2008 Intermediate Area Transmission Review
Of the New York State Bulk Power Transmission System
(Study Year 2013)

DRAFT REPORT

March 12, 2009

Approved at RCMS

Caution and Disclaimer

The contents of these materials are for information purposes and are provided "as is" without representation or warranty of any kind, including without limitation, accuracy, completeness or fitness for any particular purposes. The New York Independent System Operator assumes no responsibility to the reader or any other party for the consequences of any errors or omissions. The NYISO may revise these materials at any time in its sole discretion without notice to the reader.

Table of Contents

1. Introduction **1**
1.1. Background 1
1.2. Facilities Included in this Review 1

2. Study Results Demonstrating Conformance **8**
2.1. Study Methodology 8
2.2. Description of Base Cases 8
2.3. Thermal Analysis 9
2.4. Voltage Analysis 13
2.5. Stability Analysis 17
2.6. N-1-1 Analysis 17
2.7. Summary 19

3. Extreme Contingency Assessment **22**
3.1. Methodology 22
3.2. Extreme Contingency Analysis 22
3.3. Extreme Contingency Summary 24

4. Review of Special Protection Systems **27**

5. Review of Dynamic Control Systems **27**

6. Short Circuit Analysis **27**
6.1. Methodology 27
6.2. Results 28

7. Review of Exclusions from the Basic Criteria **29**

8. Review of Extreme System Condition Assessment **29**

9. Overview Summary of System Performance **30**

10. Conclusion **31**

11. Addendum Section **32**
11.1. System Restoration Assessment 32
11.2. N-1-1 Assessment 32
11.3. Local Rules Consideration 32
11.4. Extreme Contingency Assessment for Loss of Gas Delivery 33
11.5. Extreme System Condition Assessment 33

Table of Tables

Table 1.1 Changes in Bulk Power Transmission Facilities 4
Table 1.2 Changes in Generation Facilities 5
Table 1.3 NYCA Scheduled Transfers 7
Table 1.4 Load and Capacity Schedule 7
Table 2.1(B) Normal Transfer Criteria Intra-Area Thermal Transfer Limits.................................. 11
Table 2.2(B) Emergency Transfer Criteria Intra-Area Thermal Transfer Limits 12
Table 2.3(C) Inter-Area Thermal Transfer Limits 13
Table 2.4.1 Summary Table of Voltage Limits 16
Table 2.5(A) Transfer Limit Summary 20
Table 2.6(A) Transfer Limit Comparison 21
Table 3.2.1 Extreme Contingency Analysis Summary 25
Table 6.1 Over-duty Breaker Summary (Study Year 2013) 29

I. Executive Summary

This report comprises the first annual Intermediate Area Transmission Review(ATR) submitted by the New York Independent System Operator (NYISO) since the 2005 Comprehensive Review that was completed in May 2006. Two interim level ATRs were submitted for the years 2006 and 2007.

This year's review is based on the NYISO 2008 Load and Capacity Data Report and the 2009 Reliability Needs Assessment (RNA). A major update to the load forecast was made in late summer to incorporate the impact of energy efficiency initiatives in New York State that significantly reduced the forecast by over 1,100 MW from that first published in the 2008 Load and Capacity Report. . This represents approximately 30% of the New York Public Service Commission's (NYSPSC) Energy Efficiency Portfolio Standard Order (EEPS), pursuant to which the PSC has taken the initial steps to implement its jurisdictional portion of the Governor's initiative to lower demands on the electric system by 15% of the 2007 forecasted levels for 2015.

Major changes in this review as compared to the 2005 comprehensive review include a 524 MW increase in load forecast, about 3,130 MW reduction in new generation, a total of 2,084 MW of Special Case Resources, three new bulk power substations, and one cancellation of a proposed HVdc tie line between PJM and New York City. Several short transmission lines at voltage levels from 138 to 345 kV will be built to integrate this new generation into the New York transmission grid. A list of these projects is shown in Table 1.1.This review is done in accordance with the applicable NPCC Basic Criteria, NPCC Area Transmission Review Guidelines, and New York State Reliability Council Rules. Five assessments are made to complete the intermediate review and are discussed below.

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 System for normal (or design) contingencies as defined in the NPCC and NYSRC reliability criteria and rules.

In the second assessment, power flow and stability analysis was conducted 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 previous intermediate reviews.

The third assessment evaluated the fault duty at selected substations. The analysis indicates four stations where breakers were over-duty for the conditions tested. However, NYISO is aware of plans to replace most of the over-dutied breakers by summer 2010 and operating procedures in place that ensure that the system is operated within existing breaker ratings until 2010.

As there are no proposed additional Type I SPS or modifications to existing 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.

Since the previous comprehensive review, there have been no proposed changes or additions to Dynamic Control Systems (DCSs) in the New York Control Area (NYCA). The expected year 2013 system conditions in the vicinity of existing DCS in NYCA has also not changed significantly. Therefore, no further analysis of DCSs was conducted in this review.

The main conclusion of this review is that the New York State Bulk Power Transmission System, as planned through the year 2013, is in conformance with the NPCC "Basic Criteria for Design and Operation of Interconnected Power Systems" 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 (NYSBPTS), in accordance with established Northeast Power Coordinating Council (NPCC), New York State Reliability Council (NYSRC), and NYISO criteria, rules, and procedures. This report is the NYISO 2008 Intermediate Area Transmission Review report and summarizes the results of the assessment for the planned year 2013 system.

NPCC, a regional council of the North American Electric Reliability Council (NERC), has established criteria for the design and operation of interconnected power systems (NPCC Basic Criteria) [1]. (A revision of these criteria was approved in August 2004 and is partially addressed in this review.) 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 Area Transmission Review, 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, NYSRC has established rules for planning and operating the New York State Power System (NYSRC Reliability Rules) [3]. The NYSRC Reliability Rules are consistent with, but in certain cases more specific or stringent than the NPCC Basic Criteria. NYSRC also has a compliance monitoring program, and NYISO provides its annual transmission reliability assessment to NYSRC in accordance with that program.

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

The most recent comprehensive review of NYSBPTS was presented by NYISO staff in May 2006 and covered the year 2010 [4]. Since then, one interim review was conducted in 2007 covering the year 2012. This intermediate review focuses on year 2013 with an updated forecast of system conditions.

1.2. Facilities Included in this Review

The system representation used in this transmission review was developed from the NPCC 2007 Base Case Development (BCD) library. The representation for NYCA is based on the NYISO 2008 FERC 715 filing with transmission system and load changes made to the NYCA system. The representations reflect the conditions reported in the NYISO 2008 Load and Capacity Data report [6].

The New York State Bulk Power System (NYSBPS), as defined in 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 bulk power transmission. 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, but not necessarily, 300 MW or larger. NYSBPTS, as defined in this review, consists of the transmission facilities included in the NYSBPS. A list of NYSBPS facilities and one-line diagrams depicting their layout are presented in Appendix B.

This review is based on the NYISO 2008 Load and Capacity Data and the 2009 Reliability Needs Assessment (RNA), and includes 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). The second milestone is demonstration of satisfactory progress in the regulatory process. Details of proposed projects are presented in Appendix B and discussed below. Projects that have met these two milestones by March 1, 2008, and were not considered in the previous review, are referred to as the Class 2007 Projects. The 2009 RNA, and the base cases for this ATR includes approximately 30% of the New York Public Service Commission's (NYSPSC) Energy Efficiency Portfolio Standard Order (EEPS), pursuant to which the PSC has taken the initial steps to implement its jurisdictional portion of the Governor's initiative to lower demands on the electric system by 15% of the 2007 forecasted levels for 2015.

The transmission plans shown on Table 1.1 reflect a few changes since the most recent Comprehensive Area Reviews. The changes involve facilities associated with project cancellations. There has been no additional bulk power projects proposed for the New York Control Area commensurate with the 2008 Gold Book. Proposed major generation projects listed in Table 1.2 at the end of this section.

1.2.1. Interface Definitions

The Linden VFT Intertie Project between CoGenTech 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 flow across this VFT tie line can be scheduled up to 330 MW.

1.2.2. Scheduled Transfers

Table 1.3 provides a list of the NYISO inter-Area Scheduled Transfers modeled in the base case.

Table 1.4 provides a comparison of the 2010 load and capacity forecast used in the last comprehensive review to the current 2013 forecast used in this review. This table was derived from the NYISO 2009 Reliability Needs Assessment (RNA) study. The peak load forecast for the 2013 summer in that report is 34,725 MW and the corresponding installed capacity is 40,502 MW. Based on this, the reserve margin for NYCA is 16.6%. Including proposed Special Case Resources (SCR) additions of 2,084 MWs, the reserve margin would be 22.4%. This is well above the required installed reserve margin of 16.5% recently approved by NYSRC.

Table 1.1 Changes in Bulk Power Transmission Facilities

	Most recent Comprehensive ATR: 2005 Forecast for Summer 2010	2006 ITR: Forecast for Summer 2011	2007 ITR: Forecast for Summer 2012	2008 ITR: Forecast for Summer 2013
	Status /	**Status /**	**Status /**	**Status /**
Bulk Transmission:	**I/S Date**	**I/S Date**	**I/S Date**	**I/S Date**
Plattsburgh IPC	In Service	N	N	N
	In Service	Y		
NM-East Marcy FACTS Project	In Service	Y	In-Service	In-Service
O&R Middletown 345/138 kV Substation	In Service	Y	In Service	In Service
NM-East Athens 345 kV Substation and Athens-Leeds 345 kV Double-Circuit Line(Associated with the Athens Gen Project)	In Service	Y	In Service	In Service
Controlable AC Transmission Linden VFT Line (Q#125)	N	N	N	In-Service
Spagnoli Rd 138 kV Substation	2008-2009	Y	Y	Y
Calpine Wawayanda 345 kV Substation	2008/Q2	N	Canceled	Canceled
Bowline 3 345 kV Cable	2008/Q2	N	Canceled	Canceled
Besicorp Empire State Newsprint 345 kV Substation	2007/Q2	Y	N	Y
PSEG Cross Hudson 345 kV Cable	2008	Y	N	Canceled
Atlantic Energy Neptune PJM-LI DC	2007/Q3	Y	In-Service	In-Service
Liberty 230 kV Substation and 345 kV Goethals Substation Upgrade	2007/05	N	N	Canceled
Flat Rock Wind Power 230 kV Substation	In Service / 2005	Y	Y	Y
Mott Haven 345 kV Substation	2007/S	Y	Y	Y
CONED: Sherman Creek 345 kV Substation (M29)	2007/S	Y	2010	2011

S = Summer, W = Winter

Table 1.2 Changes in Generation Facilities

Generation Resources					
	Size	Most recent Comprehensive ATR: 2005 Forecast for Summer 2010	2006 ITR: Forecast for Summer 2011	2007 ITR: Forecast for Summer 2012	2008 ITR: Forecast for Summer 2013
Installations		Included in Total Capacity	Included in Total Capacity	Included in Total Capacity	Included in Total Capacity
NYPA Poletti Project (Asotoria CC1 & CC2)	500	Y	Y	Y / In-Service	Y / In-Service
ConEd East River Re-powering	288	Y	Y	Y / In-Service	Y / In-Service
Entergy IP 2 Uprate	36	Y	Y	Y	Y
Entergy IP 3 Uprate	38	Y	Y	Y	Y
NYC Energy LLC (Kent Ave) GTs	79.9	Y	Y	N	N
KeySpan Spagnoli Road CC Unit	250	Y	Y	N	N
Calpine Wawayanda	500	Y	N, Withdrew	N, Withdrew	N, Withdrew
Reliant Re-powering Phases 1 & 2	1092	Y	N, Withdrew	N, Withdrew	N, Withdrew
Mirant Bowline Point 3	750	Y	N, Withdrew	N, Withdrew	N, Withdrew
SCS Astoria East Energy (Phase 1) CC Units		Y	Y, 500	Y / In-Service	Y / In-Service
SCS Astoria East Energy (Phase 2) CC Units	1000	Y	N, 500	Y / May 2010	N, 500
Fortistar LMA Lockport II	79.9	Y	Y	N	N
Besicorp Empire State Newsprint CC	660	N	N	N	Y
Fortistar VP	79.9	Y	Y	Y / Q4 2008	Y / Q4 2008
Fortistar VAN	79.9	Y	Y	N	N
PSEG Cross Hudson Project	550		N	N	N
Calpine JFK Expansion	45	Y	N	N	N
AE Neptune PJM-LI DC Line	660	Y	N	Y	Y
Liberty Radial Interconnection to NYC	400	Y	N, Withdrew	N, Withdrew	N, Withdrew
Windfarm Prattsburgh Wind Park	75	Y	N	Y / Nov 2007	Y / Nov 2007
Noble Env. Power Chautauqua Winds	50	Y	N, Withdrew	Y / Q4 2008	Y / Q4 2008
Ecogen LLC Prattsburg Winds	79.5	Y	N	Y / Jun 2008	Y / Jun 2008

Constellation Ginna Uprate	95	Y	Y	Y	Y
Caithness Long Island CC	310	N	N	Y / Q2 2009	Y / Jun 2009
Wethersfield Windfield (Q177)	126	N	N	N	12.6
Clinton II Windfield (Q211)	21	N	N	N	2.1
Bliss II Windfield (Q212)	28.5	N	N	N	2.85
Howard Wind (Q182)	62.5	N	N	N	6.25
Canandaigua II Wind (Q199)	42.5	N	N	N	4.25
Ellenberg II Windfield (Q213)	21	N	N	N	2.1
Chateauguay Windpark (Q214)	106.5	N	N	N	10.65
St. Lawrence Wind Farm (Q166)	130	N	N	N	13
Clayton Wind (Q189)	126	N	N	N	12.6
High Sheldon Windfarm (Q144)	129	N	N	N	12.9
Daisy Hills Wind Farm (Q168)	120	N	N	N	12

Retirements				
	Most recent Comprehensive ATR: 2005 Forecast for Summer 2010	2006 ITR: Forecast for Summer 2011	2007 ITR: Forecast for Summer 2012	2008 ITR: Forecast for Summer 2013
Facility	Most Recent Comprehensive ATR: Existing Capacity (MW)	Included in Total Capacity	Included in Total Capacity	Included in Total Capacity
NRG Huntley 63, 64	61	Y	Y	Y
Waterside 6, 8, 9	167	Y	Y	Y
NRG Huntley 65, 66	167	Y	Y	Y
Mirant Lovett 5	194	Y	Y	Y
RG&E Russell	240	Y	Y	Y
NYPA Poletti 1	855	Y	Y	Y / Feb 2010
Mirant Lovett 3	227	Y	Y	Y
Mirant Lovett 4		Y	Y	Y
Onondaga Cogen	78	N	N	Y
Astoria 2, 3	536	N	N	N

S = Summer, Sp = Spring

Table 1.3 NYCA Scheduled Transfers

Region		Transaction
From	To	
NYCA	NE	-172 MW
NYCA	HQ	-1200 MW
NYCA	PJM	-553 MW
NYCA	IESO	82 MW
NYCA	Other	129 MW

Table 1.4 Load and Capacity Schedule

	Comprehensive Review: 2005 Forecast for Summer 2010	Intermediate Review: 2008 Forecast for Summer 2013	Change
Peak Load (MW)	34,200	34,725	525
Total Capacity (MW)	43,632	42,586	-1,046
Reserve Margin	27.6%	22.4%	-5.2%

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 and are found in NYISO Transmission Planning Guidelines #2-0 [7] and #3-0 [8] respectively. These two NYISO guidelines are Attachments E and F of the NYISO Transmission Expansion and Interconnection Manual [9]. These guidelines conform to NPCC Basic Criteria, Guidelines for NPCC Area Transmission Reviews and NYSRC Reliability Rules. The NYISO guidelines provide additional details regarding NYISO's 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 New York State and external electrical systems for the period of study (in this case, the year 2013), (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 power flow and stability analysis to determine whether or not the transmission system meets NYSRC Reliability Rules and NPCC Basic Criteria for thermal, voltage and stability performance. In actual practice, steps (2) and (3) are interwoven during the conduct of a study, and the detailed procedures 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 NYCA system performance were developed from NPCC Base Case Development (BCD) libraries. Most of the relevant system representations were taken from the year 2013 cases in the 2007 BCD library. The PJM representation was derived from the PJM RTEP process. The NYCA representation was taken from the NYISO 2008 FERC 715 filing. Changes were made to the NYCA system to reflect the most recent updates.

The base case was developed as described above. Summer peak stability margin transfer cases (margin case and West Central margin case) 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% greater than the smaller of the emergency thermal or voltage transfer limits.

The extreme contingency base case was developed from the base case by reducing the load to approximately 80% of the summer peak load and adjusting the transfer levels to approximately the 75^{th} 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 in the base cases were dispatched differently from previous ATR analysis. Base cases were dispatched with balanced generation to provide for equal participation of all aggregated generators in the generation shift to calculate the transfer limits. Appendix J illustrates the methodology used to establishing generation dispatch for the base cases.

2.3. Thermal Analysis

2.3.1. Methodology

Thermal analysis was performed using the PTI PSS®MUST program. All NYCA tie lines with the neighboring systems were monitored as appropriate. A listing of all 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 maintain their scheduled power flow pre-contingency but are fixed at their corresponding pre-contingency angle post-contingency. The general direction of generation shifts is from the North and West to Southeastern New York and New England. When an interface besides the one being studied became limiting, the general shift pattern was modified, within the base case conditions and limitations, to minimize this effect. However, no attempt was made to find the maximum thermal limit based on an ideal shift pattern.

Approximately two thousand contingencies were evaluated. All contingencies studied are in accordance with the NPCC Basic Criteria and the NYSRC Reliability Rules.

2.3.2. Analysis Results

Tables 2.1, 2.2 and 2.3 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.

The other intra-area transfer limits were not evaluated because the system conditions near those interfaces have not changed significantly since the comprehensive review.

Thermal transfer analysis was not conducted for inter-Area interfaces of New York because anticipated system conditions affecting these interfaces in the year 2013 have not changed significantly since the last comprehensive and intermediate reviews.

It is noted that these limits were determined with the following assumptions:

Phase Angle Regulator settings at key locations:

Ramapo PAR (1 & 2)	= 500 MW each to New York
St. Lawrence PAR	= 0 MW
Plattsburgh Tie	= 117 MW to New England
Farragut (1 & 2)	= 333 MW each to New York

Goethals	= 333 MW to New York
Northport	= 100 MW to New York

DC lines modeled in the study

Neptune PJM-LI tie	= 660 MW to Long Island
LIPA/CT Tie at Shoreham	= 330 MW to New York

Table 2.1(B) Normal Transfer Criteria Intra-Area Thermal Transfer Limits

Interface	2005 Comprehensive Review (Study Year 2010)	2008 Intermediate Review (Study Year 2013)
Dysinger East	2869 (1)	3002 (1)
West Central	1328 (1)	1757 (1)
Volney East	4042 (2)	3659 (2)
Moses South	1566 (3)	2342 (11)
Central East	2870 (4)	2538 (4)
Total East	5451 (4)	5880 (4)
UPNY-SENY	4575 (5)	5446 (5)
UPNY-ConEd	5222 (6)	5810 (12)
Millwood South	8820 (7)	10191 (7)
Sprain Brook Dunwoodie-South	4846 (8)(A)	5382 (13)
Long Island Import	2065 (9)	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-Leeds 345** at 1538 MW LTE for loss of New Scotland-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. **South Bronx-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-South Bronx Station 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

A. Sherman Creek, Parkchester, Dunwoodie No., and Dunwoodie So. PARs are scheduled at 300, 250, 120 and 120 MW, respectively, to NYC.

-*- Not evaluated in this review

Table 2.2(B) Emergency Transfer Criteria Intra-Area Thermal Transfer Limits

Interface	2005 Comprehensive Review (Study Year 2010)	2008 Intermediate Review (Study Year 2013)
Dysinger East	3181 (1)	3075 (10)
West Central	1631 (1)	1825 (10)
Volney East	4887 (2)	4375 (2)
Moses South	2049 (3)	2675 (11)
Central East	3180 (4)	3055 (4)
Total East	6077 (4)	6901 (4)
UPNY-SENY	5217 (5)	5150 (5)
UPNY-ConEd	6234 (6)	6675 (12)
Millwood South	9537 (7)	13071 (7)
Sprain Brook Dunwoodie-South	4846 (8)(A)	5725 (13)
Long Island Import	2121 (9)	2110 (9)

Notes:

1. **Niagara-Rochester 345** at 1685 MW STE rating for loss of Somerset-Rochester 345
2. **Coopers Corners-Fraser 345** at 1207 MW Normal rating for pre-contingency loading
3. **Marcy-Marcy 765/345** at 1654 MW STE rating for loss of Marcy-Marcy 765/345
4. **New Scotland 77- Leeds 345** at 1724 MW STE for loss of Leeds-New Scotland 99
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. **Rainey-South Bronx 345** at 1081 MW STE rating for loss of Rainey-South Bronx 345
9. **Dunwoodie-Shore Road 345** at 679 MW Normal rating for pre-contingency loading
10. **Stolle-Meyer 230** at 430 MW Normal rating for pre-contingency loading
11. **Moses-Adirondack 230** at 440 MW STE for loss of Chateauguay-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.

-*- Not evaluated in this review

Table 2.3(C) 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)(A)	2382 (9)(A)
PJM - New York (B)	3039 (10)(B)	3413 (11)(B)

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.
-*- Not evaluated in this review

2.4. Voltage Analysis

2.4.1. Methodology

The voltage analysis was conducted using PTI's PSS®E (Rev. 30) in conjunction with the NYISO Voltage Contingency Analysis Procedure (VCAP). VCAP is used to evaluate voltage-based transfer limits in accordance with the NYISO Transmission Planning Guideline #2-0 [8], 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 2013 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 transfers 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 areas 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 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 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 voltage, within their capabilities, in the post-contingency power flows. Inertial pickup is assumed for contingencies involving a loss of generation or HVdc import.

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 the automatic response of the system following the contingency, but before system operator actions are undertaken.

The voltage-constrained transfer limits for the Dysinger East, West Central, Central East and Sprain Brook Dunwoodie South transmission interfaces were studied:

Voltage analysis was not conducted for other interfaces of New York because anticipated system conditions affecting these interfaces in the year 2013 have not changed significantly since the last comprehensive and intermediate reviews.

2.4.2. Results

The pre-contingency voltage profile of the bulk transmission system was found to be acceptable.

The increase in the Dysinger East and West Central voltage-constrained transfer limit is due to the variation in the generation dispatched in Upstate New York The Dunwoodie South, UPNY/CONED, and UPNY/SENY voltage-constrained transfer limits increased due to changes in reactive resources in Southeast New York (the addition of the 240 MVARs of switched capacitors at Millwood and removal of series reactors at Gowanus), and the increase in power flow (760MW) on the Branchburgh to Ramapo 550 kV transmission line.

Table 2.4.1 Summary Table of Voltage Limits

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

2.5. Stability Analysis

2.5.1. Methodology

The normal and emergency design criteria stability analysis was performed on a summer peak case with the transmission interfaces loaded to the following levels: Dysinger East 3159 MW, West Central 1765 MW, Central East 3129 MW, and UPNY-SENY 6759 MW. These flows are 11.1% above the more restrictive of the emergency thermal or voltage limit. This case has all Oswego complex generation dispatched at an output of 5,185 MW and 1,171 MW of import from Hydro Quebec.

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

The dynamic representation used in this analysis was developed from the 2007 NPCC Base Case Development library. The real power load models used for various Areas were (1) constant current (power varies with the voltage magnitude) for Hydro Quebec, New Brunswick, MAAC, and ECAR, (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 Areas except Hydro Quebec, which uses a 13% constant current/87% constant impedance model for reactive load.

2.5.2. Results

Table H.1 of Appendix H lists the contingencies evaluated and a determination of the overall system response as being stable or unstable.

All contingencies were stable and damped. The stability response files indicated that there may be some wind generators which may be tripped due to low voltage or frequency generation protection. However, the impact of these trips are local and does not affect the stability performance of the Bulk Power System.

2.6. N-1-1 Analysis

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 1 through 9). To demonstrate compliance with criteria for zones 10 and 11, or New York City and Long Island, the local Transmission Owners periodically conducts studies according to their own criteria and local reliability rules. For New York City, this criteria, which is more stringent by not allowing any loss of service, can be found in EP7100 on the NYISO website. Studies done by the Local TO, Con Edison, are presented to the NYSPSC in proceedings for major system upgrades. Base case system representations are provided by Con Edison in various NYISO processes that meet this criteria. For zone 11, there are limited bulk power facilities that were assessed manually. The local Transmission Owner periodically conducts operating studies and planning studies assessing the local system and NYISO has reviewed these studies.

2.6.1. Methodology

N-1-1 contingency analysis of the NYCA was performed in a separate study referenced here 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.

2.6.2. N-1 Powerflow Cases

Starting with the 2013 summer peak load base case, twenty-six N-1 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 case was within the normal thermal facility ratings and pre-contingency voltage limits. N-1 cases were created for each of the twenty-six N-1 outages in this manner.

2.6.3. 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, and loss of generation contingencies. All N-1-1 contingencies were tested, and if post-contingency thermal violations were present, 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 violations following any of the N-1-1 contingencies.

2.6.4. Results

After the automated N-1-1 process was performed on the 2013 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 combination. A list of the contingencies that were tested is included in Appendix K.

2.7. Summary

Tables 2.5 and 2.6 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 2.5(A) Transfer Limit Summary

Interface	Normal Transfer Limit (MW)	Type	Emergency Transfer Limit (MW)	Type
Dysinger East	2550	VX	2550	VX
West Central	1425	VX	1425	VX
Volney East	4075*	VX	4075*	VX
Moses South	2000	V	2000	V
Total East	5875	T	6050	S
Central East	2525	T	3000	VX
UPNY-SENY	5425	T	6150	VX
UPNY-CONED	5500	VX	5500	VX
Millwood South	8650	T	9850	T
Sprain Brook Dunwoodie South	5350	VX	5350	VX
Long Island Import	2050	T	2100	T

Notes:

1. – Transfer Limits expressed in MW, and rounded down to nearest 25 MW point.
2. – 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. – Transfer Limits assume 240 MW base schedule on the Ramapo PAR.

Type Codes: Type Codes: T – Thermal; V - Voltage Post; VX - Voltage 95%; S – Stability

* – From 2005 Comprehensive review report—Not evaluated in this review

A – Limits determined in this study were not optimized.

Table 2.6(A) Transfer Limit Comparison

Interface	2005 Comprehensive Review (Study Year 2010)				2008 Intermediate Review (Study Year 2013)			
	Normal (MW)		Emergency (MW)		Normal (MW)		Emergency (MW)	
Dysinger East	2726	VX	2726	VX	2550	VX	2550	VX
West Central	1283	VX	1283	VX	1425	VX	1425	VX
Volney East	4042	T	4089	VX	4075	VX	4075	VX
Moses South	1566	T	2049	T	2000	V	2000	V
Total East	5451	T	5541	S	5875	T	6050	S
Central East	2870	T	2907	S	2525	T	3000	VX
UPNY/SENY	4575	T	4860	VX	5425	T	6150	VX
UPNY/ConEd	4582	V	4905	VX	5500	VX	5500	VX
Millwood South	7630	VX	7630	VX	8650	T	9850	T
Sprain Brook Dunwoodie South	4680	V	4680	V	5350	VX	5350	VX
Long Island Import	2065	T	2121	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.

A. 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 Power Technologies Incorporated Power System Simulator software, PSS®E. Each contingency was tested for dynamic stability, voltage, and thermal limits.

3.1.1. Pre-Contingency Powerflow Base Case

All extreme contingencies start with the same initial conditions. Since extreme contingencies are considered low probability events they were not tested against the peak summer case used for normal contingencies. Instead, a power flow case was developed from the summer peak base case with the load reduced by approximately 20%. The generation dispatch of the NYCA system was modified to obtain transfer levels on the key NYCA interfaces of approximately the 75^{th} 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 a disturbance, dynamic simulations are performed. 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 fault contingency, several events change the system in sequence to match breaker actions. All simulations were run for 20 seconds to show system stability. A set of plots was created for each contingency. After an inspection of these plots, a determination was made whether or not the system remains stable after the event.

3.1.3. Post-Contingency Powerflow Analysis

A power flow solution was calculated to determine voltage impacts and line overloads with the new (post-contingency) system settings. 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 (EC) 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 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 are local and do not affect the stability performance of the Bulk Power System. Table 3.2.1 summarizes the results of the extreme contingency analysis. The summarized power flow results and the stability plots of selected contingencies are placed under Appendices I and J respectively. A few significant contingencies are discussed below.

3.2.1. 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 50 MW into New York. Removing these ties shows no significant voltage deviations or any thermal overloads, and the system remains stable.

It it's noted that this contingency showed low amplitude undamped oscillations among NYCA and Ontario generators.

3.2.2. Loss of Right of Way West of Rochester

This contingency is the no-fault loss of Rochester-Pannell Rd 345 kV lines. Significant 115 kV thermal overloads and voltage drops were observed around Buffalo area, indicating a potential loss of local load; however, the remainder of the NYCA bulk power system, as well as adjoining Areas, would not be adversely impacted.

3.2.3. Three-Phase Fault at Marcy

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.

3.2.4. Three-Phase Fault at Moses

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 sixteen Moses-St. Lawrence units (800 MW) and one Beauharnois unit; however, the remainder of the bulk power system remained stable. No significant voltage deviations or thermal overloads were present. These results are consistent with the previous intermediate review.

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	Transmission Line (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	-	-	-	-	-	-
EC03 - L/O R.O.W. WEST OF ROCHESTER	S	-	-	-	-	-	-
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	-	-	-	-	-	8
EC12 - L/O MARCY-VOLNEY AND MARCY-EDIC	S	-	-	-	-	-	-
EC13 - L/O EDIC SUBSTATION	S	-	-	-	-	-	3
EC14 - L/O R.O.W. SOUTH OF UTICA	S	-	-	-	-	-	-
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	-	-	-	1	2	4
EC18 - L/O NEW SCOTLAND SUBSTATION	S	-	-	-	-	-	1
EC19 - L/O LEEDS SUBSTATION	S	Coopers Corners	-	-	1	-	11
EC20 - L/O FISHKILL SUBSTATION	S	-	-	-	-	-	-
EC21 - L/O ROSETON SUBSTATION AND GENERATION	S	-	-	-	-	-	-

EC22 - L/O RAMAPO SUBSTATION	S	-	-	-	-	-	-
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	-	-	-	-	-	-

S – Stable; U – Unstable

* - 16 Moses-St. Lawrence units and one Beauharnois unit are first-swing unstable

^ - Flat Rock generators tripped by overfrequency relay

- Flat Rock generators tripped by undervoltage relay

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 NYCA, with exception to the installation of the Athens SPS. The expected year 2013 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. A complete list of the SPS in New York is provided in Appendix K.

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 2013 system conditions in the vicinity of existing DCS in NYCA has also not changed significantly. Therefore, no further analysis of DCS was conducted in this review. A complete list of the DCS in New York is provided in Appendix L.

6. Short Circuit Analysis

6.1. Methodology

The 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. This representation was developed from the NYISO 2008 Statewide Short Circuit representation, with updates from the NYCA transmission owners.

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 all lines, feeders, and generating units be placed in service regardless of whether or not the system can actually be operated that manner. This assumption would provide an adequate design margin of safety and reliability by yielding the worst case, most conservative fault levels.

In addition, the SC Guideline requires that Flat Gen voltage profile (pre-fault voltage of 1.0 per unit behind the generator subtransient reactance) be used, 30 degree phase shift in delta-wye transformer configurations be taken into account, and all loads and shunts be ignored.

Three phase, two phase to ground, and single line to ground faults were applied at selected substations obtained from the NY transmission and generation owners. 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 used Con Edison IBA methodology for the Con Edison system. For other NY transmission owners' system, NYISO used the standard, conservative methodology in which the breaker being evaluated opens last regardless of the voltage level.

The lowest circuit breaker ratings shown for each of the selected substations were also obtained from the NY 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 breaker interrupting ratings supplied by the transmission owners may include these methodologies.

6.2. Results

Based on the study results, there are four stations with over-duty breakers. Of these stations, one is 345kV station, one is 230 kV station, and two are 138 kV stations. Table 6.1 summarizes over-duty breakers at each station. The NYISO has plans to replace most of the over-dutied breakers by summer 2010 and operating procedures in place that ensure that the system is operated within existing breaker ratings.

For more information (e.g., fault currents at selected stations or IBA), see Appendix M.

Table 6.1 Over-duty Breaker Summary (Study Year 2013)

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 "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." 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

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. Contingency analysis was performed monitoring all 230 kV and above buses or branches for post-contingency bus voltage limits and LTE thermal ratings. The powerflow analysis results are reported in Appendix N.

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 condition resulting from extreme weather conditions.

New York City and Long Island are required by the New York State Reliability Council (NYSRC) Local Reliability Rules to be operated so that the loss of a single gas facility does not result in the loss of 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, power flow and stability analysis was conducted to evaluate the thermal, voltage and stability performance of NYSBPS for normal (or design) contingencies as defined in the NPCC Basic Criteria and NYSRC Reliability Rules. Thermal, voltage and stability performance was evaluated under peak load and stressed transfer conditions. In addition, stability performance was also evaluated for heavy transfer conditions. Overall, the transfer limit analysis indicates that there is a potential for a small reduction of transfer limits for Central East interface. However, this reduction should not pose an adverse reliability impact on New York State Bulk Power System since the reduction is a function of the base case dispatch and transfer shift assumptions and the majority of the proposed new generation projects are located east of this interface and would offset the reduction in transfer limit. The stability analysis also indicates that there are wind generators which would be tripped due to low voltage or frequency generator protection. However, the impact of these trips are local and do not affect the stability performance of the Bulk Power System.

In the second assessment, power flow and stability analysis was conducted 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 selected substations. The analysis indicates four stations where breakers were over-duty for the conditions tested. However, NYISO has plans to replace these breakers by summer 2010 and operating procedures are in place that ensure that the system is operated within existing breaker ratings.

As there are no proposed additional SPS or modifications to existing 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.

Since the previous intermediate review, there have been no proposed changes or additions to DCS in NYCA. The expected year 2013 system conditions in the vicinity of existing DCS in NYCA has also not changed significantly. Therefore, no further analysis of DCS was conducted in this review.

10. Conclusion

The main conclusion of this review is that NYSBPS, as planned through the year 2009, is in conformance with 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 NYCA Area Transmission Review(ATR) but are not specifically addressed in the Intermediate Area Transmission Review(IATR). Items not included in the IATR report that are the subject of the NYSRC compliance requirements have been added to the TFSS approved 2008 NYCA IATR. The most recently completed Comprehensive Reliability Plan has evaluated potential impacts of RGGI and HEDD implementation in addition to the base case reliability assessments.

11.1. System Restoration Assessment

It is has been 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 done in 2007 and associated updated NYISO Restoration Diagram Revision 70717 dated December 1, 2007. Proposed facilities in the system expansion plan that have not been evaluated are not connected to the restoration path shown in the NYISO Restoration Diagram.

11.2. N-1-1 Assessment

For this Intermediate Area Transmission Review, analysis was performed with critical elements, monitored facilities and severe contingencies that were previously identified. Results are discussed in Section 2.6.3.

11.3. Local Rules Consideration

System conditions have not changed sufficiently to impact the results and modeling assumptions in the 2005 Comprehensive Area Transmission Review regarding this assessment. At the beginning of every year before conducting its annual studies, the NYISO requests from the local Transmission Owners, information on changes in local system conditions that would impact the Bulk Power System. Local rules are considered in the development of the base cases used for all reliability assessments. Review of the appendices of this Intermediate Review and other studies that show a summarization of base case conditions showing the implementation of the local rules in the assessments.

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 Area Transmission Review regarding this assessment. The CATR concluded that there are no detrimental adverse impacts from loss of gas delivery (major pipeline) to the New York Transmission system. The Extreme Contingency analysis includes critical loss of plant contingencies caused by loss of supply to the plant.

11.5. Extreme System Condition Assessment

11.5.1. Loss of Fuel Supply

System conditions have not changed sufficiently to impact the results and modeling assumptions in the 2005 Comprehensive Area Transmission Review regarding this assessment. Recent Loss of Gas/Minimum Oil Burn studies 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 well balance of fuel mix which provides operational flexibility and reliability. Especially, many generation plants have a dual fuel capability. Figure 3.5.1 presents the fuel mix as it existed as of year end 2004. As indicated in Figure 3.5.1, 15% of generating capacity is fueled by natural gas only, 35% of generating capacity is fueled by oil and natural gas, and the rest is fueled by oil, coal, nuclear, hydro and other.

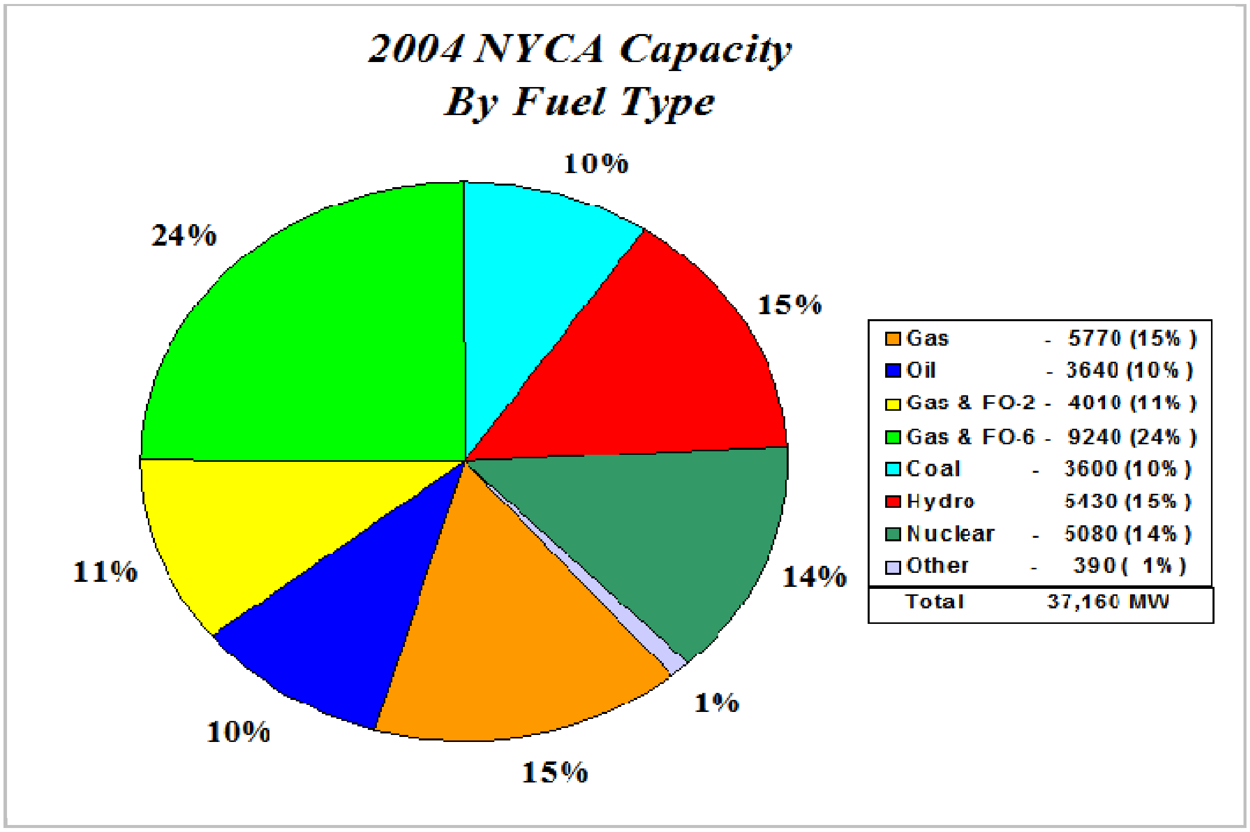
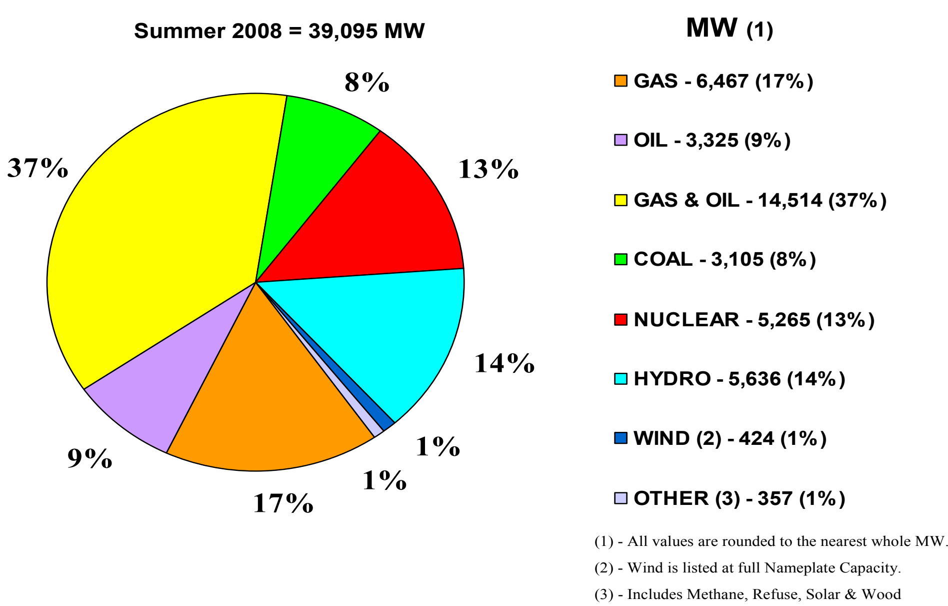


Figure 3.5.1: 2004 NYCA Capacity by Fuel Type

Figure 3.5.1: 2008 NYCA Capacity by Fuel Type



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, it's determined that loss of a major gas pipeline would not create a detrimental negative adverse impact to the NY electric system. 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).

The NYISO is in the process of performing a follow up study with Levitan to screen for the potential loss of generating stations due to common natural gas main interruption. This will be completed in 2009.

11.5.2. Impact of Environmental Regulations on Fuel Adequacy

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

OTC-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 DEC's preliminary proposal to update NOx 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 NOx 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 NOx emissions (Figure D-1) the correlation between NYCA NOx emissions and ambient ozone concentrations is much weaker (Figure D-2). 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 CAIR will be in place by 2012.

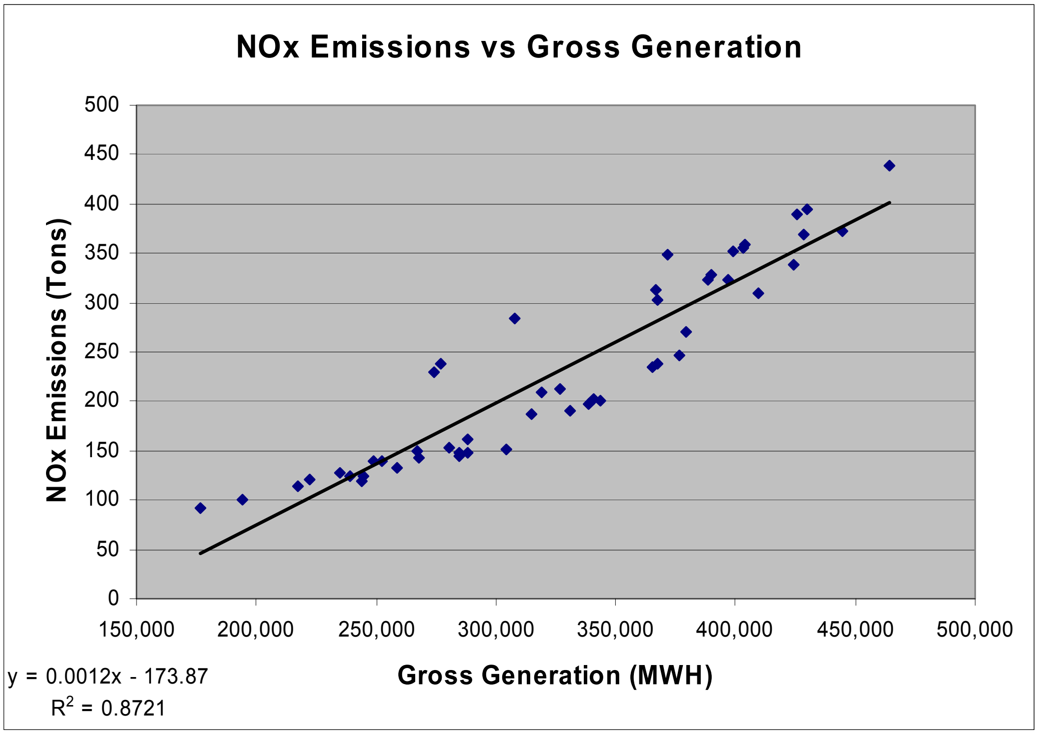


Figure D-1: NOx Emissions vs Gross Generation

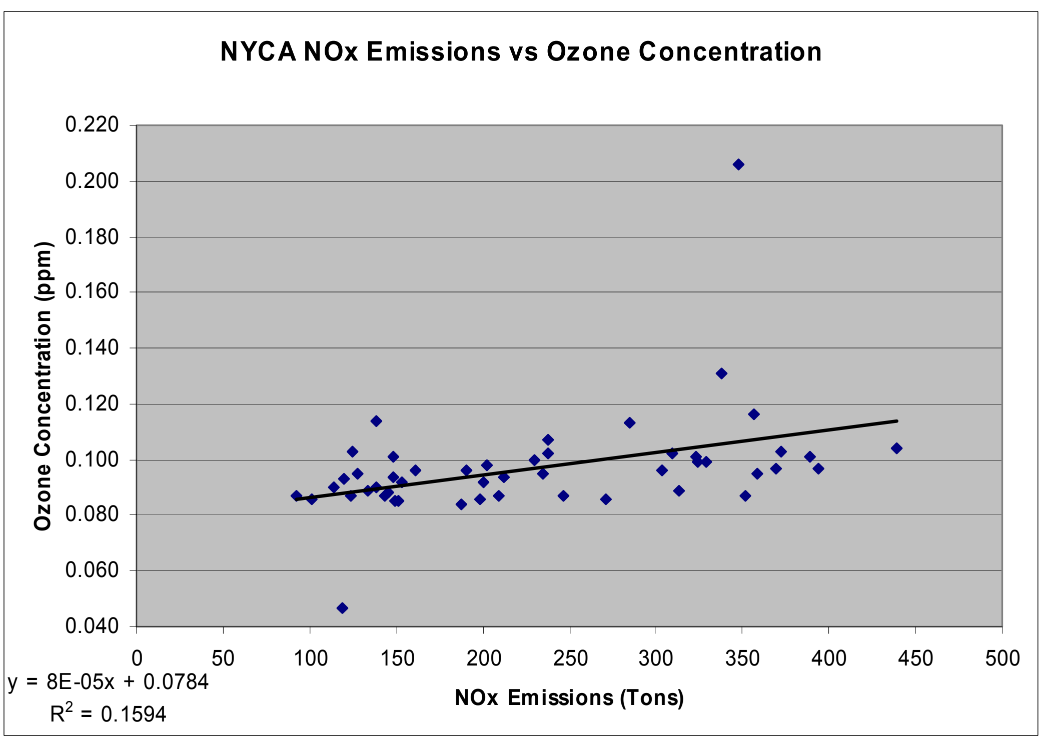


Figure D-2: NYCA NOx Emissions vs Ozone Concentration

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 NOx.

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. Therefore, the preliminary analysis of the effects of HEDD on reliability was approximated by making 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 *(1-(OTC RACT %)) (Scenario 3).

NOx 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. NOx emission reductions varied from zero to 28 tons. The results of the analysis are given in Table D-1 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 LOLEs compared to last year, 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. Given that the owners of these units have indicated that technology retrofits are not economically feasible, programs designed to reduce NOx emissions from the HECT units will require at a minimum, 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. NOx emission reductions varied from 10 tons to 75 tons. The results of the analysis are given in Table D-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 LOLEs compared to last year, 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.

The use of SCR resources for these three scenarios, together with that in the base case are shown in Figure D-3.

Table D-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 D-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

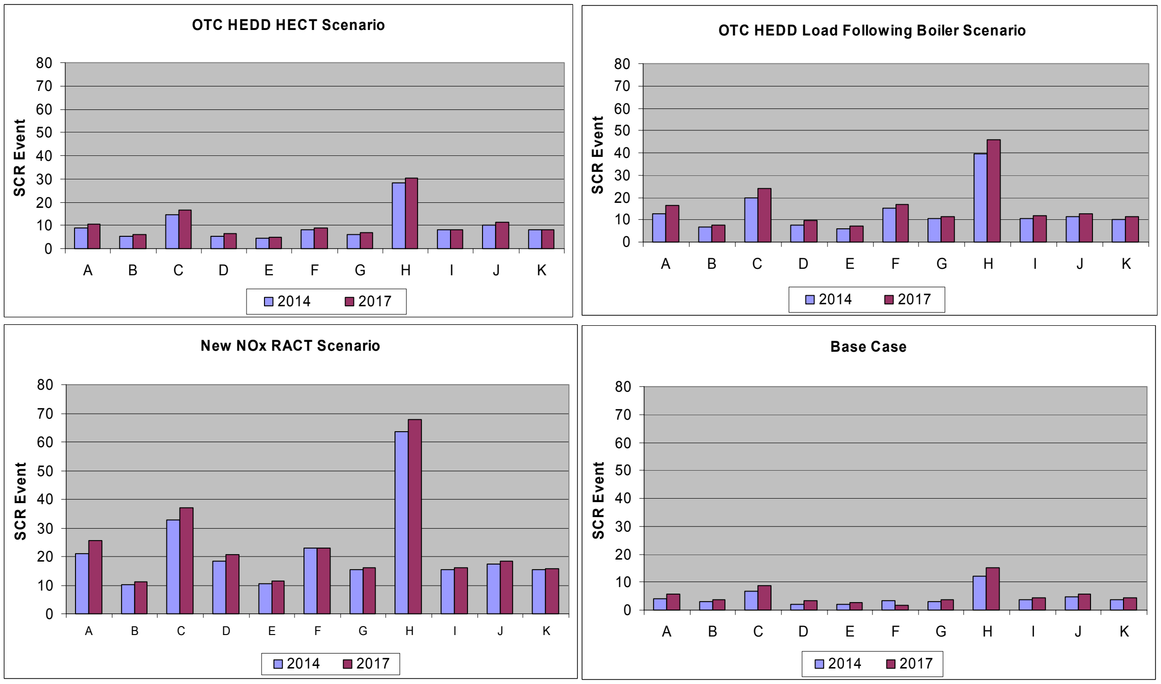


Figure D-3: Uses of SCR in NOx Reduction Scenarios

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 NAAQS standards by implementing 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, efforts to curb emission from those units on high electric demand days will 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 CO_2 allowances[1]. 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 CO_2 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 Commissioner has stated in the rule making process, that in such a situation, he would act to maintain electric system reliability.

---

[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.

4.0 Impact Assessment and Overview Summary

Upon review of the changes in forecasted system conditions and planned facilities in New York since the 2005 Comprehensive Transmission Review and the 2007 Interim Review, the NYCA bulk power transmission system, as planned through 2013, is judged to be in conformance with the NYSRC, NPCC, and NERC planning standards and design criteria in effect at the time of the start of the study.