edison service territory in both the pre-contingency and post-contingency power flows. The Con Edison voltage-varying load model is used to model the Con Edison load in all cases.

All reactive power adjustments modeled by generators, PARs, autotransformers, SVC and FACTS devices are regulated or adjusted within their respective capabilities. 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 power flows, but are fixed at their corresponding pre-contingency settings in the post-contingency power flows. Similarly, switched shunt capacitors and reactors are switched at pre-determined voltage levels in the pre-contingency power flows, but are held at their corresponding pre-contingency position in the post-contingency power flows. In accordance with NYISO normal (pre-contingency) operating practice, SVC and FACTS devices are held at or near zero reactive power output in the pre-contingency power flows, but are allowed to regulate in the post-contingency power flows.

Voltage-constrained transfer analysis is performed to evaluate the adequacy of the system post-contingency voltage and to find the region of voltage instability. As the transfer 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 post-contingency voltage falls below the voltage limit criteria [9]; or (2) 95% of the pre-contingency power flow at the “nose” of the post-contingency PV curve. The “nose” is the point at which the slope of the PV curve becomes infinite (vertical) reaching the point of voltage collapse and occurs when reactive capability supporting power transfer is exhausted. The region near the “nose” of the curve is generally referred to as the region of voltage instability.

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

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

2.4.2. Results

Table 2.4.1 summarizes the voltage-constrained transfer limits. Detailed results are provided in Appendix G. Reactive power resources are included to ensure adequate reactive resources are available to meet system requirements. The assessment demonstrates that the New York State BPTF system meets the applicable NERC Reliability Standards and NPCC transmission design criteria with respect to voltage performance. 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 generation capacity in the typical source areas requires an increased amount of generation from Ontario to stress the interface sufficiently, creating longer transmission paths for the source generation, thereby reducing the voltage at the interface.

The Dysinger East and West Central voltage-constrained transfer limits decreased compared to the 2010 ATR. The difference in transfer limitation is due to the mothball of Dunkirk generation (and other generation modeling assumptions) and an increased amount of generation from Ontario to stress the interface sufficiently. The voltage-constrained transfer limit is mostly restored to the 2010 CATR limit by providing that sufficient switched capacitor banks are switched on in the pre-contingency case.

The Volney East and Central East voltage-constrained transfer limits decreased compared to the 2010 ATR. The difference in transfer limitation is due to generation mothball/retirements in the West and Central Zones, increased load on the 115 kV system out of PJM, and an increased amount of generation from Ontario to stress the interface sufficiently.

The UPNY-SENY voltage-constrained transfer limit increased compared to the 2010 ATR. The difference in transfer limitation is due to the change in assumed status of the proposed CPV Valley combined-cycle plant which interconnects to the Coopers Corners – Rock Tavern 345 kV line, the addition of the planned North Rockland transformer, and Ramapo PAR schedule. For the 2010 CATR, the CPV Valley plant (which is below the UPNY-SENY Interface) increases flow on the Leeds-Pleasant Valley transmission paths resulting in higher pre-loading of the limiting constraint. For this ATR, the schedule for the Ramapo PARs is approximately 400 MW (1000 MW in the 2010 CATR) and the CPV Valley generation is not in-service. The factors move the limit further from the PV nose pre-contingency, allowing more power to be shifted across the interface before voltage collapse occurs.

The UPNY-Con Edison and Sprainbrook Dunwoodie-South voltage-constrained transfer limits decreased compared to the 2010 ATR. The majority of the difference in transfer limitation is due to the sensitivity of the interfaces to the Ramapo PAR schedule. The schedule for the Ramapo PARs is approximately 400 MW (1000 MW in the 2010 CATR), the difference in schedule accounts for a 600 MW change in transfer limit. The remaining difference in reduction of the voltage-constrained transfer limit is due to the the Danskammer plant being out-of-service, reduction in Bowline generation [9], modeling CPV Valley out-of-service, and decreased generation capacity in the source zones requiring more generation from Ontario to stress the interface sufficiently.

Table 2.4.1 Summary of Voltage Constrained Transfer Limits

Interface	2010 Comprehensive Review (Study Year 2015)	2013 Intermediate Review (Study Year 2018)
Dysinger East	2950 (2) 2975 (1)	2775 (3)
West Central	1650 (2) 1725 (1)	1400 (3)
Volney East	5025 (4)	4325 (5) 4400 (4)
Central East	3175 (6) 3225 (7)	2950 (5) 3000 (7)
UPNY-SENY	6150 (8)(A)	6350 (9)(B) 6425 (10)(B)
UPNY-Con Edison	5475 (11)(A)	4575 (9)(B) 4750 (10)(B)
Sprain Brook Dunwoodie-South	5350 (11)(A)(C)	4450 (9)(B)(C) 4600 (10)(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. 95% of PV nose occurs for L/O Tower 79/80 (L/O Huntley-Gardenville 230 kV double ckt.)
4. 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)
5. Marcy 345 kV pre-contingency low limit
6. 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)
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. Pleasant Valley 345 kV bus voltage post-contingency low limit for L/O Tower 34/42 (Coopers Corners – Rock Tavern 345 kV double ckt.)
9. Pleasant Valley 345 kV pre-contingency low limit
10. 95% of PV nose occurs for L/O Tower 34/42 (Coopers Corners – Rock Tavern 345 kV double ckt.)
11. 95% of PV nose occurs for L/O Tower 67/68 (Ladentown-Bowline 345 kV double ckt.)

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 NYC

2.5. **Stability Analysis**

2.5.1. Methodology

Starting with a 2018 summer peak load stability base case, the NYISO created four NYCA transmission interface transfer cases using the PTI PSS/E Stability program. These cases are used to evaluate the stability performance of the NYCA system for potentially limiting design criteria contingencies at various transfer levels in order to confirm that power transfer levels will not be restricted by a stability constraint. The methodology for this analysis is described in NYISO Transmission Planning Guideline #3-1, *Guideline for Stability Analysis and Determination of Stability-Based Transfer Limits* [6].

The NYISO performed the normal design criteria (NERC Category B and C contingencies) stability analysis on four 2018 summer peak stability margin cases (UPNY margin, Central margin, Western margin, and Moses margin). For each summer peak case, the flows 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. This ensures that the application of the margin does not result in the determination of a "stability limit" that is lower than the voltage transfer limit or emergency thermal transfer limit.

The UPNY-SENY and UPNY-Con Edison open interfaces of the UPNY margin case were loaded at 7100 MW and 5325 MW, respectively. The UPNY-SENY emergency thermal limit is more limiting at 5125 MW and UPNY-Con Edison is voltage limited at 4575 MW. This case has the Oswego Complex generation dispatched at an output of 5225 MW and 1200 MW of import from Hydro Quebec (supplied by Beauharnois hydro generation). The Chateauguay HVdc poles were taken out of service to exclude the dynamic benefit of the HVdc controls. The Ramapo PARs are scheduled at 500 MW each into New York in order to stress the UPNY-Con Edison Interface over the Emergency Transfer Limit

The Central margin case has the Oswego Complex generation dispatched at an output of 5300 MW and 1200 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 are loaded at 3135 MW and 6120 MW, respectively. The Central East Interface emergency thermal limit is 2800 MW and the UPNY-SENY emergency thermal limit is 5125 MW.

The Western margin case is loaded to the following open interface levels: Dysinger East 2130 MW; West Central 705 MW; Ontario-NY 885 MW and HQ-NY 1300 MW (Chateauguay HVdc 910 MW; Beauharnois 390 MW). The Dysinger East Interface emergency thermal limit is 1925 MW and West Central has an emergency thermal limit of 500 MW.

The Moses margin case has the Moses South open interface loaded to 3000 MW, HQ-NY loaded to 1985 MW (Chateauguay HVdc 1000 MW, Beauharnois 985 MW), and the St Lawrence L33/34 PARs scheduled at 250 MW each. The Moses South Interface emergency thermal limit is 2625 MW.

Diagrams and descriptions of these bases cases can be found in Appendix D.

The dynamic data used in this analysis is developed from the NPCC 2012 BCD library. The load model can have a significant impact on the stability performance of the Bulk Power System; a primary load model comprised of 100% constant impedance for both active and reactive power load is used for the NYCA and New England. The real power load models used for the other Planning Areas were: constant current (power varies with the voltage magnitude) for Hydro Québec, New Brunswick, MRO, RFC, SERC, and SPP; 50% constant current/50% constant impedance for Ontario and Nova Scotia, and Cornwall; and 90% constant current/10% constant impedance for FRCC. Reactive load was 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 model for reactive load.

A Light Load analysis was not performed given that system conditions have not changed sufficiently to impact the results previously performed in the 2010 CATR.

2.5.2. Results

This analysis demonstrates that the New York State BPTF system meets Table I for Category A, B, and C of NERC TPL Reliability Standards [1] with respect to stability. New York State BPTF system security is maintained by limiting power transfers according to the determined stability limits. This study performed dynamic stability simulations for those Category B and C contingencies expected to produce the more severe system results or 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.

Appendix H lists the design criteria contingences that are evaluated and a determination of the overall system response as stable or unstable. The approximately 300 design criteria contingencies that are evaluated for the four margin cases are stable and damped.

2.6. N-1-1: Non-Simultaneous Loss of Two or More Bulk Power System Elements

2.6.1. Methodology

N-1 analysis is performed using Siemens PTI PSS® MUST program and the PowerGem TARA program. N-1-1 analysis is performed using the TARA program utilizing its N-1-1 capability. The N-1 and N-1-1 analysis is performed using the summer 2018 50/50 forecast of the statewide coincident peak load.

Approximately 900 contingencies are evaluated including single element, common structure, stuck breaker, generator, multiple element, and DC contingencies as the second contingency with single contingencies evaluated as the first contingency. All contingencies studied are consistent with the applicable NERC Category A, B, and C contingencies and NPCC and NYSRC Design Criteria contingencies. The monitored elements are the New York State BPTF elements. Phase angle regulators (PARs) maintain their scheduled power flow pre-contingency but are fixed at their corresponding pre-contingency angle in the post-contingency solution. Corrective actions including generator redispatch, PAR adjustments, and HVdc adjustments are allowed between the first and second contingency. The corrective actions not only prepare the system for the next contingency, but also bring the flows back to their normal rating after the first contingency.

2.6.2. N-1 Contingency Results

N-1 testing noted a minor overload on the Clay-Lockheed Martin 115kV (line 14) (104%). The contingency is a stuck breaker at Lafayette 345kV substation and the reduced transfers on the Dysinger East and West Central Interfaces. National Grid noted in their local transmission plans [17] that they have a Corrective Action Plan to reconductor the Clay-Lockheed Martin 115kV (line 14) which would mitigate this overload. The proposed in-service date provided in the LTP is early 2017; however, National Grid has communicated to the NYISO an updated proposed in-service date of late 2016. With Cayuga mothballed, the overload will be exacerbated. Also, N-1 testing shows a low voltage issue for a stuck bus-tie breaker at Porter 115 kV. National Grid also noted in their local transmission plans [17] a Corrective Action Plan to install a second bus-tie breaker in series with the existing Porter bus-tie breaker effectively eliminating the stuck bus-tie breaker contingency. The proposed in-service date for the Corrective Action Plan is summer 2017.

2.6.3. N-1-1 Contingency Results

National Grid's Clay 115 kV station includes eight 115 kV transmission connections and two 345/115 kV transformers that serve the Oswego and Syracuse areas. N-1-1 testing shows the Clay-Lockheed Martin 115 kV (line 14) would be loaded at 114% of its LTE rating for the loss of a parallel circuit followed by a stuck breaker contingency. This overload is due to power flowing from east to west on the 115 kV system after the loss of a north-to-south 345 kV path (i.e. Oswego-Elbridge-Lafayette-Clarks Corners). As noted above under the N-1 analysis, National Grid is planning on reconductoring this line. Also as noted under the N-1 analysis, with Cayuga mothballed, the overload will be exacerbated.

National Grid's Porter 115 kV station includes eight 115 kV transmission connections and two 345/115 kV transformers that serve the Utica and Syracuse areas. N-1-1 testing shows the Porter-Kelsey 115 kV (line 3) would be loaded at 119% of its LTE rating for the loss of a parallel circuit followed by a bus contingency. This overload is due to power flowing from east to west on the 115 kV system to serve load in the Utica, Syracuse, and Finger Lakes area. The National Grid Corrective Action Plan for the Porter-Kelsey 115 kV (line 3) is to open a 115 kV breaker at the Yahnundasis station which transfers load away from Porter-Kelsey 115 kV (line 3). The long-term solution under consideration by National Grid is to reconductor the Porter-Kelsey 115 kV (line 3).

Orange & Rockland (O&R) is planning to construct a new North Rockland 345/138 kV substation between Ramapo and Buchanan to serve the O&R service area, with a planned in-service date of 2018. The new 345/138 kV transformer would be significantly overloaded for the N-1-1 loss of two 345 kV lines that would isolate 100% of Indian Point unit #2 on the transformer. O&R is reviewing mitigation options in coordination with Con Edison which may include an alternate point of interconnection. The mitigation plan will be in place prior to the new substation being placed in-service.

Except as noted above, corrective actions are identified for each N-1 facility outage condition such that there are no post-contingency thermal or voltage violations on the New York State BPTF following any N-1-1 contingency combination. These results indicate that sufficient ten-minute reserve, phase angle regulator control, and HVdc control is available within the New York Control Area to allow the projected demand to be supplied following two non-simultaneous contingencies. The complete N-1-1 results are provided in Appendix I. Subsequent annual assessments will review the continuing need for the system facilities identified in the Corrective Action Plans.

2.6.4. Re-Evaluation of Reliability Needs Identified in 2012

Transmission security analysis performed for the NYISO 2012 RNA [7] identified thermal violations under N-1-1 post-contingency conditions in four substations on the BPTF within the five-year assessment period for which sufficient system adjustments could not be identified: Rochester (345/115 kV transformers at RG&E Station 80 345 kV and RG&E Pannell 345 kV); Syracuse (115 kV line at National

Grid Clay 115 kV); and Orange and Rockland counties (O&R 345/138 kV transformers at Ramapo 345 kV). These facilities are relied upon to serve load from the transmission system in these areas, and were found to be overloaded due to the N-1-1 loss of multiple sources (generators or transformers) for those areas. At the time of issuance of the 2012 Interim ATR [16], the solutions to address the identified violations were not finalized; therefore, this assessment includes the re-evaluation of the areas of the system impacted by the violations.

Following the issuance of the NYISO 2012 RNA [7], the NYISO requested and evaluated solutions submitted in response to the identified Reliability Needs. The development of solutions to the Reliability Needs is discussed in the 2012 NYISO CRP [8]. In response to the request for solutions to the Reliability Needs, updates to Local Transmission Plans (LTPs) and Regulated Backstop Solutions were received from the Responsible Transmission Owners. RG&E submitted a Regulated Backstop Solution that included replacement of two existing 345/115 kV transformers at Station 80 and a new breaker and a half substation (Station 255) with two 345 /115 kV transformers, a 115 kV line to Station 23, and another 115kV line into the western Rochester Area. The transformer replacements are already in-service and the new substation is scheduled to be in-service for winter 2016 [9]. The National Grid solution for the Clay-Teall 115 kV (line 10) is reconductoring the line. This facility is scheduled to be in-service for winter 2017 [9]. The O&R solution for the Ramapo 345 kV substation includes a new protection system that results in the exclusion of the Ramapo 345/138 kV transformers from the NPCC Bulk Power System. This protection system is already in-service.

These solutions are incorporated in the base case model for the 2013 Intermediate ATR. All transmission security violations identified in the 2012 RNA are resolved as shown in this review.

2.7. Summary of Study Results Demonstrating Conformance

Table 2.6.1 at the end of this section provides a summary of the normal and emergency transfer limits for the open transmission interfaces used in NYISO transmission planning studies. With the Corrective Action Plans identified for the violations noted in Section 2.6, these results confirm that the base case meets criteria, and by limiting power transfers consistent with the transfer limits reported here, the security of the New York State BPTF will be maintained and projected demand will be supplied in accordance with NERC Reliability Standards, NPCC Transmission Design Criteria, and NYSRC Reliability Rules.

Table 2.6.1 Transfer Limit Comparison

Interface	2010 Comprehensive Review (Study Year 2015)				2013 Intermediate Review (Study Year 2018)			
	Normal (MW)		Emergency (MW)		Normal (MW)		Emergency (MW)	
Dysinger East	2700	T	2775	T	1275	T	1925	T
West Central	1425	T	1500	T	-125	T	500	T
Volney East	4600	T	5025	VX	3625	T	4325	VX
Moses South	2475	T	2675	T	2500	T	2625	T
Central East	2900	S	2900	S	2475	T	2800	T
Total East	5725	T	5975	T	5500	T	6200	T
UPNY-SENY	5250	T	5900	T	5125	T	5125	T
UPNY-Con Edison	5375	T	5475	VX	4575	V	4575	V
Sprain Brook Dunwoodie South	5350	VX	5350	VX	4575	V	4450	V
Long Island Import	1950	T	2675	T	1950	T	2475	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.
- Transfer limits for all-lines-in condition.
- 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. Description of the Short Circuit Base Case

The NYISO 2018 Statewide Short Circuit representation dated May 23, 2013, Revision 1, is used for this study. The short circuit representation includes the modeling assumptions discussed in Section 1.2 and the Class Year 2011 projects identified in the 2013 Load and Capacity Data [9]. Inclusion of Class Year 2011 projects provides a more conservative system representation in evaluating the circuit breaker interrupting capability. These units include Taylor Biomass, Berrians GT and GT II, Arkwright Summit Wind Farm, CPV Valley Energy Center, and Cricket Valley Energy Center.

3.2. Methodology

The short circuit levels for the fault current assessment are calculated using the ASPEN OneLiner® program and the NYISO guideline for Fault Current Assessment [14]. 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 are obtained from the applicable transmission and generation owners. The ratings are 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 this analysis. Transmission Owners may take into account the effects of these advanced circuit breaker techniques in the ratings that are provided.

3.3. Results

The fault current assessment identified overdutied circuit breakers at the National Grid Porter 115 kV and 230 kV substations as well as the Con Edison Astoria West 138 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.

Mitigation plans to resolve the overdutied breakers are as follows:

Porter 115 kV:

National Grid has a plan to replace all the Porter 115 kV circuit breakers, which is currently in progess with a scheduled completion by Winter 2014/2015.

Porter 230 kV:

National Grid has a plan to add microprocessor relays at the Porter 230 kV substation, which is scheduled for completion by Spring 2014.

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). G1N and G2N will be replaced in order to accommodate the interconnection of the Q201 Berrians GT project. The timing of the replacements will be dependent on the Berrians project schedule.

Table 3.3.1 2013 ATR Over-Duty Circuit Breaker Summary

Substation	**kV**	**Number of Over-Duty Circuit Breakers**	**Breaker ID**
Porter	115	10	R130, R10, R20, R30, R40, R50, R60, R70, R80, R90
Porter	230	9	R110,R120,R15, R170, R25, R320, R835, R825, R845
Astoria West	138	2	G1N, G2N

4. Extreme Contingency Assessment

4.1. Methodology

Analysis of the NYCA extreme contingencies (NERC Category D) is performed using the Siemens PTI PSS®E and PSS®MUST software package. Each contingency is simulated to evaluate the New York State BPTF transient stability, voltage, and thermal response consistent with NPCC Design Criteria [2] and NYSRC Reliability Rules [3].

4.1.1. Pre-Contingency Power Flow Base Case

Extreme contingencies are considered very low probability events; therefore, they are not tested on the coincident summer peak case used for normal contingency testing. Instead, a power flow case is developed starting from the coincident summer peak base case and reducing the NYCA load to approximately 80% of the coincident summer peak value. The generation dispatch of the NYCA system is modified so that transfer levels on the NYCA intra-Area interfaces were at or above the 75th percentile of expected transfer levels and less than 100% of the normal transfer limit (Section 2.3).

For the 2013 Intermediate ATR, the values for the 75th percentile of expected transfer level is obtained by using actual flow values during the time period August 1, 2012 through August 1, 2013, from Markets and Operations Power Grid Data for Interface Limits and Flows. For the Dysinger East and West Central Interface, the historic 75th percentile transfer level is greater than the calculated 2018 normal transfer limit. For the extreme contingency assessment, the interface flow on the Dysinger East and West Central Interfaces is modeled to be less than the normal transfer limit (Table 2.3.2). The calculated Dysinger East and West Central Interface flow is less than the historical flow over the previous year due to system modifications (such as the mothball of Dunkirk) and study modeling assumptions discussed in Section 2 of this report.

4.1.2. Dynamics Simulation

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 simulation is first initialized to the pre-contingency power flow conditions and then run to 0.1 seconds before altering the system configuration. For no-fault contingencies, this is a simple case of removing an element from service. In the case of a contingency that includes a fault, several events change the system in sequence to match breaker actions. All simulations assume that generators with an angle separation greater than 300 degrees from the rest of system will trip during post-contingency transient system conditions. After inspecting the simulation plots and dynamic simulation log files for each contingency, a determination is made whether or not the system remains stable after the event.

4.1.3. Post-Contingency Power Flow Analysis

Power flow simulations are performed via Siemens PTI PSS®MUST software package to determine voltage impacts and line overloads with the new (post-contingency) system configuration. This procedure requires that each element taken out of service in the dynamics simulation be taken out of service for the post-contingency power flow.

4.2. Extreme Contingency Analysis

Extreme contingencies for NYCA are developed for conformance to NERC Reliability Standards (TPL-004-0a) [1], NPCC Directory #1 (Section 5.6) [2], and the NYSRC Reliability Rules (Requirement B-R4) [3]. For this study, a total of 55 extreme contingencies applicable to NERC Category D and NPCC and NYSRC extreme contingencies 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 fuel delivery system (i.e. gas pipeline contingencies) are evaluated. Most of the contingencies simulated were stable and showed no thermal overloads over the STE rating or significant voltage violations or deviations on the BPTF. Some contingencies showed voltage violations, significant voltage drops, and/or thermal overloads on the underlying 115/138 kV sub-transmission system, but these conditions were 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 generators. In all of the evaluated cases and conditions tested, the affected area is confined to the NYCA system. Details of the extreme contingency power flow analysis are provided in Appendix K. The stability plots are included in Appendix L. The details of the results are classified as Critical Energy Infrastructure Information and therefore are not discussed in the body of this report.

In September 2013, LAI expanded on the 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. Details of the LAI report are provided in Appendix O.

Eight potential gas-side contingencies are discussed in the LAI study, two of which were related to either New York City or Long Island. New York City and Long Island are required by the NYSRC Local Reliability Rules I-R3 and I-R5 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.

4.3. Extreme Contingency Summary

The purpose of extreme contingency assessment is “to obtain an indication of system strength, or to determine the extent of a 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 the previous reviews. This indicates that the strength of the planned interconnected power systems is not expected to deteriorate in the near future.

5. Review of Extreme System Condition Assessment

NPCC Directory #1 [2] and NYSRC Reliability Rules [3] require assessment of extreme system conditions, which have a low probability of occurrence, such as summer extreme weather (90/10) load conditions or loss of major gas supply.

5.1. Extreme Weather Condition Assessment

N-1-1 and stability analysis was also performed for summer extreme weather (90/10) load conditions. Table 5.1.1 provides a comparison 50/50 and 90/10 forecast of 2018 coincident summer peak load [9]. The thermal overloads identified in the baseline analysis were aggravated by the additional load, and the following are new thermal/voltage violations in three areas of the BPTF for which sufficient corrective actions could not be identified: National Grid Niagara – Packard – Huntley 230 kV (Zone A)(Figure 5.1.1 #1); NYSEG Oakdale 345/115 kV (Zone C)(Figure 5.1.1 #2); and National Grid Leeds – Pleasant Valley 345 kV corridor (Zones F & G)(Figure 5.1.1 #3).

The 230 kV system between Niagara and Gardenville includes two parallel 230 kV transmission lines from Niagara to Packard to Huntley to Gardenville, including a number of taps to serve load in the Buffalo area. Loading on these two 230 kV lines would be between 103% and 110% of LTE ratings for various N-1-1 contingencies under extreme weather conditions. These overloads are due to increased load in the Buffalo area and aggravated by both the mothball of Dunkirk generation and a new load serving substation (Four Mile Junction) just within the PJM Area. Solutions for this situation could include adding additional 230 kV or 345 kV transmission lines down this same transmission corridor. Other solutions could include generation, transmission, and/or demand-side management in the Western New York area.

The Oakdale 345/230/115 kV substation serves the Binghamton area. Under extreme weather conditions, loading on both 345/115 kV transformers at Oakdale would be between 103% and 107% of LTE ratings for N-1-1 contingencies involving stuck breakers at Oakdale. These overloads are due to load in the Binghamton area. Also, there would be voltage violations for N-1-1 loss of 345 kV sources into the area. Solutions for this could include adding transformers in the Oakdale area. Other solutions could include generation, transmission, and/or demand-side management in the Binghamton and Elmira areas.

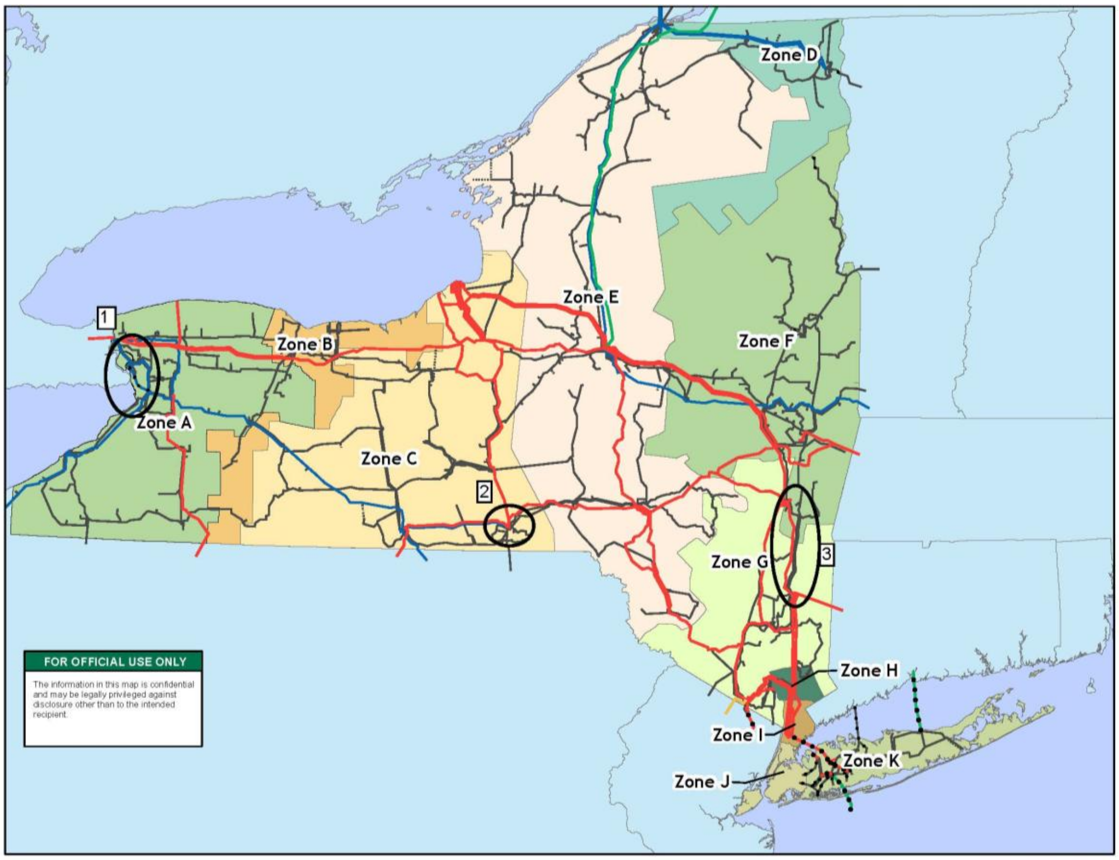
The Leeds – Pleasant Valley 345 kV corridor includes two 345 kV lines from north to south: Leeds-Pleasant Valley 345 kV and Leeds-Athens-Pleasant Valley 345 kV. Under extreme weather conditions, each of these lines would be loaded at 119% of LTE ratings for two combinations of N-1-1 contingencies. These overloads are due to load growth and a reduction in generation in the Lower Hudson Valley and New York City areas. Solutions for this could include upgrades on Leeds – Pleasant Valley facilities or adding transmission facilities in the Marcy-South corridor, such as those proposed in the New York Public Service Commission AC Transmission proceedings. Other solutions could include generation, transmission, and/or demand-side management in Southeast New York.

No stability issues are noted with the analysis. The stability plots are reported in Appendix M.

Table 5.1.1 2018 50/50 and 90/10 Coincident Summer Peak Load Delta by Zone (MW)

Zone	A	B	C	D	E	F	G	H	I	J	K	NYCA
50/50	2,693	2,139	2,993	815	1,458	2,456	2,388	725	1,507	12,266	5,663	35,103
90/10	2,914	2,314	3,238	882	1,578	2,657	2,584	776	1,612	12,879	6,286	37,721
Delta	221	175	245	67	120	201	196	51	105	613	623	2618

Figure 5.1.1 Extreme Weather Condition Thermal/Voltage Violations



5.2. **Loss of Gas Supply Assessment**

Natural gas-fired generation in NYCA is supplied by various networks of major gas pipelines (Appendix O). NYCA generation capacity has a balance of fuel mix which provides operational flexibility and reliability. Several generation plants have duel fuel capability. Figure 5.2.1 presents the NYCA fuel mix presented in the NYISO 2013 Load and Capacity Data [9]. As indicated in Figure 5.2.1, 8% of the generating capacity is fueled by natural gas only, 47% by oil and natural gas, and the remaining is fueled by oil, coal, nuclear, hydro, wind, and other.

The loss of gas supply assessment is performed using the winter 2018 50/50 forecast of the coincident peak load. The power flow base case is developed by assuming all gas only units and dual fuel units that do not have a current license to operate with the alternative fuel are not available due to a gas supply shortage. The total reduction in generating capacity is 4,251 MW;

however, only 2,777 MW had to be redispatched due to the modeling assumptions in the base case. Table 5.2.1 provides a summary of the winter peak load and total capacity with all units in-service and assuming a loss of gas supply.

Table 5.2.1 Loss of Gas Supply Winter Peak Load and Capacity

	Intermediate Review: 2013 Forecast for Winter 2018 (MW)
Peak Load	25,219
Loss of Gas Supply Capacity	4,251
Total Remaining Capacity	39,059 (1)

Notes:

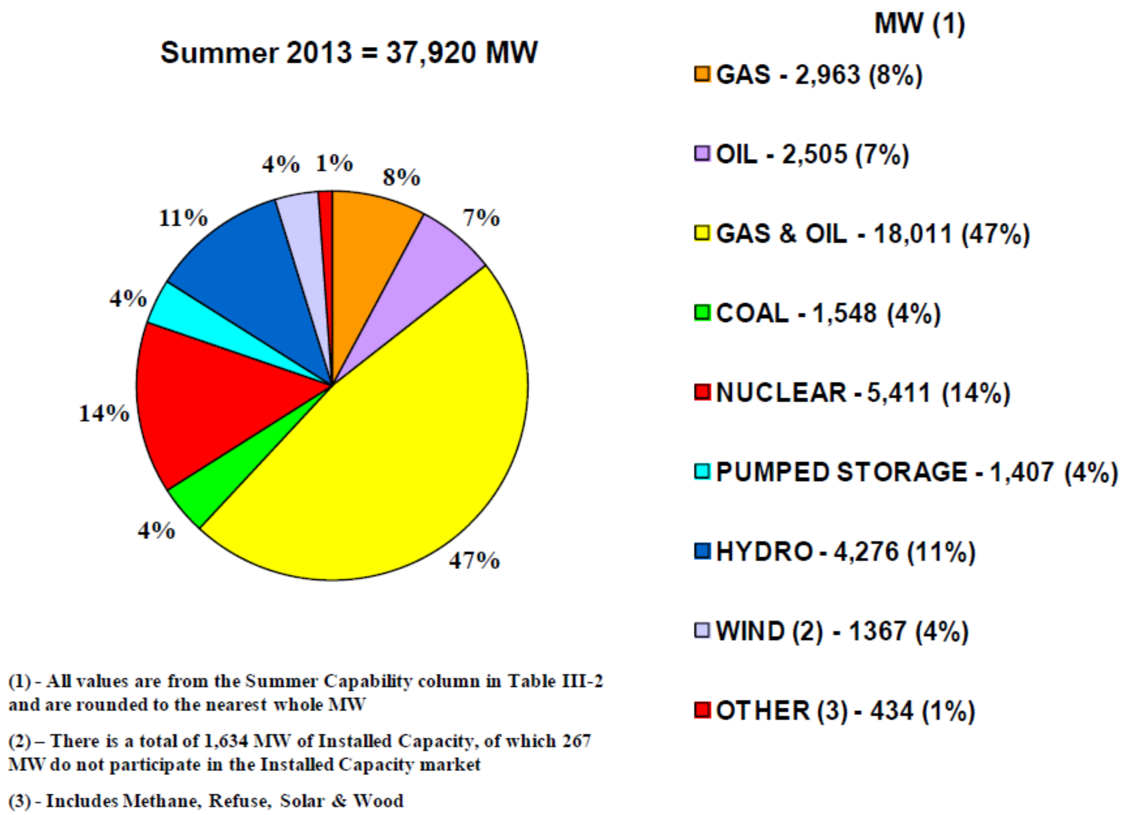
1. This is derived from the NYISO 2013 Load and Capacity Data. It's the 2018 Total Resource Capability (42462.5 MW), from Table V-2b in the NYISO 2013 Load and Capacity Data, plus net resource changes (847.7) from Tables IV-1, IV-2, and IV-3 in the NYISO 2013 Load and Capacity Data. Only the proposed generator additions that have completed the class year facilities study are included from Table IV-1. Wind generation capacity is based on 100% of the nameplate rating.

The N-1-1 violations observed under the summer peak conditions (Section 2.6 of this report) are also identified for this extreme system condition.

The only stability issue noted was an undamped response to a single-line to ground stuck breaker fault at Marcy on the Marcy – Volney 345kV line. Possible mitigation would be to balance the VAr flow from each plant at the Oswego complex or redispatching the Oswego complex. The stability plots are reported in Appendix M.

New York City and Long Island are required by the NYSRC Local Reliability Rules I-R3 and I-R5 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. Recent loss of gas/minimum oil burn (LOG-MOB) studies indicated compliance with the current rules.

Figure 5.2.1 2013 NYCA Generation Capability by Fuel Type



6. Review of Special Protection Systems

New York has not added nor changed any Type 1 SPS nor planned any new Type 1 SPS since the 2010 CATR. System conditions have not changed sufficiently to impact the operation or classification of existing SPS.

7. Review of Dynamic Control Systems

System conditions have not changed sufficiently to impact the operation or classification of previously reviewed dynamic control systems since the 2010 CATR.

8. Review of Exclusions from NPCC Basic Criteria

NPCC Directory #1 [2] 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 [3] that are not addressed in other sections of this report. Previous sections in this report have addressed NYSRC Reliability Rules B-R1 (Section 2.3), B-R2 (Section 2.4), B-R3 (Section 2.5), B-R4 (Section 4), B-R6 (Appendix N), B-R7 (Section 3), and K-R3 (Section 5).

9.1. System Restoration Assessment B-R5

NYSRC Reliability Rule B-R5 [3] requires the NYISO to evaluate the impacts of system expansion plans on the NYCA System Restoration Plan. The following planned transmission system expansions may impact the NYCA System Restoration Plan:

- The Rochester Gas & Electric (RG&E) Rochester Transmission Reinforcement (Q#330) 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.
- The Stony Creek 230 kV Substation (Q#263) is a planned wind-farm point of interconnection located in Wyoming County approximately 3 miles west of the Wethersfield Substation on the NYSEG Stolle Rd. – Meyer 230 kV transmission line.
- The Goethals 345 kV Substation upgrade is a modification of the existing facility.
- The NYSEG Watercure 345/230 kV transformer is an addition to the existing Watercure facility.
- The NYSEG Fraser 345/115 kV transformer is an addition to the existing Fraser facility.
- The NYSEG Gardenville 230/115 kV transformer is an addition to the existing Gardenville facility.
- The NYSEG South Perry Substation is a planned 345/115 kV substation located approximately 10 miles from the Wethersfield substation on the NYSEG Stolle Rd. – Meyer 230 kV transmission line.
- The Orange & Rockland (O&R) North Rockland Substation is currently planned to separate Ramapo 345 kV and Buchanan 345 kV on the Y94 line.

The potential impacts 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 I-R1 through I-R5

The NYSRC has adopted Local Reliability Rules that apply to the 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. At the beginning of every year, before conducting its annual studies, the NYISO requests information from the local Transmission Owners on changes in local system conditions that would impact the New York State BPS. The base case 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 model used in the assessments:

I-R1 Operating Reserves/Unit Commitment, I-R2 Locational Reserves (New York City)

Local Operating Reserve rules are considered in the development of the base cases used for all reliability assessments.

I-R3 Loss of Generator Gas Supply (New York City), I-R5 Loss of Generator Gas Supply (Long Island)

Specific loss of generator gas supply studies are performed by Con Edison and LIPA and reviewed by the NYISO. The planned system is expected to be compatible with local rules regarding loss of generator gas supply.

I-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 will be evaluated before proposed facilities are in-service.

10. Overview Summary of System Performance

Eight assessments are made for the 2013 Intermediate ATR. In the first and second assessments, power flow and stability analyses are conducted to evaluate the thermal, voltage and stability performance of the New York State BPTF for normal (or design) contingencies as defined in the NERC Reliability Rules, NPCC Transmission Design Criteria, and the NYSRC Reliability Rules. As part of the first assessment, power flow analyses are conducted to evaluate the performance of the New York State BPTF for N-1-1 contingencies. Thermal and voltage performance is evaluated under peak load and high transfer conditions; additionally, stability performance is evaluated using transfers that exceed the normal limits. Overall, the system performance based on transfer limit and stability analysis is acceptable. Corrective actions are identified for each first contingency (N-1) such that there were no post-contingency thermal and voltage violations following any second contingencies (N-1-1). In performing the N-1 and N-1-1 evaluations, the National Grid Porter 115 kV station, Porter-Kelsey 115 kV (line 3), Clay – Lockheed Martin 115 kV (line 14), and the Orange and Rockland new North Rockland 345/138 kV substation transformer require mitigation plans. For those facilities that are new, the mitigation plans will be in-place before the facilities are placed in-service. For existing facilities, Corrective Action Plans are in-place to mitigate the issue. 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, NPCC Transmission Design Criteria, and NYSRC Reliability Rules.

The third assessment evaluates the fault duty at each bus in the short-circuit representation. The analysis indicates that three BPTF buses may experience over-dutied breakers for the conditions tested. The applicable owners are responsible for making the necessary facility upgrades as part of their internal planning processes.

In the fourth assessment, power flow and stability analyses are conducted to evaluate the performance of the Bulk Power System for low probability extreme contingencies as defined in the NPCC Directory #1 and NYSRC Reliability Rules. The stability analysis results indicate that the interconnected power system is stable for the extreme contingencies tested and for the system conditions tested. The power flow analysis results indicate, in all cases, that the extreme contingencies do not cause significant thermal or voltage problems over a widespread area for the system conditions tested. 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. Overall, the extreme contingency system conditions are comparable to the previous CATR and no serious consequences are identified.

The fifth assessment evaluated the extreme system conditions, which have a low probability of occurrence (e.g., loss of major gas supply and high load conditions resulting from extreme weather). Beyond the N-1-1 violations found in the summer peak case, no significant thermal or voltage issues are found on the BPTF for the tested loss of major gas supply condition; however, there is one stability contingency with an undamped response. There are thermal and voltage issues found on the BPTF for the tested high load conditions; however, there are no stability issues.

The sixth assessment is a review of Special Protection Systems (SPS). New York has not added nor changed any Type 1 SPS nor planned any new Type 1 SPS since the 2010 CATR. System conditions have not changed sufficiently to impact the operation or classification of existing SPS.

The seventh assessment is a review of the Dynamic Control Systems (DCS). System conditions have not changed sufficiently to impact the operation or classification of previously reviewed DCS since the 2010 CATR.

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

11. Conclusion

The analysis in the 2013 Intermediate ATR indicates that the New York State Bulk Power Transmission Facilities, as planned (including Corrective Action Plans) through the year 2018, conform to the reliability criteria described in the NYSRC Reliability Rules, NPCC Directory #1 "Design and Operation of the Bulk Power System", and applicable NERC Reliability Standards. There are facilities that need mitigation plans to meet the performance requirements. For those facilities that are already in-service, mitigation plans have been developed as described in sections 2.6.2 and 2.6.3. For those facilities that are planned to be in-service in the future, mitigation will be in-place before the facilities are in-service. With these mitigation actions in place, the Intermediate ATR confirms that no additional upgrades are necessary to meet the performance requirements of the NYSRC Reliability Rules, NPCC Directory #1, or NERC TPL Reliability Standard Categories A, B, and C of Table I.

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3. New York State Reliability Council, “NYSRC Reliability Rules for Planning and Operating the New York State Power System”, Version 32, dated January 11, 2013.

4. New York Independent System Operator, “Transmission Expansion and Interconnection Manual”, Attachment F: NYISO Transmission Planning Guideline #1-1 – Guideline for System Reliability Impact Studies Section 2.4.2 Impact on System Performance and Transfer Limits, Version 2.0, dated November 18, 2012.

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15. New York Independent System Operator, “Methodology for Assessment of Transfer Capability in the Near-Term Transmission Planning Horizon”, dated May 20, 2013.

16. New York Independent System Operator, “2012 Interim Area Transmission Review of the New York State Bulk Power Transmission System”, Final Report, dated September 12, 2012.

17. National Grid’s Local Transmission Plan (LTP), dated October 11, 2013.