



2009 Intermediate Area Transmission Review
Of the New York State Bulk Power Transmission System
(Study Year 2014)

FINAL REPORT

February 8, 2010

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I. Executive Summary

This report comprises the second intermediate Area Transmission Review (ATR) submitted by the New York Independent System Operator (NYISO) since the 2005 Comprehensive ATR that was completed in May 2006. In 2008 an intermediate level ATR was performed by the NYISO. An Interim level ATR was submitted for 2007.

The 2009 review is based on the 2009 Reliability Needs Assessment (RNA) and the 2009 Comprehensive Reliability Plan (CRP) updated with the NYISO 2009 Load and Capacity Data. . The 2009 Load and Capacity Data load forecast used in the power system base case model incorporates approximately 30% of the New York Public Service Commission's (NYSPSC) Energy Efficiency Portfolio Standard Order (EEPS), the impact of energy efficiency initiatives in New York State. This level represents the initial programs the NYSPSC has approved to implement its jurisdictional portion of the Governor's initiative to lower demand on the electric system by 15% of the 2007 forecasted consumption levels by 2015.

Changes in this review as compared to the 2008 intermediate ATR include a 416 MW reduction in load forecast and an increase of approximately 725 MW in capacity resources. The capacity resources include 1,937 MW of Special Case Resources. Special Case Resources are demand side resources that provide an effective reduction in the system load, and are subject to testing and performance requirements comparable to generation resources. The updated Local Transmission Plans were incorporated into the ATR base case. A list of changes to the transmission system is shown in Table 1.2.1. The NYISO conducts this review in accordance with the applicable Northeast Power Coordinating Council (NPCC) Basic Criteria, NPCC Area Transmission Review Guidelines, and New York State Reliability Council (NYSRC) Reliability Rules. Five assessments are made to complete the intermediate review, and are discussed below. Overall, the results are comparable to the previous intermediate review.

In the first assessment, power flow and stability analyses were conducted to evaluate the thermal, voltage and stability performance of the New York State Bulk Power Transmission System ("NYSBPS") for normal (or design) contingencies as defined in the NPCC and the New York State Reliability Council ("NYSRC") reliability criteria and rules. The NYSBPS, as defined in this review, includes all of the facilities designated by the NYISO to be part of the NPCC bulk power system.

In the second assessment, power flow and stability analysis were conducted to evaluate the performance of the bulk power system for extreme contingencies as defined in the NPCC "Basic Criteria for Design and Operation of Interconnected Power Systems" ("NPCC Basic Criteria"). The stability analysis results indicate that the interconnected power systems would be stable for the extreme contingencies tested and for the system conditions tested. The power flow analysis results indicate that, in most cases, extreme contingencies would not cause significant thermal or voltage problems over a widespread area for the 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 most of these cases the affected area would be confined to the NYISO system.

The third assessment evaluated the fault duty at all buses in the short-circuit representation. The analysis performed identified four additional stations from the previous ATR, where breakers were over-duty for the conditions tested. Operating procedures are in place, however, that maintain system operations within existing breaker ratings. The New York Transmission Owners (“TOs”) are responsible for making the necessary facility upgrades as part of their internal planning processes.

The fourth assessment was a review of Special Protection Systems (“SPS”). There are no proposed additional Type I SPS, and system conditions in the vicinity of existing SPS have not changed significantly since the previous review. No further analysis of SPS in New York was conducted in this review. The Athens SPS (Type III) is assumed to no longer be in service starting January 2011. The operation of the SPS associated with the Empire generating facility was included in the analyses. The PV-20 cross-trip type III SPS was considered to be out of service in the analyses for this review.

The fifth assessment was a review of Dynamic Control Systems (“DCS”). Since the previous comprehensive review, there have been no proposed changes or additions to DCS in the New York Control Area (NYCA). The expected year 2014 system conditions in the vicinity of existing DCS facilities in NYCA have also not changed significantly. Therefore, the NYISO conducted no further DCS analysis in this review.

An assessment of issues specific to the NYSRC Reliability Rules is included in Section 11 of this report. The topics covered in Section 11 include: System Restoration Assessment B-R5, N-1-1 Assessment, Local Rules Consideration I-R1 through I-R5, Extreme Contingency Assessment for Loss of Gas Delivery, and Extreme System Condition Assessment K-R3.

The main conclusion of this review is that the NYSBPS, as planned through the year 2014, is in conformance with the NPCC Basic Criteria and the reliability criteria described in the NYSRC Reliability Rules.

1. Introduction

1.1. Background

The New York Independent System Operator (NYISO) is required to conduct an annual assessment of the reliability of the planned New York State Bulk Power Transmission System (NYSBPS), in accordance with established Northeast Power Coordinating Council (NPCC), New York State Reliability Council (NYSRC), and NYISO's own criteria, rules, and procedures. This report sets forth the NYISO 2009 Intermediate Area Transmission Review (ATR) and summarizes the results of the assessment for the planned year 2014 system.

NPCC, a regional council of the North American Electric Reliability Council (NERC), has established the "Basic Criteria for Design and Operation of Interconnected Power Systems" [1] ("NPCC Basic Criteria"). 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, which is an assessment of the reliability of the planned bulk power transmission system within the Area in a future year. The process and requirements for this assessment are outlined in the "Guidelines for NPCC Area Transmission Reviews" [2].

In addition to the NPCC Basic Criteria, the NYSRC has established rules for planning and operating the NYSBPS ("NYSRC Reliability Rules") [3]. The NYSRC Reliability Rules are consistent with, but in certain cases are more specific or stringent than, the NPCC Basic Criteria. NYSRC also has a compliance monitoring program, and NYISO provides its ATR to the NYSRC in accordance with that program.

The Guidelines for NPCC Area Transmission Reviews require each Area to conduct a Comprehensive level ATR at least every five years and either an Interim level or an Intermediate level ATR in each of the years between comprehensive reviews, as appropriate. This assessment was conducted in accordance with the requirements for an Intermediate level review, as described in the Guidelines.

The most recent comprehensive review of NYSBPS was presented by NYISO staff in May 2006 and covered the year 2010 [4]. One interim ATR was conducted in 2007 covering the year 2012. An intermediate ATR was conducted in 2008 covering the year 2013. This intermediate review focuses on year 2014, and includes updates to the forecast of system conditions.

1.2. Facilities Included in this Review

The system representation used in this transmission review was developed from the NPCC 2008 Base Case Development ("BCD") library. The representation for the NYCA is

based on the NYISO 2009 FERC 715 filing with transmission system and load changes made to the NYCA system. The representations reflect the conditions reported in the NYISO 2009 Load and Capacity Data [5].

The NYSBPS, as defined in the NYSRC Reliability Rules, primarily consists of 4,039 miles of 765, 345 and 230 kV transmission and is supplemented by about 6,750 miles of 138 and 115 kV transmission, a small portion of which is considered to be part of the NYSBPS. A 500 kV tie-line connects the Branchburg station in the PJM Interconnection (PJM) to the Ramapo station in Southeastern New York. Also included in NYSBPS are a number of large generating units that are generally 300 MW or larger. The NYSBPS, as defined in this review, includes all of the facilities designated by the NYISO to be part of the NPCC bulk power system. A list of NYSBPS facilities and one-line diagrams are presented in Appendix B.

This review is based on the 2009 Reliability Needs Assessment [6] (RNA) and the 2009 Comprehensive Reliability Plan [7] (CRP) updated with the NYISO 2009 Load and Capacity Data, and may include proposed transmission and generation projects throughout the period of the review that have met two milestone requirements. The first milestone is the approval by the NYISO Operating Committee of a System Reliability Impact Study (SRIS) for generation projects or System Impact Study (SIS) for transmission projects. The second milestone is demonstration of satisfactory progress in the regulatory process. The 2009 Load and Capacity Data, and the base cases for this ATR take into account the New York Public Service Commission's (NYSPSC) Energy Efficiency Portfolio Standard Order (EEPS). The NYISO currently estimates that 30% of the EEPS will be achieved as a result of the initial steps the NYSPSC has taken to implement its jurisdictional portion of the Governor's initiative to lower demands on the electric system by 15% of the 2007 forecasted levels by the year 2015.

The transmission plans shown on Table 1.2.1 reflect changes since the most recent Comprehensive ATR. The changes involve facilities associated with project cancellations. There has been no additional bulk power projects proposed for the NYCA beyond those in the 2009 Load and Capacity Data. Proposed major generation projects are listed in Table 1.2.2.

1.2.1. Interface Definitions

The Linden Variable-Frequency Transformer (VFT) Intertie Project between CoGen Tech and Linden creates a new controllable tie line between New Jersey and New York City. This tie line changes the interface definition of NY-PJM, PJM-NY, and Total East interfaces. The schedule on the Linden VFT is 300 MW towards NY.

1.2.2. Scheduled Transfers

Table 1.2.3 provides a list of the NYISO inter-Area Scheduled Transfers modeled in the base case.

1.2.3. Load and Capacity

Table 1.2.4 provides a comparison of the 2013 load and capacity forecast used in the last intermediate review to the current 2014 forecast used in this review. The peak load forecast for the 2014 summer in that report is 34,309 MW and the corresponding installed capacity is 41,374 MW. Including the Special Case Resources (SCR) of 1,937 MW, the reserve margin would be 26.2%. This is well above the installed reserve margin of 18% recently approved by the NYSRC for the 2010-2011 capability period.

Table 1.2.1 Changes in Bulk Power Transmission Facilities

	Most recent Comprehensive ATR: 2005 Forecast for Summer 2010	2008 ATR: Forecast for Summer 2013	2009 ATR: Forecast for Summer 2014
Bulk Transmission:	Status	Status	Status
Controllable AC Transmission Linden VFT Line (Q#125)	N	Y	Y / In-Service
Spagnoli Rd 138 kV Substation	Y	N	N
Calpine Wawayanda 345 kV Substation	Y	Canceled	Canceled
Bowline 3 345 kV Cable	Y	Canceled	Canceled
Besicorp (aka Empire Generating) 345 kV Substation	Y	Y	Y
PSEG Cross Hudson 345 kV Cable	Y	Canceled	Canceled
Atlantic Energy Neptune PJM-LI DC	Y	Y / In-Service	Y / In-Service
Liberty 230 kV Substation and 345 kV Goethals Substation Upgrade	Y	Canceled	Canceled
Con Ed: Sherman Creek 345 kV Substation (M29)	Y	Y	Y
O&R 345/138 kV Lovett transformer	N	N	Y
Millwood Shunt Capacitor Banks (240 MVar)	N	Y	Y / In-Service

Table 1.2.2 Changes in Generation Facilities

Generation Resources				
	Size	Most recent Comprehensive ATR: 2005 Forecast for Summer 2010	2008 ATR: Forecast for Summer 2013	2009 ATR: Forecast for Summer 2014
Installations		Included in Total Capacity	Included in Total Capacity	Included in Total Capacity
NYPA Poletti Project (Asotoria CC1 & CC2)	500	Y	Y / In-Service	Y / In-Service
Con Ed East River Re-powering	288	Y	Y / In-Service	Y / In-Service
Entergy IP 2 Uprate	36	Y	Y / In-Service	Y / In-Service
Entergy IP 3 Uprate	38	Y	Y / In-Service	Y / In-Service
NYC Energy LLC (Kent Ave) GTs	79.9	Y	N	N
KeySpan Spagnoli Road CC Unit	250	Y	N	N
Calpine Wawayanda	500	Y	N / Withdrew	N / Withdrew
Reliant Re-powering Phases 1 & 2	1092	Y	N / Withdrew	N / Withdrew
Mirant Bowline Point 3	750	Y	N / Withdrew	N / Withdrew
SCS Astoria East Energy (Phase 1) CC Units	1000	Y	Y / In-Service	Y / In-Service
SCS Astoria East Energy (Phase 2) CC Units		Y	N, 500	Y, 500
Fortistar LMA Lockport II	79.9	Y	N	N / Withdrew
Besicorp Empire State Newsprint CC (Empire Generating)	660	N	Y	Y
Fortistar VP	79.9	Y	N	N / Withdrew
Fortistar VAN	79.9	Y	N	N / Withdrew
PSEG Cross Hudson Project	550		N	N / Withdrew
Calpine JFK Expansion	45	Y	N	N / Withdrew
AE Neptune PJM-LI DC Line	660	Y	Y / In-Service	Y / In-Service
Liberty Radial Interconnection to NYC	400	Y	N, Withdrew	N, Withdrew
NYPA Gilboa Uprate	120	N	Y	Y
Windfarm Prattsburgh Wind Park	75	Y	N	N
Noble Env. Power Chautauqua Winds	50	Y	N	N

Ecogen LLC Prattsburg Winds	79.5	Y	N	N
Constellation Ginna Uprate	95	Y	Y / In-Service	Y / In-Service
Caithness Long Island CC	310	N	Y	Y / In-Service
Wethersfield Windfield (Q177)	126	N	Y	Y / In-Service
Clinton II Windfield (Q211)	21	N	Y	Y / In-Service
Bliss II Windfield (Q212)	28.5	N	Y	Y / In-Service
Canandaigua II Wind (Q199)	42.5	N	Y	Y / In-Service
Ellenberg II Windfield (Q213)	21	N	Y	Y
Chateauguay Windpark (Q214)	106.5	N	Y	Y / In-Service
High Sheldon Windfarm (Q144)	129	N	Y	Y / In-Service

Retirements				
		Most recent Comprehensive ATR: 2005 Forecast for Summer 2010	2008 ITR: Forecast for Summer 2013	2009 ITR: Forecast for Summer 2014
Facility	Capacity (MW)	Included in Total Capacity	Included in Total Capacity	Included in Total Capacity
Onondaga Cogen	78	Y	N / Retired	N / Retired
Greenidge 3	54	Y	Y	N
Westover 7	43	Y	Y	N
Astoria 2, 3	536	N	Y	Y

Table 1.2.3 NYCA Scheduled Transfers

Region		Transaction
From	To	
NYCA	NE	-245 MW
NYCA	HQ	-1200 MW
NYCA	PJM	-1763 MW
NYCA	IESO	0 MW
NYCA	Other	110 MW

Table 1.2.4 Load and Capacity Schedule

	Comprehensive Review: 2005 Forecast for Summer 2010	Intermediate Review: 2008 Forecast for Summer 2013	Intermediate Review: 2009 Forecast for Summer 2014	Change
Peak Load (MW)	34,200	34,725	34,309	-416
Total Capacity (MW)	43,632	42,586	43,311	725
Reserve Margin	27.6%	22.4%	26.2	3.8%

2. Study Results Demonstrating Conformance

2.1. Study Methodology

The analysis for this review was conducted in accordance with NYSRC Reliability Rules. Specific guidelines for voltage and stability analysis are found in NYISO Transmission Planning Guidelines #2-0 [8] and #3-0 [9] respectively. These two NYISO guidelines are Attachments E and F of the NYISO Transmission Expansion and Interconnection Manual [10]. These guidelines conform to NPCC Basic Criteria, NPCC Guidelines for NPCC Area Transmission Reviews, and NYSRC Reliability Rules. The NYISO guidelines provide additional details regarding NYISO methodology for evaluating the performance of the NYSBPS.

The procedure used to evaluate the performance of NYSBPS 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 2014); (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 NYSBPS as modeled meets NYSRC Reliability Rules and NPCC Basic Criteria for thermal, voltage and stability performance. In practice, steps (2) and (3) are interwoven while conducting a study and the detailed procedures can differ for the various types of analyses conducted. The details regarding the representation, base cases, analysis procedures, and results are discussed in the sections that follow.

2.2. Description of Base Cases

The base cases used in evaluating NYSBPS performance were developed from NPCC Base Case Development (BCD) libraries. Most of the relevant system representations were taken from the year 2014 cases in the 2008 BCD library. The PJM system representation was derived from the PJM Regional Transmission Expansion Plan (RTEP) planning process. The NYCA representation was taken from the NYISO 2009 FERC 715 filing. Changes were made to the NYCA system to reflect the most recent updates.

The base case was developed as described above. Two summer peak stability margin transfer cases were then created from the base case. In the margin cases, the transfer levels of the interfaces in western and southeastern New York are at least 11.1% higher than the lower of either the emergency thermal or the voltage constrained transfer limits.

The extreme contingency base case was developed from the summer peak base case by reducing the load to approximately 80% and adjusting the transfer levels to approximately the 75th percentile of the expected maximum transfer levels. Diagrams and descriptions of the base cases utilized in criteria testing can be found in Appendix D.

Generation resources in the base cases were dispatched similarly to the previous 2008 intermediate ATR analysis. Base cases were dispatched with generation balanced to provide for equal participation of all aggregated generators in the generation shift to calculate the transfer limits.

2.3. Thermal Analysis

2.3.1. Methodology

Thermal transfer limit analysis was performed using the Siemens PTI PSS[®] MUST program utilizing the Linear FCITC Calculation activity. All NYCA tie lines with the neighboring systems were monitored as appropriate. A listing of NYCA intra-Area and inter-Area interface definitions including those evaluated in this study is presented in Appendix E.

The contingencies examined include the individual opening of all lines connected between buses with base voltage between 100 kV and 765 kV and all appropriate common structure, stuck breaker, generator, multiple element, and DC contingencies. 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 general direction of generation shifts is from the north and west to Southeastern New York. No attempt was made to find the maximum thermal limit based on an ideal shift pattern.

Approximately nine hundred contingencies were evaluated including single element, double-circuit tower and breaker failure contingencies. All contingencies studied are in accordance with the NPCC Basic Criteria and the NYSRC Reliability Rules.

2.3.2. Analysis Results

Tables 2.3.2, 2.3.3 and 2.3.4 provide summaries for the normal and emergency thermal transfer limits determined for the NYCA intra-Area and inter-Area transmission interfaces. Additional details regarding the thermal analysis results are provided in Appendix F.

Thermal transfer analysis was not conducted for inter-Area interfaces of New York because anticipated system conditions affecting these interfaces in the year 2014 have not changed significantly since the last comprehensive review.

The analysis was performed with the following assumptions:

Table 2.3.1 Schedules on Controllable Devices

Location	Schedule	Direction
Ramapo PAR 1	500 MW	Toward NY
Ramapo PAR 2	500 MW	Toward NY
St. Lawrence PARs	0 MW	
Sandbar PAR	117 MW	Toward VT
Farragut PAR 1	333 MW	Toward NY
Farragut PAR 2	333 MW	Toward NY
Goethals PAR	334 MW	Toward NY
Linden VFT	300 MW	Toward NY
Neptune HVdc	660 MW	Toward NY
Cross-Sound Cable dc	330 MW	Toward NY
Chateauguay HVdc	350 MW	Toward NY

Table 2.3.2 Normal Transfer Criteria Intra-Area Thermal Transfer Limits

Interface	2005 Comprehensive Review (Study Year 2010)	2008 Intermediate Review (Study Year 2013)	2009 Intermediate Review (Study Year 2014)
Dysinger East	2869 (1)	3002 (1)	2861 (15)
West Central	1328 (1)	1757 (1)	1679 (15)
Volney East	4042 (2)	3659 (2)	3879 (2)
Moses South	1566 (3)	2342 (11)	2331 (11)
Central East	2870 (4)	2538 (4)	2778 (4)
Total East	5451 (4)	5880 (4)	6120 (2)
UPNY-SENY	4575 (5)	5446 (5)	5330 (5)
UPNY-ConEd	5222 (6)	5810 (12)	5694 (12)
Millwood South	8820 (7)	10191 (7)	10282 (17)
Sprain Brook Dunwoodie-South	4846 (8)(A)	5382 (13)	5265 (16)
Long Island Import	2065 (9)	2056 (14)	2056 (14)

Notes:

1. **Niagara-Rochester 345** at 1501 MW LTE rating for loss of Somerset-Rochester 345
 2. **Fraser-Coopers Corners 345** at 1404 MW LTE rating for loss of Porter-Rotterdam 230 and Marcy-Coopers Corners 345
 3. **Adirondack-Porter 230** at 353 MW LTE rating for loss of Edic-Porter 345/230 and Flat Rock-Porter 230
 4. **New Scotland 77-Leeds 345** at 1538 MW LTE for loss of New Scotland 99-Leeds 345
 5. **Leeds-Pleasant Valley 345** at 1538 MW LTE rating for loss of Athens-Pleasant Valley 345
 6. **Rock Tavern-Ramapo 345** at 1890 MW LTE rating for loss of Roseton-Fishkill 345 and Rock Tavern-Sugarloaf 115
 7. **East View 3-Sprain Brook 345** at 2214 MW LTE rating for loss of Millwood-East View 2-Sprain Brook 345, East View 2-East View 345/138, Millwood-East View 4-Sprain Brook 345, and East View 4-East View 345/138
 8. **Mott Haven-Rainey 345** at 1081 MW STE rating for loss of South Bronx-Rainey 345
 9. **Sprain Brook-E.G.C. 345** at 948 MW LTE rating for loss of Dunwoodie-Shore Rd 345
 10. **Dunwoodie-Mott Haven 345** at 715 MW at normal rating for pre-contingency loading
 11. **Moses-Adirondack 230** at 359 MW LTE for loss of Chateauguay-Massena-Marcy 765
 12. **Rock Tavern-Ramapo 345** at 1990 MW LTE rating for loss of Roseton-Fishkill 345 and Fishkill 345/115
 13. **Dunwoodie-Mott Haven 345** at 851 MW LTE for loss of Dunwoodie-Mott Haven 345
 14. **Dunwoodie-Shore Rd. 345** at 962 MW LTE for loss of Sprain Brook-E.G.C. 345 and Sprain Brook-Dunwoodie No. 345/138
 15. **Wethersfield-Meyer 230** at 494 MW LTE for loss of Niagara-Rochester 345 and Rochester-Pannell 345
 16. **Mott Haven-Rainey 345** at 851 for loss of Mott Haven-Rainey 345
 17. **Buchanan N-Eastview 345** at 1990 MW for loss of Tower W97/W98
- A. Sherman Creek, Parkchester, Dunwoodie No., and Dunwoodie So. PARs are scheduled at 300, 250, 120 and 120 MW, respectively, to NYC.

Table 2.3.3 Emergency Transfer Criteria Intra-Area Thermal Transfer Limits

Interface	2005 Comprehensive Review (Study Year 2010)	2008 Intermediate Review (Study Year 2013)	2009 Intermediate Review (Study Year 2014)
Dysinger East	3181 (1)	3075 (10)	2943 (10)
West Central	1631 (1)	1825 (10)	1763 (10)
Volney East	4887 (2)	4375 (2)	4640 (2)
Moses South	2049 (3)	2675 (11)	2639 (3)
Central East	3180 (4)	3055 (4)	3091 (4)
Total East	6077 (4)	6901 (4)	6890 (2)
UPNY-SENY	5217 (5)	6150 (5)	6049 (5)
UPNY-ConEd	6234 (6)	6675 (12)	6692 (6)
Millwood South	9537 (7)	13071 (7)	12352 (7)
Sprain Brook Dunwoodie-South	4846 (8)(A)	5725 (13)	5743 (13)
Long Island Import	2121 (9)	2110 (9)	2117 (9)

Notes:

1. **Niagara-Rochester 345** at 1685 MW STE rating for loss of Somerset-Rochester 345
 2. **Fraser-Coopers Corners 345** at 1207 MW Normal rating for pre-contingency loading
 3. **Marcy 765/345** at 1971 MW STE rating for loss of Marcy 765/345
 4. **New Scotland 77- Leeds 345** at 1724 MW STE for loss of New Scotland 99-Leeds
 5. **Leeds-Pleasant Valley 345** at 1724 MW STE rating for loss of Athens-Pleasant Valley 345
 6. **Roseton-Fishkill 345** at 1935 MW Normal rating for pre-contingency loading
 7. **Buchanan South-Millwood 345** at 1902 MW STE rating for loss of Buchanan S.-Millwood 345
 8. **Mott Haven-Rainey 345** at 1081 MW STE rating for loss of Mott Haven-Rainey 345
 9. **Dunwoodie-Shore Road 345** at 679 MW Normal rating for pre-contingency loading
 10. **Wethersfield-Meyer 230** at 430 MW Normal rating for pre-contingency loading
 11. **Moses-Adirondack 230** at 440 MW STE for loss of Chateaugay-Massena-Marcy 765
 12. **Rock Tavern-Ramapo 345** at 2283 MW STE rating for loss of Roseton-Fishkill 345
 13. **Dunwoodie-Mott Haven 345** at 783 MW Normal rating for pre-contingency loading
- A. Sherman Creek, Parkchester, Dunwoodie No., and Dunwoodie So. PARs are scheduled at 300, 250, 120 and 120 MW, respectively, to NYC.

Table 2.3.4 Inter-Area Thermal Transfer Limits

Interface	2005 Comprehensive Review (Study Year 2010)	
	Normal Transfer (MW)	Emergency Transfer (MW)
New York – New England	1265 (1)	1758 (2)
New England – New York	2248 (3)	2486 (4)
New York - Ontario	1364 (5)	1558 (6)
Ontario – New York	1377 (7)	1777 (8)
New York – PJM (A)	2382 (9)	2382 (9)
PJM - New York (B)	3039 (10)	3413 (11)

Notes:

1. **Long Mountain-Pleasant Valley 345** at 1386 MW LTE rating for loss of Southington-Haddam 345 and Millstone-Haddam 345
 2. **Long Mountain-Pleasant Valley 345** at 1195 MW Normal rating for pre-contingency loading
 3. **Norwalk Harbor 138-Norwalk Harbor 115** at 402 MW LTE rating for loss of Fishkill-Pleasant Valley 345, Long Mountain -Pleasant Valley 345
 4. **Norwalk Harbor 138-Norwalk Harbor 115** at 449 MW STE rating for loss of Long Mountain - Pleasant Valley 345
 5. **Niagara-PA27 230** at 460 MW LTE rating for loss of Niagara 345-Niagara2E 230 and Niagara-Beck B 345
 6. **Niagara-PA27 230** at 400 MW Normal rating for pre-contingency loading
 7. **Niagara-Rochester 345** at 1501 MW LTE rating for loss of Somerset-Rochester 345
 8. **Niagara-Rochester 345** at 1685 MW STE rating for loss of Somerset -Rochester 345
 9. **S Ripley-Erie South 230** at 499 MW Normal rating for pre-contingency loading
 10. **Hillside-E. Towanda 230** at 531 MW LTE rating for loss of Homer City-Watercure 345 and E. Sayre-N. Waverly 115
 11. **Homer City-Watercure 345** at 755 MW Normal rating for pre-contingency loading
- A. Ramapo PAR set to 1000 MW toward PJM and Neptune PJM-LI HVDC is out of service.
 B. Ramapo PAR set to 1000 MW toward New York.

2.4. Voltage Analysis

2.4.1. Methodology

The voltage analysis was conducted using the Siemens PTI PSS[®]E (Rev. 30) software package in conjunction with the NYISO Voltage Contingency Analysis Procedure (VCAP). The VCAP is used to evaluate voltage-based transfer limits in accordance with the NYISO Transmission Planning Guideline #2-0, and with consideration of the Voltage limit criteria (Exhibit A-3 of NYISO Emergency Operation Manual [11], formerly known as OP-1 criteria), which specifies

minimum and maximum voltage limits at key NYSBPS buses. The required post-contingency voltage is typically within 5% of nominal. A set of power flow cases with increasing transfer levels was created from the 2014 summer peak load base case. The generation shifts that were employed for the VCAP are similar to the ones used for the thermal analysis. These shifts were used to obtain an increase in transfer level across the particular interface being studied. The first part of the shift was similar for all interfaces studied, while unique shifts particular to each interface were employed to complete the shifts within the limitations and condition of the base case. The VCAP program was run on the particular set of transfer cases for an interface to evaluate the system response to that interface's appropriate contingencies.

In this 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.

The reactive power of generators is regulated, within the capabilities of the units, to hold scheduled voltage in both the pre-contingency and post-contingency power flows.

Tap settings of phase angle regulators and autotransformers are adjusted (within their capabilities) to regulate power flow and voltage, respectively, in the pre-contingency power flows, but they 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 they are held at their corresponding pre-contingency position in the post-contingency power flows.

In accordance with NYISO operating practice, Static VAR Compensator (SVC) and Flexible AC Transmission System (FACTS) devices are held at or near zero reactive power output in the pre-contingency power flows, but are allowed to regulate voltage, within their capabilities, in the post-contingency power flows. Inertial pickup is assumed for contingencies involving a loss of generation or HVdc connections to Québec.

As the transfer across an interface is increased, the voltage-constrained transfer limit is determined to be the lesser of: (a) the pre-contingency power flow at which the post-contingency voltage falls below the OP-1 post-contingency limit; or (b) 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) and reaches the point of voltage collapse. This operating point occurs when the reactive capability supporting the power transfer becomes exhausted. The region near the "nose of the curve" is generally referred to as the region of "voltage instability". Therefore, the voltage-constrained transfer limit is intended to ensure adequate post-contingency voltage and to avoid operating within this region of voltage instability.

The NYISO uses the above methodology to model a worst case steady-state voltage response based on examination of actual system events. For the New York system, this represents a time frame of approximately 30-60 seconds after the contingency occurs, which

recognizes some automatic response of the system following the contingency, but before system operator actions are initiated.

The voltage-constrained transfer limits for the Dysinger East, West Central, Moses South, Central East, Total East, UPNY-SENY, UPNY-ConEd and Sprain Brook Dunwoodie South transmission interfaces were studied. There was no attempt to calculate the maximum voltage-constrained transfer limit for these interfaces.

2.4.2. Results

The pre-contingency voltage profile and the simulation of the NYSBPS response to contingencies were found to be acceptable.

The increase in the Dysinger East and West Central voltage-constrained transfer limit is mainly due to the incorporation of the projects included in the updated Local Transmission Plans and the reduction in load forecast in the vicinity of the interfaces.

Table 2.4.1 Summary of Voltage-Constrained Transfer Limits

Interface	2005 Comprehensive Review (Study Year 2010)	2008 Intermediate Review (Study Year 2013)	2009 Intermediate Review (Study Year 2014)
Dysinger East	2407	2550	2754
West Central	1113	1425	1603
Central East	3040	3011	3052
UPNY-SENY	4860	6150	6116
UPNY-ConEd	4905	5500	5347
Sprain Brook Dunwoodie-South	4680	5365	5290

2.5. Stability Analysis

2.5.1. Methodology

The NYISO performed the normal and emergency design criteria stability analysis on two summer peak margin cases with the transmission interfaces loaded to the following levels: Dysinger East 3098 MW, West Central 1833 MW and UPNY-SENY 6722 MW. These flows are 11.1% above the more restrictive of the emergency thermal or voltage limit. The stability margin cases have 1,174 MW of import from Hydro Québec that is synchronized to the NY system.

The dynamic data used in this analysis was developed from the 2008 NPCC BCD library. The real power load models used for various Areas were: (1) constant current (power varies with the voltage magnitude) for Hydro Québec, New Brunswick; (2) constant impedance (power varies with the square of the voltage magnitude) for New York and New England; and (3) 50% constant current/50% constant impedance for Ontario and Nova Scotia. Reactive load was modeled as constant impedance for all NPCC Areas.

2.5.2. Results

Table H.1 of Appendix H lists the eighty-one design criteria contingencies that were evaluated and a determination of the overall system response as being stable or unstable. All contingencies were stable and damped.

2.6. Summary

Tables 2.6.1 and 2.6.2 at the end of this section provide a summary of the normal and emergency transfer limits for the transmission interfaces used in NYISO transmission planning studies. The corresponding transfer limits of "open" interfaces used in system operation are also provided for informational purposes only.

Table 2.6.1 Transfer Limit Summary

Interface	Normal Transfer Limit (MW)	Type	Emergency Transfer Limit (MW)	Type
Dysinger East	2750	VX	2750	VX
West Central	1600	VX	1600	VX
Volney East	3875	T	4625	T
Moses South	2325	T	2625	T
Total East	6120	T	6825	S
Central East	2775	T	3050	V
UPNY-SENY	5325	T	6025	T
UPNY-ConEd	5325	VX	5325	VX
Millwood South	10275	T	12350	T
Sprain Brook Dunwoodie South	5250	T	5275	VX
Long Island Import	2050	T	2100	T

Notes:

1. – Transfer Limits expressed in MW, and rounded down to nearest 25 MW point.
2. – Thermal and Voltage Limits Apply under Summer Peak Load Conditions.
3. – Emergency Limits account for more restrictive voltage collapse limit.
4. – Limits for All-Lines-In Condition.
5. – Limits determined in this study were not optimized.

Type

Codes:

- T – Thermal
- V – Voltage Post-contingency
- VX – Voltage 95% from collapse point
- S – Stability

Table 2.6.2 Transfer Limit Comparison

Interface	2005 Comprehensive Review (Study Year 2010)				2008 Intermediate Review (Study Year 2013)				2009 Intermediate Review (Study Year 2014)			
	Normal (MW)		Emergency (MW)		Normal (MW)		Emergency (MW)		Normal (MW)		Emergency (MW)	
Dysinger East	2726	VX	2726	VX	2550	VX	2550	VX	2750	VX	2750	VX
West Central	1283	VX	1283	VX	1425	VX	1425	VX	1600	VX	1600	VX
Volney East	4042	T	4089	VX	4075	VX	4075	VX	3875	T	4625	T
Moses South	1566	T	2049	T	2325	T	2675	T	2325	T	2625	T
Total East	5451	T	5541	S	5875	T	6050	S	6120	T	6825	S
Central East	2870	T	2907	S	2525	T	3000	VX	2775	T	3050	V
UPNY-SENY	4575	T	4860	VX	5425	T	6150	VX	5325	T	6025	T
UPNY-ConEd	4582	V	4905	VX	5500	VX	5500	VX	5325	VX	5325	VX
Millwood South	7630	VX	7630	VX	10175	T	13050	T	10275	T	12350	T
Sprain Brook Dunwoodie South	4680	V	4680	V	5350	VX	5350	VX	5250	T	5275	VX
Long Island Import	2065	T	2121	T	2050	T	2100	T	2050	T	2100	T

Notes:

- 1) Thermal and Voltage Limits Apply under Summer Peak Load Conditions.
- 2) Emergency Limits account for more restrictive voltage collapse limit.
- 3) Transfer Limits for All-Lines-In Condition.
- 4) Transfer Limits assume 240 MW for 2005 CATR base scheduled on the Ramapo PAR.
- 5) Limits determined in this study were not optimized.

Type Codes:

- T – Thermal
- V - Voltage Post-contingency
- VX - Voltage 95% from collapse point
- S – Stability

3. Extreme Contingency Assessment

3.1. Methodology

Analysis of the NYCA extreme contingencies was performed using Siemens PTI PSS[®] E software package. Each contingency was simulated to evaluate the NYSBPS transient stability, voltage, and thermal response.

3.1.1. Pre-Contingency Powerflow Base Case

All extreme contingencies start with the same initial conditions. Since extreme contingencies are considered very low probability events, they were not tested on the summer peak case used for normal contingency testing. Instead, a power flow case was developed starting from the summer peak base case and reducing the NYCA load by approximately 20%. The generation dispatch of the NYCA system was modified so that transfer levels on the NYCA intra-Area interfaces were at approximately the 75th percentile of expected maximum transfer levels.

3.1.2. 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 was first initialized to the pre-contingency power flow conditions and then run to 0.1 seconds before altering the system configuration. For the no fault contingencies, this was a simple case of removing an element from service. In the case of a contingency that included a fault, several events change the system in sequence to match breaker actions. All simulations were run for a duration of 15 seconds, and variables were plotted for each contingency. After an inspection of these plots, a determination was made whether or not the system remains stable after the event. The plots are included in Appendix J.

3.1.3. Post-Contingency Powerflow Analysis

A power flow simulation was performed to determine voltage impacts and line overloads with the new (post-contingency) system configuration. This procedure required that each element taken out of service in the dynamics simulation be taken out of service for the post-contingency power flow.

3.2. Extreme Contingency Analysis

Extreme contingencies for NYCA were developed for conformance to NYSRC Reliability Rules and NPCC Basic Criteria as outlined in NPCC document A-2, section 7.0

and reported here as required in NPCC document B-4, section 5.1.3 and the NYSRC Reliability Rules, section B-R4. A total of 33 extreme contingencies including loss of entire substations, loss of entire generation plants, and loss of all circuits along a transmission right-of-way were evaluated. Most of the contingencies simulated were stable and showed no thermal overloads over the STE rating or significant voltage violations or deviations on bulk power facilities. Some contingencies showed voltage violations, significant voltage drops, and/or thermal overloads on the underlying 115/138 kV subtransmission system, but these conditions were local in nature. The analysis indicated that there are wind generators which would trip due to low voltage or frequency generator protection. However, the impact of these trips is local and does not affect the stability performance of the Bulk Power System. Table 3.2.1 summarizes the results of the extreme contingency analysis. Appendices I and J contain the summarized power flow results and the stability plots of selected contingencies, respectively. A few significant contingencies are discussed below.

3.2.1. EC01 Loss of Niagara Ties Between NYCA and Ontario

This contingency is the no-fault loss of the Beck-Niagara 345 kV ties, PA301 and PA302, the Beck-Niagara 230 kV tie PA27 and the Beck-Packard 230 kV tie BP76. The net pre-contingency flow on all of these ties is around 0 MW. Removing these ties shows no significant voltage deviations or thermal overloads, and the system remains stable.

This contingency showed low amplitude undamped oscillations among NYCA and Ontario generators. This is due to the high level of Western New York (WNY) export in this case. These oscillations become less severe after rejecting Niagara generation to reduce the WNY export below 1100 MW.

3.2.2. EC12 Three-Phase Fault at Marcy with delayed clearing

This contingency is the three-phase version of the criteria contingency CE15. A three phase fault occurs at Marcy 345 kV on the Marcy-Volney #19 line (VU-19). A stuck breaker develops at Marcy, requiring backup clearing of the fault by tripping the Edic-Marcy 345 kV UE1-7 line. The effect of this contingency is to leave a three phase fault on Edic/Marcy for 11 cycles, clearing the fault by opening two of the west-east 345 kV paths supplying Central East.

No significant voltage deviations, OP-1 voltage violations, thermal overloads, or instabilities occurred due to this extreme contingency.

3.2.3. EC30 Three-Phase Fault at Moses with delayed clearing

This contingency is the three-phase version of the design criteria contingency MS06. A 3-phase fault occurs at Moses 230 kV on the Moses-Massena MMS-2 line. A stuck

breaker develops at Moses, requiring backup clearing by opening one of the Moses 230/115 kV transformer banks. The effect of this contingency is to leave a three phase fault on the Moses 230 kV bus for 12.5 cycles. This event resulted in the first-swing instability of six Moses-St. Lawrence units (300 MW) and several Beauharnois units (connected radially to NY); however, the remainder of the bulk power system remained stable. No significant voltage deviations or thermal overloads manifested. These results are consistent with the previous intermediate review.

3.2.4. EC10 Loss of Oakdale Substation

The powerflow simulation of the loss of Oakdale substation trips 345, 230, 115 and 34.5 kV buses, and results in numerous low voltage conditions on the 115 and 34.5 kV system. This condition was confined to the local distribution networks served through the Oakdale station. The impact of this extreme contingency was worsened by generation retirements within those networks removing dynamic VAr support from the area. No system stability issues were observed.

3.3. Extreme Contingency Summary

As stated in the NPCC Basic Criteria, 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." In this review, the system response to extreme contingencies was comparable to the previous intermediate review. This indicates that the strength of the planned interconnected power systems is not expected to deteriorate in the near future.

Table 3.2.1 Extreme Contingency Analysis Summary

Extreme Contingency	Stable / Unstable	OP-1 Violations	Facilities (kV) Above 90% STE Loading				
			765	500	345	230	138/115
EC01 – L/O NY-ON TIES AT NIAGARA	S	-	-	-	-	-	-
EC02 - L/O NIAGARA STATION & GENERATION PLANT	S	-	-	-	-	1	-
EC03 - L/O R.O.W. WEST OF ROCHESTER	S	-	-	-	-	-	2
EC04 - L/O ROW EAST OF ROCHESTER	S	-	-	-	-	-	-
EC05 - L/O WATERCURE SUBSTATION	S	-	-	-	-	-	-
EC06 - L/O R.O.W. NORTH OF VOLNEY	S	-	-	-	-	-	-
EC07 - L/O R.O.W. SOUTH OF VOLNEY	S	-	-	-	-	-	-
EC08 - L/O CLAY SUBSTATION	S	-	-	-	-	-	-
EC09 - L/O LAFAYETTE SUBSTATION	S	-	-	-	-	-	-
EC10 - L/O OAKDALE SUBSTATION	S	-	-	-	-	-	5
EC11 - L/O R.O.W. NORTH OF ADIRONDACK	S	-	-	-	-	-	-
EC12 - L/O MARCY-VOLNEY AND MARCY-EDIC	S	-	-	-	-	-	-
EC13 - L/O EDIC SUBSTATION	S	-	-	-	-	-	-
EC14 - L/O R.O.W. SOUTH OF UTICA	S	-	-	-	-	-	1
EC15 - L/O R.O.W. EAST OF UTICA	S	-	-	-	-	-	1
EC16 - L/O FRASER SUBSTATION	S	-	-	-	-	-	-
EC17 - L/O R.O.W. WEST OF ROTTERDAM	S	-	-	-	-	-	2
EC18 - L/O NEW SCOTLAND SUBSTATION	S	-	-	-	-	-	1
EC19 - L/O LEEDS SUBSTATION	S	-	-	-	-	-	6
EC20 - L/O FISHKILL SUBSTATION	S	-	-	-	1	-	-
EC21 - L/O ROSETON SUBSTATION AND GENERATION	S	-	-	-	-	-	-

EC22 - L/O RAMAPO SUBSTATION	S	-	-	-	-	-	1
EC23 - L/O BUCHANAN SUBSTATION	S	-	-	-	-	-	-
EC25 - L/O MILLWOOD SUBSTATION	S	-	-	-	-	-	-
EC26 - L/O R.O.W. SOUTH OF MILLWOOD	S	-	-	-	-	-	-
EC27 - L/O ASTORIA GENERATION	S	-	-	-	-	-	-
EC28 - L/O RAVENSWOOD GENERATION	S	-	-	-	-	-	-
EC29 - L/O NORTHPORT SUBSTATION AND GENERATION	S	-	-	-	-	-	-
EC30 - 3PH/STK @MOSES 230 / MASSENA-MOSES 765/230 MMS-2	S*	-	-	-	-	-	-
EC31 - 3PH/STK @EDIC 345 ON EDIC-FRASER	S	-	-	-	-	-	-
EC32 - 3PH/STK @EDIC 345 ON EDIC-NSCOT, CLR@FITZ345	S	-	-	-	-	-	-
EC33 - 3PH@ ROCHESTER 345KV ON ROCHESTER-PANNELL RP-1	S	-	-	-	-	-	-
EC35 - 3PH/STK@EDIC345KV FITZ-EDIC #FE-1/BKUP CLR@N.SCOT345	S	-	-	-	-	-	-
LOG1 – L/O BETHLEHEM AND BESICORP GENERATION	S	-	-	-	-	-	-

S – Stable

U – Unstable

* six Moses-St. Lawrence units and several Beauharnois units are first-swing unstable

4. Review of Special Protection Systems

Since the previous intermediate review, there have been no proposed changes or additions to Special Protection Systems (SPS) in the NYCA. The expected year 2014 system conditions in the vicinity of existing SPS in NYCA has not changed significantly. Therefore, no further analysis of SPS was conducted in this review. The Athens SPS (Type III) is assumed to no longer be in service starting January 2011.

5. Review of Dynamic Control Systems

Since the previous intermediate review, there have been no proposed changes or additions to Dynamic Control Systems (DCS) in NYCA. The expected year 2014 system conditions in the vicinity of existing DCS in NYCA have also not changed significantly. Therefore, no further analysis of DCS was conducted in this review.

6. Short Circuit Analysis

6.1. Methodology

The analysis performed for the NYISO Class Year 2008 System Facilities Studies was used to assess the fault duty levels on the planned system.

NYISO 2013 Statewide Short Circuit representation, dated April 1, 2008, Revision 1, was used for this study. This representation includes system changes, known as of October 31, 2008. The data was reviewed and updated by the NYCA transmission owners and project developers.

The short circuit analysis was conducted using the ASPEN OneLiner program. The short circuit assessment was performed in accordance with NYISO Guideline for Fault Current Assessment (SC Guideline) [12].

The SC Guideline requires that Key assumptions used under this methodology are as follows:

- a. All generating units are in service,
- b. All transmission lines and transformers are in service,
- c. All series elements (series reactors, series capacitors) are in service except those that are normally out of service,
- d. Ignore load,
- e. Ignore Shunts (shunt capacitors, shunt reactors, line charging, etc.),

- f. Do not ignore delta-wye transformer phase shift,
- g. Do not ignore tap positions of fixed tap transformers,
- h. All generator internal voltages are set at 1.0 PU and no phase displacement due to load (i.e., use Flat Gen voltage profile, which now called as “a linear network solution” voltage profile),
- i. Apply the following faults:
 - i. Three line to Ground,
 - ii. Double line to ground,
 - iii. Single line to ground.

Three phase, two phase to ground, and single line to ground faults were applied at each bus in the short-circuit representation. The highest of these three faults was compared against the respective station lowest circuit breaker rating to determine whether or not the circuit breaker is over-duty.

In many situations, a high substation fault duty does not automatically mean that each circuit breaker rated lower than the substation fault will be over-duty. Only an Individual Breaker Analysis (IBA) can provide a true fault current that a particular breaker will see. NYISO does not have an IBA universal methodology defined; therefore each Transmission Owner uses its own internal methodology. When there is no internal methodology defined, the NYISO used the standard, conservative methodology in which the breaker in question is the last breaker opened to clear the fault regardless of the voltage level.

The lowest circuit breaker ratings shown for each of the selected substations were also obtained from the New York facility owners. The ratings shown 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 were converted to an approximate symmetrical current rating by using the nominal voltage of the substation. Advanced circuit breaker rating techniques (e.g., asymmetrical current analyses, derating for reclosing, and derating for age) were not implemented by the NYISO for this screening analysis; however, some of the breaker interrupting ratings supplied by the transmission owners may include these methodologies.

6.2. Results

Based on the study results, there are four additional stations with over-duty breakers. Table 6.2.1 summarizes over-duty breakers at each station. The applicable

New York TOs are responsible to make the necessary facility upgrades as part of their internal planning processes. Operating procedures are in place that ensure that the system is operated within existing breaker ratings.

Table 6.2.1 Over-duty Breaker Summary (Study Year 2013)

Station	kV	Number of Over-duty Breaker(s)	Breaker ID
NIAGARA	115	13	
ST. LAWRENCE	115	15	
N.GARDENVILLE	115	3	T10-12, T11-12, 90312
SENECA FALLS	34.5	1	56172

Table 6.2.2 Over-duty Breakers reported in the 2008 ATR

Station	kV	Number of Over-duty Breaker(s)	Breaker ID
FITZPATRICK	345	1	10052
PORTER	230	6	R320, R825, R120, R835, R110, R845
PILGRIM	138	1	1410
ASTORIA	138	5	1N, 2N, 8N, 9N, 1S

7. Review of Exclusions from the Basic Criteria

The NPCC Basic Criteria contains a provision that allows a member to request an exclusion from criteria contingencies that are "[s]imultaneous permanent phase to ground faults on different phases of each of two adjacent transmission circuits on a multiple circuit tower, with normal fault clearing." NYISO does not have any such exclusion at this time and, therefore, none were reviewed. Furthermore, NYISO does not anticipate requesting any exclusion in the near future.

8. Review of Extreme System Condition Assessment

As part of NPCC Basic Criteria, each Area is required to assess the extreme system conditions, which have a low probability of occurrence, such as loss of major gas supply and peak load level resulting from extreme weather conditions.

To satisfy the requirement of assessing the peak load condition resulting from the extreme weather conditions, a powerflow case was developed from the summer peak base case with the load increased to meet the extreme weather forecast load.

All normal transfer criteria contingencies were tested on the extreme system condition base case. Thermal and voltage contingency analysis was performed using the Siemens PTI PSS[®] MUST program utilizing the AC Contingency Analysis activity, monitoring all 115 kV and above buses or branches for post-contingency bus voltage limits and LTE thermal ratings. The powerflow analysis results are reported in Appendix K.

New York City and Long Island are required by the NYSRC Local Reliability Rules 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 studies have indicated compliance with these rules.

A review of the nature of the network of gas supplies and fuel diversity in the rest of New York State indicated no significant changes from the previous Comprehensive Review.

9. Overview Summary of System Performance

The five assessments presented in this report are summarized here. In the first assessment, the NYISO conducted power flow and stability analyses to evaluate the thermal, voltage and stability performance of the NYSBPS for normal (or design) contingencies as defined in the NPCC Basic Criteria and NYSRC Reliability Rules. Thermal and voltage performance was evaluated under peak load and high transfer conditions. In addition, stability performance was evaluated on a system that modeled transfers that exceeded the normal limits. Overall, the system performance during transfer limit analysis and the system performance simulated during dynamic stability analysis were acceptable. Local generation tripping was identified, but because these trips were local, they did not affect the stability performance of the NYSBPS.

In the second assessment, the NYISO conducted power flow and stability analyses to evaluate the performance of the bulk power system for extreme contingencies as defined in the NPCC Basic Criteria. The stability analysis results indicate that the interconnected power systems would be stable for the extreme contingencies tested and for the system conditions tested. The power flow analysis results indicate that, in most cases, extreme contingencies would not cause significant thermal or voltage problems over a widespread area for the 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 most of these cases the affected area would be confined to the NYISO system. Overall, the results are comparable to the previous intermediate review.

The third assessment evaluated the fault duty at each bus in the short-circuit representation. The analysis indicates four additional stations where breakers were

over-duty for the conditions tested. The applicable New York TOs are responsible for making the necessary facility upgrades as part of their internal planning processes. Operating procedures are in place that ensure that the system is operated within existing breaker ratings.

The fourth assessment was a review of SPS. As there are no proposed additional SPS within New York, and system conditions in the vicinity of existing SPS have not changed significantly since the previous review, no further analysis of SPS in New York was conducted in this review. The Athens SPS (Type III) is assumed to no longer be in service starting January 2011.

The fifth assessment was a review of DCS. Since the previous intermediate review, there have been no proposed changes or additions to DCS in the NYCA. The expected year 2014 system conditions in the vicinity of existing DCS in the NYCA has also not changed significantly. Therefore, no further analysis of DCS was conducted in this review.

10. Conclusion

The NYISO's analysis in this ATR indicates that the NYSBPS, as planned through the year 2014, conforms to the NPCC "Basic Criteria for Design and Operation of Interconnected Power Systems" and the reliability criteria described in the NYSRC Reliability Rules.

11. Addendum Section

This section addresses NYSRC compliance requirements that are related to the NPCC required ATR but are not specifically addressed in the Intermediate ATR. The most recently completed Comprehensive Reliability Plan has evaluated potential impacts of Regional Greenhouse Gas Initiative (RGGI) and High Electricity Demand Day (HEDD) implementation in addition to the base case reliability assessments.

11.1. System Restoration Assessment B-R5

The NYISO has determined that the system expansion plan shown in this report does not impact the existing NYCA System Restoration Plan (SRP). This determination is based on a review of the updated SRP performed in 2007 and associated NYISO Restoration Diagram Revision 70717 dated February 24, 2009. Proposed facilities that are included in this ATR are not connected to the restoration path shown in the NYISO Restoration Diagram.

11.2. N-1-1 Assessment

N-1-1 contingency analysis was performed for the Intermediate ATR observing critical facility outages, monitored facility limits and testing of all design-criteria contingencies. This analysis was performed by the NYISO and its consultant for nine of the eleven zones comprising the New York Control Area, known as Rest of State (Zones A through I). Transmission security analysis was performed for several critical facility outage conditions that were previously identified. The list of N-1 facilities that were tested is included in Appendix L. N-1-1 analysis for Zones J and K was performed by the local Transmission Owners as part of the Local Transmission Planning Process and the results reported in the Local Transmission Plans.

11.2.1. Methodology

N-1-1 contingency analysis of the NYCA was performed using Siemens PTI Power System Simulator software, PSS[®] E and an automated process developed by PTI for the NYISO. Individual N-1 cases were created by taking a critical facility out-of-service (N-1) from the base case. Using the automated process a set of corrective actions was developed for each N-1 case, such that when additional contingencies were tested on the N-1 case, there were no post-contingency thermal or voltage violations on the bulk power system.

11.2.2. N-1 Powerflow Cases

Starting with the 2014 summer peak load base case, thirty-six N-1 outage cases were created. After the N-1 facility was taken out-of-service the automated process applied corrective action adjustments to the case, if it was necessary, so that the N-1 outage case was within the normal thermal facility ratings and pre-contingency voltage limits. Individual N-1 cases were created for each of the thirty-six N-1 outages in this manner.

11.2.3. N-1-1 Contingency Testing

Contingency analysis was performed on each of the N-1 cases. A second list of contingencies (N-1-1 contingencies) was used for this purpose. The N-1-1 contingency list included the most severe stuck breaker, tower failure, loss of generation and single element contingencies. All N-1-1 contingencies were tested, and if post-contingency thermal or voltage limits were exceeded, the automated process would develop a set of corrective actions to remove them. These corrective actions would then be applied to the N-1 case, and the N-1-1 contingencies tested again. The process would repeat these steps until a set of corrective actions were derived such that there were no post-contingency thermal or voltage violations following any of the N-1-1 contingencies for each of the N-1 outage cases.

11.2.4. Results

After the automated N-1-1 process was performed on the 2014 summer peak load base case, lists of corrective actions were defined for each N-1 facility outage condition, such that there were no post-contingency thermal or voltage violations on the bulk power system, following any N-1-1 contingency. Lists of the N-1 outages and the N-1-1 contingencies that were tested are included in Appendix L.

11.3. Local Rules Consideration I-R1 through I-R5

System conditions have not changed sufficiently to impact the results and modeling assumptions in the 2005 Comprehensive ATR. 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 NYSBPS. Summaries of base case conditions are included in the appendices of this Intermediate ATR, and illustrate the application of the 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 ConEdison 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)

A 345/138 kV transformer was modeled at Lovett 138 kV station tapping the Ramapo – Buchanan North 345 kV circuit. This circuit is part of the set of multiple contingencies that the system is secured to operationally during Thunderstorm Watch conditions. The impact of this network change on the response factors of the system to the affected contingencies is minimal when compared to the previous configuration. The multiple contingency set would need to be modified to replace the Ramapo – Buchanan North 345 kV circuit with the loss of the Ramapo – 345kV Tap - Buchanan North 345 kV circuit in all applicable contingencies.

11.4. Extreme Contingency Assessment for Loss of Gas Delivery

System conditions have not changed sufficiently to impact the results and modeling assumptions in the 2005 Comprehensive ATR regarding this assessment. The NYISO concluded in the Comprehensive ATR that there are no detrimental adverse impacts from loss of gas delivery (major pipeline) to the New York Transmission system. For the 2009 Intermediate ATR an assessment of the natural gas pipeline system was made to determine the most severe impact on generation caused by a pipeline interruption. The simultaneous loss of the Bethlehem and Besicorp plants due to loss of gas delivery is included in the Extreme Contingency analysis.

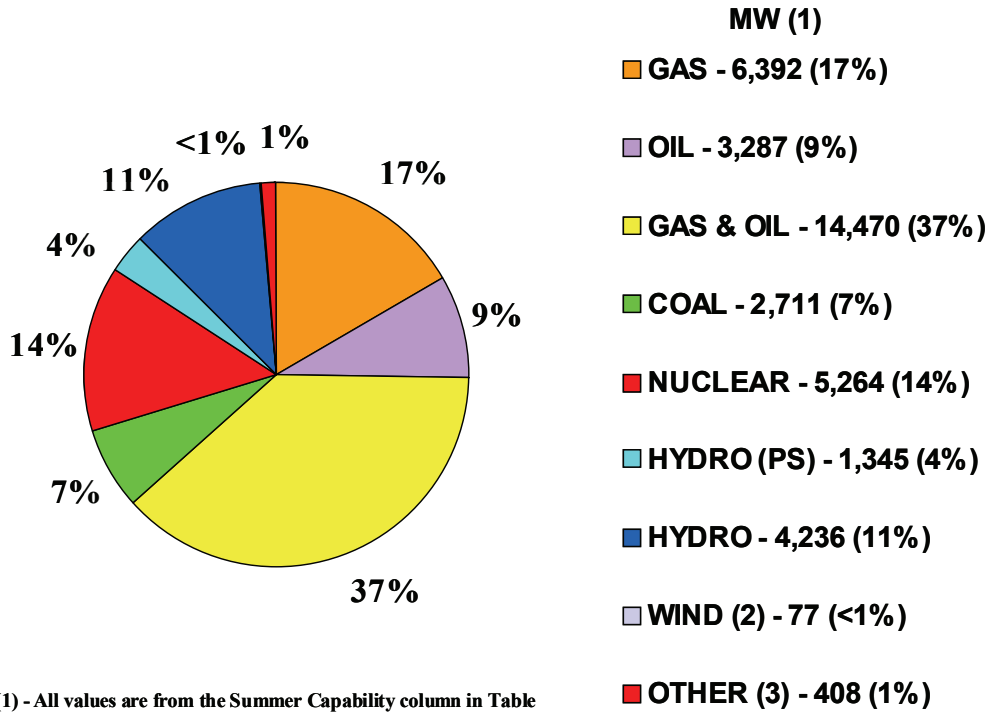
11.5. Extreme System Condition Assessment K-R3

11.5.1. Loss of Fuel Supply

System conditions have not changed sufficiently to impact the results and modeling assumptions in the 2005 Comprehensive ATR regarding this assessment. Recent Loss of Gas/Minimum Oil Burn studies performed by the Transmission Owners and reviewed by the NYISO have confirmed this.

Natural gas-fired generations in NYCA are supplied by various networks of major gas pipelines (e.g., Duke Energy, Columbia Gas Transmission, CNG Transmission, National Fuel Supply, Tennessee Gas Pipeline, and Iroquois Gas Transmission). In addition, NYCA generating capacity has a balance of fuel mix which provides operational flexibility and reliability. Especially, many generation plants have a dual fuel capability. Figure 11.5.1 presents the fuel mix as it existed as of year end 2008. As indicated in Figure 11.5.1, 17% of generating capacity is fueled by natural gas only, 37% of generating capacity is fueled by oil and natural gas, and the rest is fueled by oil, coal, nuclear, hydro and other.

Figure 11.5.1: 2009 NYCA Capacity by Fuel Type



- (1) - All values are from the Summer Capability column in Table III-2 and are rounded to the nearest whole MW.
- (2) - Wind Generators - Summer Rating = 10% of Nameplate
- (3) - Includes Methane, Refuse, Solar & Wood
- (PS) - Pumped Storage

Based on: (1) the nature of network of gas supplies and fuel diversity; and (2) the NYSRC Loss of Generator Gas Supply Reliability Rule that requires the BPS in New York City and Long Island to be operated so that the loss of single gas facility does not result in the loss of electric load, the NYISO determined that loss of a major gas pipeline would not create a detrimental negative adverse impact to the New York BPS. This assessment is also supported by the NYSERDA/NYISO Gas Study (“Ability to Meet Future Gas Demands from Electricity Generation in New York State”, prepared by Charles Rivers Associates for NYSERDA and NYISO) and the Northeast Regional Gas Study (“Multi-Region Assessment of the Adequacy of the Northeast Natural Gas Infrastructure to Serve the Electric Power Generating Section”, [Classified Confidential for Homeland Security], prepared by Levitan & Associates for PJM, ISO-NE, NYISO, NERC and IMO).

11.5.2. Impact of Environmental Regulations on Fuel Adequacy

This section is provided in response to a specific request by the NYSRC Reliability Compliance Monitoring Subcommittee (RCMS) to include an assessment that was performed as part of the NYISO’s Reliability Needs Assessment and the results are excerpted below.

Ozone Transport Commission (OTC)-High Electricity Demand Day (HEDD)

This year the analysis review the impact of the OTC-HEDD emission reductions on targeted units for all high ozone days during the period 2005 to 2007. In addition, potential impacts of the Department of Environmental Conservation (DEC) preliminary proposal to update Oxides of Nitrogen (NO_x) Reasonably Available Control Technology (RACT) standards for all units are also examined.

A review of recent generation and air quality data should aid in the understanding of the nature of possible reduction requirements. According to DEC data, throughout the period of 2005-2007 there have been a total of 49 days when New York's air quality did not meet the existing NAAQS for ozone of 84 ppb. With the new standard of 75 ppb in place, it is reasonable to expect that additional exceedances would have been recorded with the current level of emissions. On these days of high ozone levels, NYCA generation levels varied from a minimum of 387 GWh to a maximum of 679 GWh. According to EPA data, NYCA NO_x emissions varied from a minimum of 93 tons to a maximum of 439 tons. While the data shows a strong correlation between NYCA generation and NYCA NO_x emissions (Figure 11.5.2) the correlation between NYCA NO_x emissions and ambient ozone concentrations is much weaker (Figure 11.5.3). Following this correlation to its limit, we note that operating NYCA in a zero emissions mode (which is not possible) would still find exceedances of the standard. It should be apparent that fossil generation is not the only contributing source to ozone non-attainment and the problem can only be solved on a regional basis from a variety of sources. Thus the first assumption for the analysis is that some form of regulation effectively similar to Clean Air Interstate Rule (CAIR) will be in place by 2012.

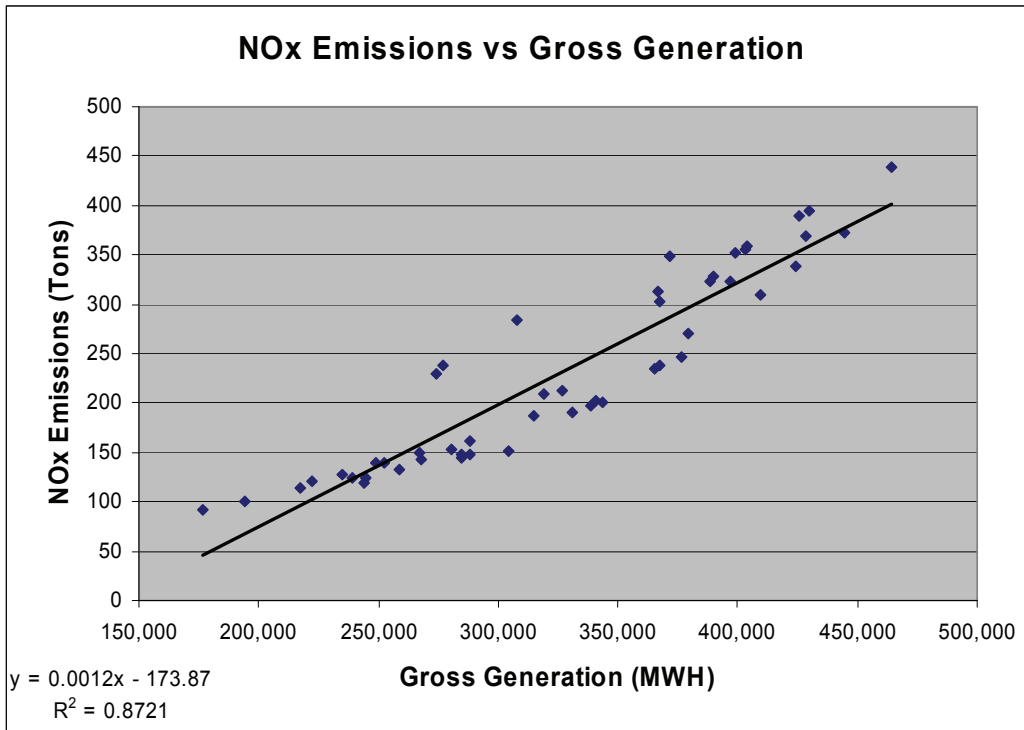


Figure 11.5.2: NOx Emissions vs Gross Generation

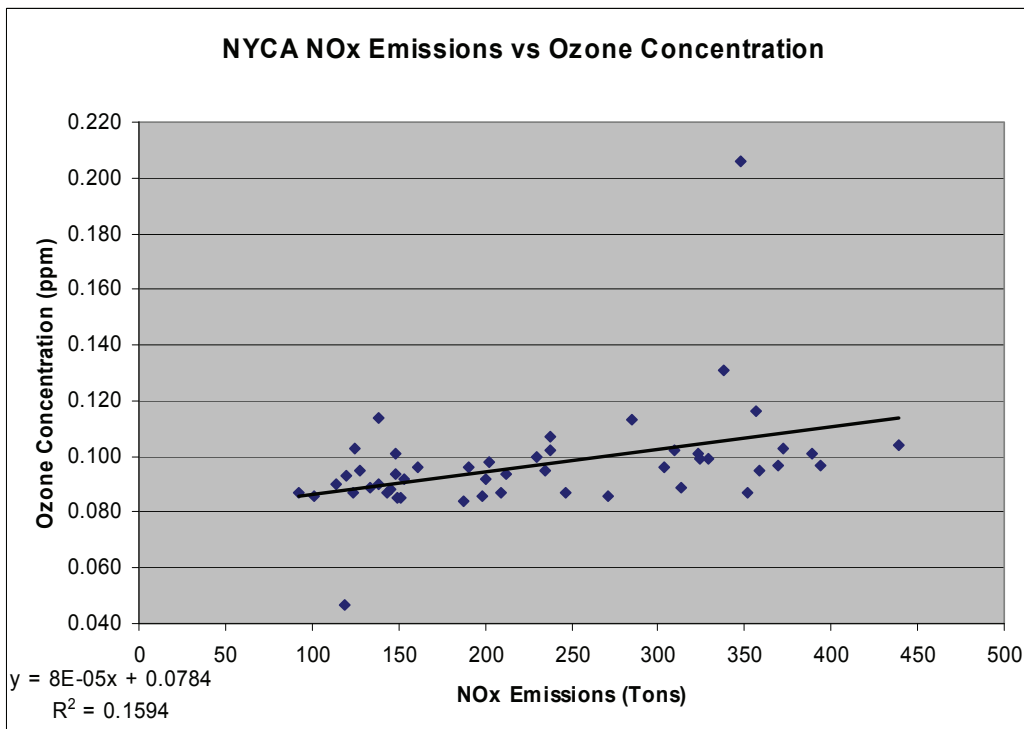


Figure 11.5.3: NYCA NOx Emissions vs Ozone Concentration

The NYISO analyzed the same dataset to determine the potential impact of the OTC HEDD program. The analysis was conducted in two parts, looking first at the High Emitting Combustion Turbines (HECT), and then at the Load Following Boilers (LFB). The complete OTC HEDD analysis is the sum of the two analyses. The HECTs, have provided 2,816 MW of capacity in New York. The NYISO determined that production on high ozone days varies from a minimum of 0.2 GWh to a maximum of 35 GWh. Reported emissions varied from zero to a maximum of 136 tons of NO_x.

The Environmental Energy Alliance (EEA), in speaking for many of the owners of the identified HEDD units, has advised the NYISO that the proposed technology retrofits are not economically feasible. For purposes of the preliminary analysis of the effects of HEDD on BPS reliability, the NYISO assumed a pro rata reduction of Dependable Maximum Net Capability (DMNC) for the Summer Capability Period for units identified by the OTC and DEC as HEDD units based on the targeted reduction for each unit called upon on that day. As a first approximation for the analysis, the following assumptions were made:

The HEDD units will operate for the same number of hours as they did on each of the high ozone days (Scenario 1 and 2).

The HEDD units will operate at a capacity equivalent to its DMNC $\times (1 - (\text{OTC RACT } \%))$ (Scenario 3).

NO_x Emission Rates are assumed to be equal to the reported emission rate. The equivalent capacity reduction required varied from a minimum of zero to a maximum of 1,231 MW, with 610 MW of the derating occurring in load pockets. NO_x emission reductions varied from zero to 28 tons. The results of the analysis are given in Table 11.5.1. This analysis shows a reduction in the magnitude of the Loss of Load Expectation (LOLE) compared to prior analysis, which is a result of the increased use of SCR resources. The analysis shows that these SCR resources will be called upon significantly more than current practice. If, as the owners of these units have indicated, technology retrofits are not economically feasible, programs designed to reduce NO_x emissions from the HECT units will apparently require equivalent capacity replacement to maintain resource adequacy.

A similar analysis is focused on the LFB identified in the OTC HEDD program. The LFBs have provided 4,051 MW of capacity. The equivalent capacity reduction required varied from a minimum of 1,704 MW to a maximum of 1,739 MW, with 165 MW of the derating occurring in load pockets. NO_x emission reductions varied from 10 tons to 75 tons. The results of the analysis are given in Table 11.5.2 and show that resource adequacy criteria will be violated at the end of the planning period. This analysis shows a reduction in the magnitude of the LOLE results compared to last year, due to the increased use of SCR resources. The analysis shows that these SCR resources will be called upon significantly more than current practice.

The use of SCR resources for these three scenarios, together with that in the base case are shown in Figure 11.5.4.

Table 11.5.1 LOLE for RNA Base Case Environmental Retirement Scenario RNA Base Case Load Forecast
Scenario 1: OTC – HEDD HECTs

Area/Year	2010	2011	2012	2013	2014	2015	2016	2017	2018
AREA-A									
AREA-B					0.00		0.00	0.00	0.01
AREA-C									
AREA-D									
AREA-E									
AREA-F									
AREA-G									
AREA-H									
AREA-I	0.01	0.02	0.02	0.03	0.04	0.03	0.04	0.05	0.09
AREA-J	0.02	0.03	0.03	0.03	0.04	0.04	0.05	0.08	0.12
AREA-K		0.00		0.00		0.00		0.00	0.00
NYCA	0.02	0.03	0.03	0.04	0.05	0.05	0.05	0.08	0.12

Table 11.5.2 LOLE for RNA Base Case Environmental Retirement Scenario RNA Base Case Load Forecast
Scenario 2: OTC - HEDD LFBs

Area/Year	2010	2011	2012	2013	2014	2015	2016	2017	2018
AREA-A									
AREA-B					0.00	0.00	0.00	0.00	0.01
AREA-C									
AREA-D									
AREA-E									0.00
AREA-F									
AREA-G	0.00				0.00	0.00	0.00	0.00	0.01
AREA-H									
AREA-I	0.04	0.04	0.04	0.05	0.06	0.05	0.06	0.09	0.13
AREA-J	0.05	0.04	0.04	0.05	0.06	0.06	0.07	0.10	0.15
AREA-K									
NYCA	0.05	0.04	0.04	0.05	0.07	0.06	0.07	0.10	0.15

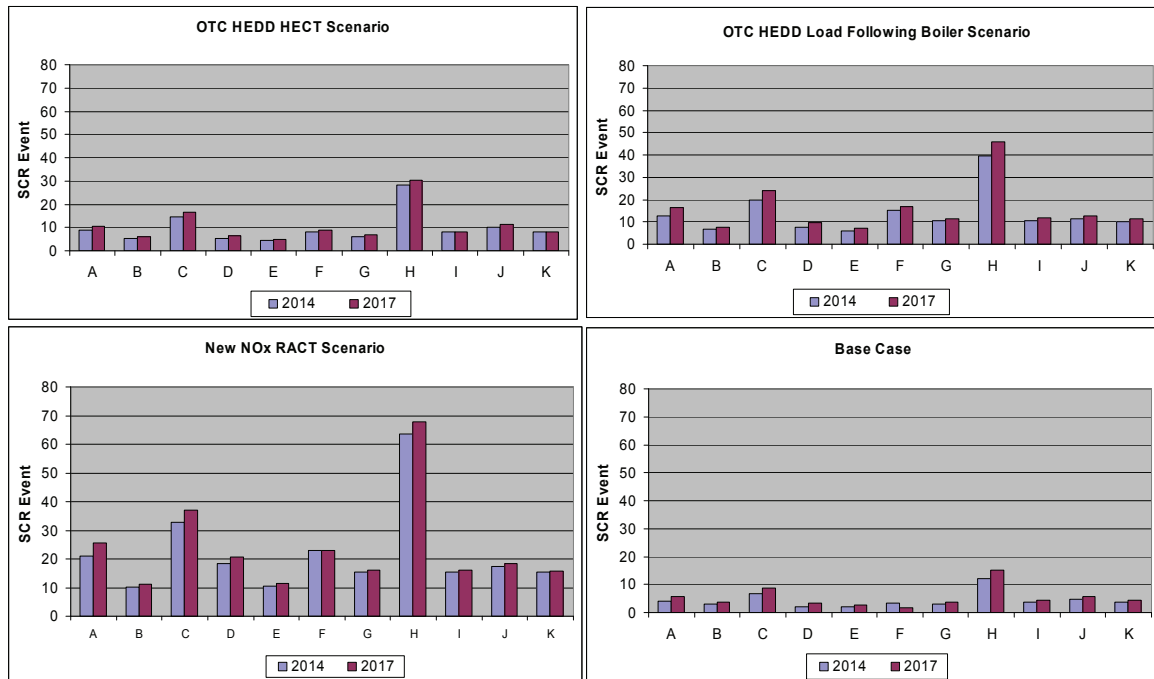


Figure 11.5.4: Uses of SCR in NOx Reduction Scenarios

Several observations can be made based upon the NYISO’s analysis of these scenarios. First, New York’s plan to achieve improvements in air quality will need to be regional in nature because New York cannot achieve the National Ambient Air Quality Standards (NAAQS) by implementing the State Implementation Plan (SIP) without upwind states being part of the solution to improve air quality. Second, although emission technology retrofits can accomplish a great deal, they are not universally applicable. For certain units that are relied upon for peaking capacity to maintain bulk power system reliability, the owners have indicated that emission technology additions are not economic. Accordingly, if retrofits cannot be accomplished, efforts to curb emission from those units on high electric demand days would need to proceed in phases to provide for equivalent capacity replacement in load pockets.

11.5.3. CO₂ or Regional Greenhouse Gas Initiative (“RGGI”)

With respect to RGGI, the NYISO has conducted analyses which demonstrate that if the new RGGI allowance market operates as expected by the State, (i.e., allowance prices remain low and a substantial spread persists between natural gas and coal pricing), power grid reliability will not be negatively impacted in the near term. Assuming today’s coal and gas fuel price spread and any other environmental program compliance costs, higher carbon allowance prices, and certainly prices of \$35 to \$50/ton, would cause the availability of high carbon emitting coal fired capacity to be reduced, placing significant strain on these resources. The level of RGGI allowance cost, fuel price spread, and other environmental program compliance costs have an interrelated and cumulative effect on high carbon emitting units, and thus, reliability.

Therefore, these adverse economic effects on high carbon emitting units could occur with lower carbon allowance prices, or if the coal and gas fuel price spread narrows from the level assumed in the study, or other environmental compliance costs increase.

Previous RNAs examined the impact on resource adequacy of the hypothetical retirement of varying amounts of coal-fired capacity in New York State. It was determined that the LOLE criterion was violated when approximately one half of the coal fired capacity was removed from service. All RGGI-affected generators in New York will require allowances to comply with this program. Several situations can be postulated that can result in an insufficient supply of allowances after accounting for fuel switching, offsets, and efficiency improvements. For example, a loss of a major nuclear unit would translate into a need for an additional 11.4 million tons per year of CO₂ allowances¹. It is also possible that non-RGGI-affected entities could remove significant quantities of allowances from the New York markets for other purposes.

Two issues arise with respect to RGGI that may affect bulk power system reliability in New York. First, the convergence of CO₂ emission allowance prices with world market prices may create carbon emission costs that would render units uneconomic, leading to otherwise unexpected retirements. Second, carbon emission costs could cause coal-fired units to become generators that are on the margin in the energy markets. Coal-fired units have traditionally been operated and offer into the markets as baseload units. This treatment results from the long start-up and shut-down periods for coal-fired units. Should coal-fired units become marginal units, they could be forced to cycle in and out of service. Such circumstances could cause units to endure atypical wear and tear, or to avoid that, make themselves unavailable for operation during peak times when they were formerly at the base of the offer stack. The NYISO will monitor the behavior of coal-fired units in New York to determine if this phenomenon arises, and if it does, will engage its stakeholders on how to address it.

RGGI Program compliance is measured over a three year period with the first compliance period running between 2009 through 2011. If the market price of allowances increases above threshold prices then the compliance period is extended one more year. If the new RGGI Allowance market operates as set forth by the modeling conducted by the State, bulk power system reliability would not be negatively impacted in the near term time period because of the measurement over the three year period. In addition, if a gas pipeline failure were to cause dual fueled plants to switch to oil immediately after the failure, resulting in an increase in emissions of carbon dioxide, and allowances were not available to cover the increased emissions, then some states have provided for the suspension of the RGGI program. New York State Department of Environmental Conservation administers the program in New York. The NYSDEC

¹ This is equivalent to the tons of CO₂ emitted by generators sufficient to replace the annual production of a nuclear power unit – 9,000,000 MWh.

Commissioner has stated in the rule making process, that in such a situation, he would act to maintain electric system reliability.

11.6. Conclusion

Upon review of the system analysis, and the changes in forecasted system conditions and planned facilities in the NYCA since the 2005 Comprehensive ATR and the 2008 Intermediate ATR, the NYISO has determined that the NYSBPS, as planned through 2014, will conform to the NYSRC, NPCC, and NERC planning standards and design criteria effective at the time the study was initiated.

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