1st Draft
For Discussion Purposes Only

Comprehensive Reliability Planning Process (CRPP)

2007 Draft Reliability Needs Assessment

*Prepared by the NYISO Planning Staff
for the
Electric System Planning Working Group
and the
Transmission Planning Advisory Subcommittee*

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1 Introduction

The introduction of competition in the electric industry in New York State, and in many parts of the Northeast separated the costs of utilities' services into distinct producers and marketers, and led to the unbundling of power generation and transmission development. As a result, the State's electric utilities no longer conduct vertically-integrated planning through which generation and transmission plans ~~were~~ are tightly coordinated.

In today's world, the future reliability of the bulk power system depends on a combination of additional resources, provided in response to market forces and by electric utility companies, which continue to deliver electricity to customers and have the obligation to provide safe and reliable services. To maintain the system's long-term reliability, those resources must be readily available or in development to meet future needs.

With these goals in mind, the NYISO, in conjunction with stakeholders, developed and implemented in 2005 its Comprehensive Reliability Planning Process (CRPP), which is contained in Attachment Y of the NYISO's Open Access Transmission Tariff (OATT). The NYISO's ~~Comprehensive Reliability Planning Process (CRPP)~~ is an annual, ongoing process – developed with NYISO stakeholders – to assess and establish the grid's reliability needs and solutions[1] to maintain bulk power system reliability. The first step in the CRPP is the Reliability Needs Assessment (RNA) over a ten year Study ~~p~~Period with the second step in the process being the solicitation and evaluation~~identification~~ of solutions to the identified needs and the development of the Comprehensive Reliability Plan (CRP).

If the RNA identifies a reliability need in the ten year ~~s~~Study ~~p~~Period, the NYISO will designate one or more Responsible Transmission Owners, who are responsible for the development of a regulated back-stop solution to address the identified need. In addition, the NYISO will solicit market-based and alternative regulated solutions to address the identified need. ~~If the Reliability Needs Assessment (RNA) determines the reliability of the system is inadequate, the RNA will identify reliability needs and the TOs responsible for identifying regulated backstop solutions. The solutions will consist of both market-based and Transmission Owner (TO) or alternative regulated solutions.~~ Solutions will ~~need~~ have to satisfy reliability criteria which may~~and~~ not necessarily be the same as the specified level or locations of compensatory Megawatt~~s~~ (MW) or Megavar~~s~~ (MVAR) ~~need identified in the RNA~~ used in the RNA to quantify need. There are various combinations of resources and transmission upgrades that could meet the needs identified in the RNA. In addition, reconfiguration of transmission facilities and/or modifications to operating protocols identified in the solution phase could result in changes in or modification of the needs identified in the RNA.

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[1] ~~The development of long-term firm transmission rights will help enable long-term power supply arrangements and the development of resource additions~~ The development of long-term firm transmission rights will help enable long-term power supply arrangements and the development of resource additions. ~~[JPB: FN Should be redlined]~~

This report is the second draft RNA prepared by the New York Independent System Operator. This document represents the second in a series of annual CRPP plans designed to address the long-term reliability of the New York State bulk power system. The RNA consists of this document and the supporting documents and appendices. Just as important as the electric system plan is the process of planning itself. Electric system planning is an ongoing process of evaluating, monitoring and updating as conditions warrant. In addition to addressing reliability, the CRPP is also designed to provide information that is both informative and of value to the New York wholesale electricity marketplace.

2 Summary of the 2005 Comprehensive Reliability Plan

The 2005 CRP was the first Comprehensive Reliability Plan prepared by the NYISO. The 2005 CRP was approved by the NYISO Management Committee and subsequently the NYISO Board of Directors in August of 2006. The 2005 CRP determined that the transmission owner plans and proposed solution to the identified needs would maintain the reliability of the New York State Bulk Power System (BPS) and presented the CRP findings, conclusions and recommendations:

Actions <u>identified in the 2005 CRP</u> that will maintain reliability of the BPS:

1. Defer retirement of the New York Power Authority's Charles A. Poletti generating unit in Astoria, Queens for one year, from 2008 until 2009.

2. Deploy transmission projects, including upgrades, reactive resource additions and capacity additions (466 MW); import 990 MW of generation from neighboring control areas committed to the <u>New York Control Area (</u>NYCA<u>)</u>; and implement voluntary demand reduction programs (449 MW). This results in total resource additions of 1,905 MW through 2010.

3. The development of 1,200 MW of merchant generation, in particular, the 950 MW in New York City – the 400 MW Astoria repowering project (NRG Power Marketing Inc.); and the 550 MW Oak Point Energy Center (Key-Span Ravenswood, LLC). It is important that generation equivalent to this 950 MW be in service in New York City no later than 2011. Also, proposed for development is the 250 MW Spagnoli Energy Center on Long Island (Key-Span Ravenswood, LLC).

4. The planned resource additions noted above total 3,105 MW by 2015.

<u>2005 </u>CRP Findings, Conclusions and Recommendations:

1. The New York State Legislature should reinstate the Article X power plant siting law, which expired at the end of 2002. The lack of a project siting process could delay the construction and operation of new generation plants necessary for future system reliability needs.

2. The construction of planned resources and transmission upgrades must stay on schedule. It is important for the NYISO, along with its stakeholders, to approve and deploy a process to monitor the viability of solutions and assess when regulatory solutions should be triggered.

3. The impact of fuel diversity on the power supply system should be continually monitored.

4. New York must monitor its capacity markets to determine if they are competitive and can attract enough investment to maintain system reliability.

5. The comprehensive reliability planning process must stay on schedule. Environmental factors that could lead to the retirement of generating units must be identified and addressed in the RNA and CRP.

6. Conforming New York's reactive power planning and voltage control practices to the best practices identified in the North American Electric Reliability Council's (NERC) Blackout Recommendation 7a.

7. A review of NERC blackout recommendations related to voltage is also advisable

3 ~~Study Period Base Case~~RNA study case[2] Assumptions, Drivers and Determination of Needs

3.1 ~~Study Period Study Period Base Case~~RNA study case ~~S~~ system

The NYISO established procedures and a schedule for the collection and submission of data and the preparation of the models used in the underlying studies that were performed during the Comprehensive Reliability Planning Process (CRPP) as defined in Attachment Y of the NYISO OATT.

The NYISO's procedures were designed to allow the NYISO's planning activities associated with the CRPP to be aligned with and coordinated with the related activities of NERC, NPCC, and other regional reliability organizations. The assumptions underlying the RNA were reviewed both at TPAS and ESPWG. The RNA study case consists of the Five Year Base Case and the second five years of the Study Period. The Five Year Base Case was developed based on the 2005 Annual Transmission Reliability Assessment (ATRA) base case, input from Market Participants, and a project screening procedure.

The NYISO developed the system representation for the second five years of the Study Period starting with the First Five Year Base Case and using (1) the most recent Load and Capacity Data Report published by the NYISO on its web site; (2) the most recent versions of NYISO reliability analyses and assessments provided for or published by NERC, NPCC, NYSRC, and Neighboring Control Areas; (3) information reported by neighboring control areas such as power flow data, forecasted load, significant new or modified generation and transmission facilities, and anticipated system conditions that the NYISO determines may impact the bulk-power transmission facilities; and (4) Market Participant input. Based on this process, the network model for the second five-year period ~~was identical to the network model for the year 2011 in the~~ incorporates TO and neighboring system plans not incorporated in the Five Year Base Case. In addition, ~~except for~~ the changes in the MW and MVAR load model resulting from load growth are incorporated. The load model reflected the load forecast from the 2006 Load and Capacity Data report also known as the "Gold Book"

The ~~Study Period Base Case~~RNA study case model of the New York system for the 2007 RNA includes the following new and proposed facilities:

a. TO projects on non-bulk power facilities

b. Facilities that have accepted their Attachment S cost allocations and are in service or under construction as of June, 2006.

c. Transmission upgrades related to any projects and facilities that are included in the ~~Study Period Base Case~~RNA study case, as defined above

The RNA ~~base case~~study case does not include all projects currently listed on the NYISO's interconnection queue.

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[2] The RNA study case consist of the Five Year Base Case and the second five years of the Study Period as defined in Section 4.3 of Attachment Y of the NYISO OATT.

Pursuant to Section 4.5 of Attachment Y, the NYISO also develops reliability scenarios for the first five years and second five years of the Study Period considering, among other things, load forecast uncertainty, new resources, retirements, and litmiations imposed by environmental programs. The NYISO also conducts sensitivity analyses pursuant to Section 4.6 of Attachment Y, to test the robustness of the needs assessment studies.and identify conditions under which Reliability Criteria may not be met.

Table 3.1 below presents the unit retirements, which were represented in the ~~Study Period Base Case~~RNA study case:

Table 3.1: Unit Retirements

Unit\ Year	2007	2008	2009	
Huntley 65 & 66	165.0			
Lovett 5	176.2			
Lovett 4		167.9		
Lovett 3	46.8			
Russell 1 - 4		230.6		
Poletti			888.3	
Total	388	398.5	888.3	1,674.8

Table 3.2 below presents the unit additions, which were represented in the ~~Study Period Base C~~RNA study ~~c~~ase.:

Table 3.2: Unit Additions

Unit\Year	2007	2008	2009	
SCS Astoria (Ph 1)[3]	479.9			
Prattsburg Wind	79.0			
Flat Rock (Ph 2)	100.0			
Ginna Uprate	95.0			
Caithness			310.0	
LI wind			140.0	
Total	753.9		450	1,203.9

The unit retirements and additions when combined with the existing generation as of April 1, 2006 in the "Gold Book" along with other adjustments resulted in the following ~~Study Period Base C~~RNA study case load and resource margin table

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[3] SCS Astoria's commercial or in service date was after April 1, 2006 and was not included in existing capacity in the "2006 Load and Capacity Data" report and is therefore shown ~~incorporated~~ here as an addition.

3.3 NYCA Load and Resource Margins 2007 to 2016

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Peak Load										
NYCA	33,831	34,314	34,688	35,042	35,348	35,593	35,803	36,077	36,380	36,623
Zone J	11,800	11,970	12,140	12,290	12,440	12,570	12,705	12,815	12,925	13,003
Zone k	5,549	5,628	5,738	5,840	5,936	6,037	6,141	6,249	6,372	6,511
Resources										
NYCA										
"-Capacity"	38,911	38,513	38,057	38,057	38,057	38,057	38,057	38,057	38,057	38,057
"-SCR"	1080	1080	1080	1080	1080	1080	1080	1080	1080	1080
"-UDR" (2)	990	990	990	990	990	990	990	990	990	990
Total	40,981	40,583	40,127	40,127	40,127	40,127	40,127	40,127	40,127	40,127
Zone J										
"-Capacity"	9,996	9,996	9,108	9,108	9,108	9,108	9,108	9,108	9,108	9,108
"-SCR"	325	325	325	325	325	325	325	325	325	325
"-UDR"	0	0	0	0	0	0	0	0	0	0
Total	10,321	10,321	9,433	9,433	9,433	9,433	9,433	9,433	9,433	9,433
Zone K										
"-Capacity"	5,291	5,291	5,741	5,741	5,741	5,741	5,741	5,741	5,741	5,741
"-SCR"	150	150	150	150	150	150	150	150	150	150
"-UDR"	990	990	990	990	990	990	990	990	990	990
Total	6,431	6,431	6,881	6,881	6,881	6,881	6,881	6,881	6,881	6,881
NYCA Resource Margin %	121.1%	118.3%	115.7%	114.5%	113.5%	112.7%	112.1%	111.2%	110.3%	109.6%
Resource Margin w/o UDR	118.2%	115.4%	112.8%	111.7%	110.7%	110.0%	109.3%	108.5%	107.6%	106.9%
Zone J Res/Load Ratio	87.5%	86.2%	77.7%	76.8%	75.8%	75.0%	74.2%	73.6%	73.0%	72.5%
Zone K Res/Load Ratio	115.9%	114.3%	119.9%	117.8%	115.9%	114.0%	112.1%	110.1%	108.0%	105.7%

Note (1): NYCA Resource Margin only Includes resources internal NY and does not include external resources of 2755 MW that have historically participated in the NYCA installed capacity market. The LOLE analysis does include support from neighboring control areas.

Note (2): UDRs are unforced capacity delivery rights and are supported by generation in neighboring control areas.

3.2 Determination of Needs

The General Electric Multi-Area Reliability Simulation (GE-MARS) model was used to determine the year in which loss-of-load criterion was violated and by what degree. Compensatory MWs were added to the system to resolve criteria violations, i.e., the Loss of Load Expectation (LOLE) of 0.1 days per year. As violations are found, compensatory MW needs for the NYCA were developed by adding generic 250 MW generating units to the zones based on a review of binding transmission constraints and zonal LOLE in an interative process to determine when reliability criteria were satisfied. These 250 MW additions were used to quantify the reliability needs and as indicator of the amount of load at risk of being disconnected. The additions are not intended to represent proposed solutions. However, resource needs could potentially be met by many different combinations of supply and demand-side resources in other areas in conjunction with transmission upgrades. Due to the differing natures of supply and demand-side resources and transmission constraints, the amounts and locations of resources needed to match the level of compensatory MW needs identified will vary. In addition, resource needs could be met in part by transmission system reconfigurations that increase transfer limits, or by changes in operating protocols. Operating protocols could include such actions as using dynamic ratings for certain facilities, operating exceptions or special protection systems.

4   Reliability Criteria

The standard industry definition of bulk power system reliability is the degree to which the performance of the elements of that system (i.e., generation and transmission) results in power being delivered to consumers within accepted standards and in the amount desired. It may be measured by the frequency, duration, and magnitude of adverse effects on consumer service.

Reliability consists of adequacy and security. Adequacy, which encompasses both generation and transmission adequacy, refers to the ability of the bulk power system to supply the aggregate requirements of consumers at all times, accounting for scheduled and unscheduled outages of system components. Security is the ability of the bulk power system to withstand disturbances such as electric short circuits or unanticipated loss of system components.

There are two different approaches to analyzing a bulk power system's security and adequacy. Adequacy is a planning and probability concept. The New York State Power System is planned to meet an LOLE that is less than or equal to a involuntary load disconnection that is not more than once in every 10 years or 0.1 days per year. A system is adequate if the probability of having sufficient transmission and generation to meet expected demand is equal to or less than the system's standard which is expressed as a loss of load expectation (LOLE). This requirement forms the basis of New York's installed capacity or resource adequacy requirement.

Security is an operating and deterministic concept. This means that possible events are identified as having significant adverse reliability consequences and the system is planned and operated so that the system can continue to serve load even if these events occur. Security requirements are sometimes referred to as N-1 or N-2. N is the number of system components; an N-1 requirement means that the system can withstand the loss of any one component without affecting service to consumers.

5 Reliability Needs

5.1 Introduction

This reliability needs assessment for the New York State bulk-power ~~Study Period Base C~~RNA study case system indicates that the forecasted system ~~does not meet~~exceeds the 0.1 days per year ~~reliability criteria starting in the year ~~2011~~2010 but only by a small amount of .001.~~ Continued load growth with no resource additions, ~~further exacerbates~~increases the deficiency well above 0.1 ~~in~~ for the ~~later~~ years 2011 through 2016~~ of the ten-year Study Period. This year's RNA builds upon the NYISO's first CRP which included major resource and transmission system additions in load Zones G through K. These additions have been incorporated into the ten-year ~~Study Period Base C~~RNA study case. These additions have had major impact on the RNA 2007 finding of need, in particular, for load Zone K.

Load growth over the last several years in excess of two percent per year in load Zones G through K has resulted in increasing demands being placed on the transmission system to meet capacity and energy needs in this area. By 2011, the NYCA load forecast estimates that approximately two thirds of the NYCA load will be located in load Zones G through K which is downstream of the UPNY – SENY[4] transmission interface. In addition, approximately 52% of the NYCA load will be located in load Zones J and K, which is downstream of the Dunwoodie-South transmission interface.

The demands that are increasingly being placed on the transmission system in conjunction with other system changes, consisting primarily of generating unit retirements listed in Table 3.1, load growth and neighboring system changes have and will continue to result in voltage criteria violations at much lower transfer levels than have been previously observed. The result is that over time, transfers into and through SENY will increasingly be limited by voltage constraints, rather than thermal constraints. This reduced capability of the bulk power system to make power transfers into SENY due to these voltage constraints, coupled with continuing load growth in SENY results in a resource adequacy criterion violation by 2011. Below are the principal findings of the Reliability Needs Assessment:

5.2 Reliability Needs

5.2.1 ~~Study Period Base C~~RNA study case:

The ~~Study Period Base C~~RNA study case refers to the entire ten years of the Study Period encompassing the Five Year Base Case and the second five years. Employing the ~~Study Period Base ~~RNA study ~~C~~case transfer limits[5] (from the analysis conducted with the updated transmission topology) to determine resource adequacy needs (defined as a loss-of-

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[4] UPNY or Upstate New York is defined as load Zones A through F while SENY or Southeast New York is defined as load Zones G through K

[5] The ~~Base Case~~RNA study case transfer limits apply the most restrictive limit determined from the power flow and dynamics analysis based on thermal, voltage and stability reliability criteria.

load-expectation or LOLE that exceeds 0.1 days per year)~~),~~ ~~).~~ ~~the~~ The first year ~~of need for the New York Control Area (that the NYCA)~~ is at or exceeds 0.1 days per year is ~~2011~~2010, with a LOLE of 0.~~146~~101[6] days per year. The LOLE for the NYCA increases to 0.764 days per year by 2016. The LOLE[7] results ~~for the~~for the entire ten-year ~~Study Period Base C~~RNA study case are summarized in the table below:

Table 5.2.1.1 LOLE for the ~~Study Period Base C~~RNA study case ~~Load Forecast and T~~Transfer Limits~~8~~

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
AREA-A		0.001							0.001	
AREA-B	0.002	0.008	0.027	0.042	0.058	0.088	0.096	0.132	0.169	0.190
AREA-C										
AREA-D										
AREA-E	0.001	0.002	0.001	0.015	0.021	0.035	0.039	0.059	0.080	0.102
AREA-F										
AREA-G			0.001	0.003	0.003	0.004	0.005	0.007	0.011	0.014
AREA-H									0.001	
AREA-I	0.002	0.008	0.035	0.058	0.077	0.137	0.18	0.267	0.373	0.463
AREA-J	0.002	0.007	0.053	0.096	0.140	0.246	0.32	0.442	0.585	0.738
AREA-K		0.001	0.002	0.004	0.006	0.016	0.024	0.046	0.075	0.124
NYCA	0.002	0.011	0.056	0.101	0.146	0.254	0.331	0.456	0.604	0.764

5.2.2   Thermal Limit Transmission Sensitivity

Based upon the assumption that only thermal limits are binding, the NYISO Staff conducted a sensitivity analysis of LOLE based on thermal transfer limits for the transmission system. Utilizing thermal transfer limits to determine resource adequacy needs provides information on the impact that the more restrictive limits other than thermal have on LOLE. The LOLE results for this sensitivity indicate the potential for a one year deferral in the first year of need if the voltage limits are resolved. The detailed results are presented in the table below:

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[6] This level of exceedence is within one standard error of the mean for the Monte Carlo simulation.

[7] It should be noted, the LOLE (loss-of-load-expectation) results presented for each load zone are determined based on the assumption that load in a particular load Zone has "first rights" to that capacity in that load Zone even though that capacity could be contractually obligated to load in another load Zone or area. ~~Also, T~~the MARS logic prorates capacity to zones if more than one zone is capacity deficient.

[8] The RNA study ~~Base C~~case transfer limits apply the most restrictive limit determined from the power flow and dynamics analysis based on thermal, voltage and stability reliability criteria.

Table 5.2.2.1 LOLE ~~Results~~ for the ~~Study Period Base C~~RNA study case ~~System~~ System Based on Thermal Transfer Limits

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
AREA-A		0.001							0.001	
AREA-B	0.002	0.008	0.027	0.041	0.058	0.089	0.097	0.134	0.171	0.192
AREA-C										
AREA-D										
AREA-E	0.001	0.002	0.010	0.015	0.022	0.035	0.040	0.059	0.082	0.103
AREA-F										0.001
AREA-G			0.002	0.004	0.005	0.008	0.008	0.015	0.022	0.030
AREA-H									0.001	
AREA-I	0.002	0.008	0.035	0.058	0.078	0.139	0.184	0.272	0.383	0.473
AREA-J	0.002	0.007	0.043	0.069	0.097	0.181	0.218	0.334	0.455	0.569
AREA-K		0.001	0.003	0.005	0.009	0.022	0.034	0.063	0.096	0.168
NYCA	0.003	0.010	0.045	0.074	0.102	0.191	0.231	0.349	0.477	0.598

5.2.3   *Unconstrained or Free Flowing Transmission Sensitivity*

Below are the LOLE results for the NYCA unconstrained internal transmission interface sensitivity, also known as the "free flowing" sensitivity. The "free flowing" sensitivity assumes that the NYCA internal transmission system has unlimited or infinite capability. The purpose of this sensitivity is to demonstrate whether a NYCA resource deficiency is a result of a statewide need or strictly transmission limitations.

5.2.3.1 LOLE for the ~~Study Period Base C~~RNA study case System Based on Free Flowing Conditions

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
AREA-A										
AREA-B	0.002	0.007	0.029	0.044	0.063	0.103	0.12	0.174	0.236	0.293
AREA-C										
AREA-D										
AREA-E	0.001	0.002	0.001	0.015	0.022	0.038	0.044	0.068	0.099	0.128
AREA-F					0.001	0.001	0.001	0.001	0.001	0.002
AREA-G			0.001	0.003	0.005	0.008	0.009	0.014	0.022	0.029
AREA-H										
AREA-I	0.002	0.008	0.030	0.047	0.066	0.111	0.131	0.186	0.257	0.316
AREA-J	0.002	0.006	0.033	0.052	0.072	0.121	0.143	0.208	0.285	0.357
AREA-K			0.001	0.002	0.006	0.013	0.019	0.031	0.054	0.088
NYCA	0.002	0.009	0.034	0.054	0.076	0.123	0.147	0.213	0.295	0.367

5.2.4 Reliability Needs Summary

The Chart 5.2.4.1 below presents a summary of the LOLE results for the RNA study case, as well as the thermal and "free flowing" sensitivities. In general, an LOLE results above 0.1 days per year indicates that resources are required to maintain reliability or triggers a need to identify resources. These results indicate the first year of definitive need is 2011 with 2010 showing a relatively small need which could be, for example, resolved by increasing the transfer capability of the transmission system closer to its full thermal capability, or by adding resources in Zones J considerably smaller than a generic unit.

Further, theR review of the both the free-flowing transmission sensitivity (with LOLE of 0.076 in 2011, 0.123 in 2012 and 0.367 in 2016) and the thermally limited transmission sensitivity (with LOLE of 0.102 in 2011, 0.191 in 2012 and 0.598 in 2016) indicates that the 2011 needs through 2011need date results largely from transmission constraints and not an overall resource deficiency in NYCA. Beyond 2011, the need results from of an overall resource deficiency in NYCA as well as transmission constraints.

Chart 5.2.4.1 Presents A Summary of the LOLE Results for the RNA study case, thermal and "free flowing"sensitivities
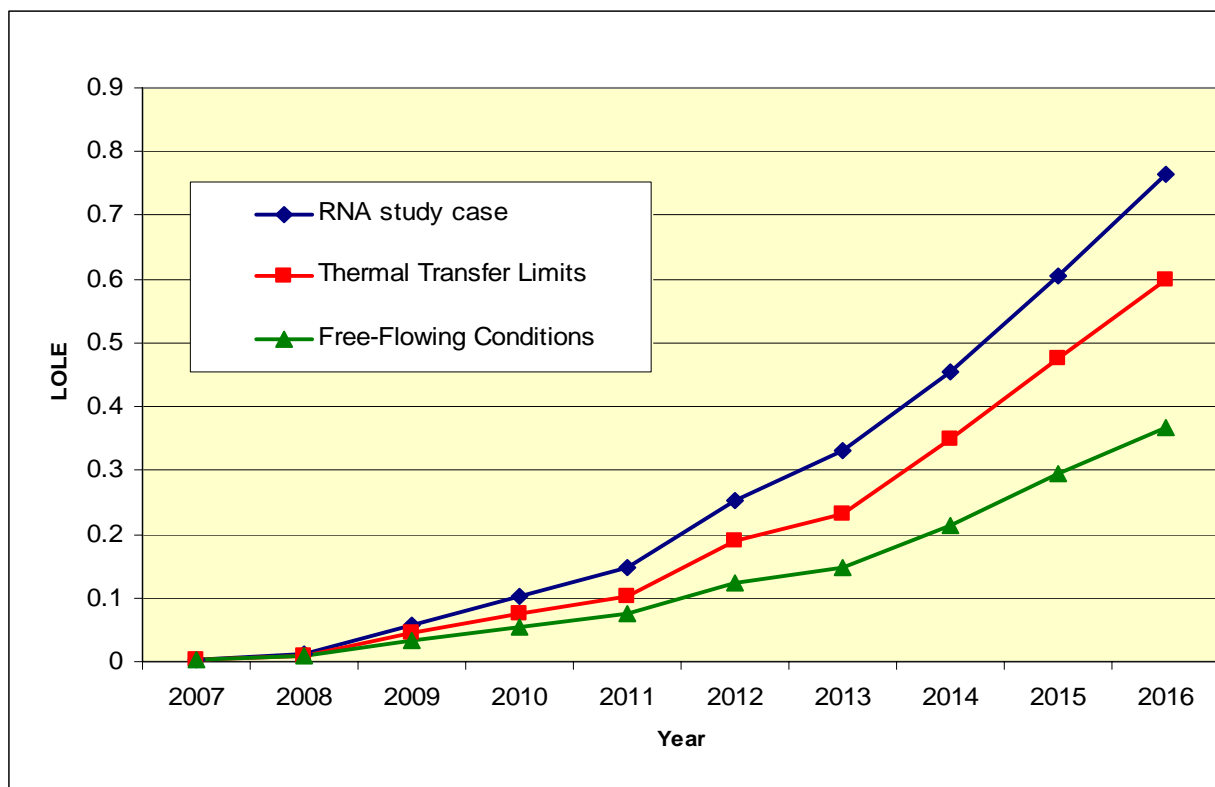
5.3 Compensatory MWs

After the reliability needs are initially identified as deficiencies in reliability criteria, the NYISO translated those deficiencies into compensatory MWs that could satisfy the need. This translation provides further information to the marketplace on the magnitude of the resources that are required to meet bulk power system reliability needs. The NYISO is providing these calculations for illustrative purposes only. It is not meant to reflect specific facilities or types of resources that may be offered as solutions to reliability needs. Accordingly, compensatory MWs may reflect either capacity, demand management or transmission additions. For this analysis, the amount and effective location of the compensatory MWs is determined by testing combinations of generic 250 MW combined cycle generating units located in various load Zones until the NYCA LOLE is reduced to 0.1 days per year or less. A unit size of 250 MWs was chosen because this unit size is consistent with nominal power rating of combined cycle unit power blocks that have been observed in practice and provides reasonable step sizes for simulation purposes. It is also recognized that solutions such as combustion turbine generating units and demand-side management solutions can be added in much smaller increments.

The results of the MARS simulations for the RNA study case~~Study Period Base Case,~~ transfer limit sensitivities, and scenario assessments provide information that can be used to guide the compensatory MWs. It should be noted that there may be other combinations of compensatory MWs which would also meet the statewide reliability criteria. It is not the intent of this analysis to identify preferred locations or combinations for potential solutions. In addition to the zonal LOLEs, the MARS simulation reports what interfaces are constraining and the frequency of the constraint. From this information, it can be determined whether the LOLE violation is driven more by capacity deficiencies or transmission system transfer constraints. If the compensatory MWs are upstream of a load Zone with an LOLE violation which is to some extent caused by a frequently constrained interface, the compensatory MWs will be less effective in reducing the zonal LOLE.

To reduce the LOLE to below the 0.1 days per year criterion in 2011[9] requires compensatory MWs to be located in load Zones G through J, which are below the UPNY – SENY interface. In general and also because of the modeling of the availability of the cables feeding load Zones J and K, locating compensatory MWs downstream of the Dunwoodie-South interface particularly in load Zone J is generally more effective in meeting LOLE requirements. However, MARS simulation shows that load Zone K export capability is being fully utilized to provide assistance to the Lower Hudson Valley and New York City, and would not be an effective location for compensatory MWs without additional transmission.

Resource additions to meet the reliability needs in 2011 were evaluated by adding either one 250 MW unit in load Zone J (A1 in the table below) or two 250 MW

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[9] Compensatory MW for 2010 were not developed because the need was small.

units for a total of 500 MWs in G (A2 in the table below). The exact location of the resource additions, whether in load Zones G through J or a combination thereof, impacts the level of compensatory MWs required. <u>The compensatory MW indicated for an area may also be provided by resources connected to that area by additional transmission facilities.</u> Also, the location of the compensatory MWs affects the reactive capability in the areas and the overall voltage performance of the system. Because the compensatory MWs are for illustrative purposes and to provide guidance, it was not necessary for the needs assessment to reevaluate transfer limits. The NYISO intends to perform such re-evaluation when analyzing potential solutions submitted for consideration by Market Participants. The following tables presents the compensatory MWs and LOLE results for 2011.

Table 5.3.1 Compensatory MW additions For the ~~Study Period Base Case~~RNA study case Load Forecast and Transfer Limits for 2011

AREA	AREA-A	AREA-B	AREA-E	AREA-G	AREA-J	AREA-K	_NYCA_
2011 A1					250		250
2011 A2				500			500

Table 5.3.2 LOLE Results for the Compensatory MW Alternatives for 2011

AREA	AREA-A	AREA-B	AREA-E	AREA-G	AREA-I	AREA-J	AREA-K	_NYCA_
2011 A1		0.041	0.015	0.002	0.054	0.084	0.006	0.088
2011 A2		0.033	0.012		0.039	0.098	0.004	0.102

For the balance of the planning horizon several alternative compensatory MW combinations were investigated by testing various alternative combinations of compensatory MWs in different load Zones. These alternatives are identified as A1, A2, etc. The tables below present the alternative compensatory MW additions by year and the resultant LOLEs. Initially, sensitivity analysis was performed for the last year of the planning horizon, 2016 (see Table 5.3~~5~~.4), to identify potential areas where compensatory MWs could be added to meet the reliability needs. A total of 1750 MWs or seven generic units were evaluated for each of six alternatives. Generic units were placed in load Zones A, B, E, G, J, and K as presented in table 3.3.3 below, in year 2016 for alternatives A1 through A6. In addition, a total of 2000 MWs consisting of eight generic units were added for two more alternative A7 and A8. Because the purpose of the analyses was not only to show the level of compensatory MWs needed to meet LOLE criteria but also the importance of the location of the compensatory MWs (i.e., load Zones A through F vs. G through I vs. J and K), not all alternatives tested were able to achieve a LOLE of no greater than 0.1 days per year. The following tables present the compensatory MW and LOLE results for the alternative sets of compensatory MWs that were evaluated for the years 2012 through 2016.

Table 5.3.3 Compensatory MW[10] additions for 2012 through ~~2016~~ 2015 for the ~~Study Period Base C~~RNA study case

AREA	AREA-A	AREA-B	AREA-E	AREA-G	AREA-J	AREA-K	_NYCA_
2012 A1					500		500
2012 A2				500	250		750
2013 A1				250	500		750
2013 A2				500	500		1000
2014 A1	500			500	500		1500
2014 A2				750	500		1250
2015 A1				750	750		1500
~~2016 A1~~	~~-~~	~~250~~	~~250~~	~~250~~	~~1000~~	~~-~~	~~1750~~
~~2016 A2~~	~~-~~	~~250~~	~~250~~	~~250~~	~~750~~	~~250~~	~~1750~~
~~2016 A3~~	~~-~~	~~-~~	~~-~~	~~750~~	~~1000~~	~~-~~	~~1750~~
~~2016 A4~~	~~-~~	~~-~~	~~-~~	~~1000~~	~~750~~	~~-~~	~~1750~~
~~2016 A5~~	~~-~~	~~-~~	~~-~~	~~750~~	~~750~~	~~250~~	~~1750~~
~~2016 A6~~				~~500~~	~~1000~~	~~250~~	~~1750~~
~~2016 A7~~		~~250~~		~~750~~	~~1000~~		~~2000~~
~~2016 A8~~		~~500~~		~~500~~	~~1000~~		~~2000~~

~~Scase~~

Table 5.3.4 LOLE Results with Compensatory MW additions for 2012 through 2015 for the RNA study case

AREA	AREA-A	AREA-B	AREA-E	AREA-G	AREA-I	AREA-J	AREA-K	_NYCA_
2012 A1	_	0.051	0.020	0.003	0.070	0.095	0.013	0.101
2012 A2	_	0.004	0.014	_	0.052	0.105	0.009	0.108
2013 A1	_	0.049	0.019	0.001	0.071	0.115	0.018	0.121
2013 A2	_	0.037	0.014	_	0.048	0.080	0.014	0.085
2014 A1	_	0.027	0.009	_	0.053	0.093	0.018	0.100
2014 A2	_	0.039	0.014	_	0.054	0.096	0.021	0.103
2015 A1	_	0.040	0.014	_	0.053	0.093	0.035	0.105

Table 5.3.5 Compensatory MW additions for 2016 for the RNA Study case

AREA	AREA-A	AREA-B	AREA-E	AREA-G	AREA-J	AREA-K	_NYCA_
2016 A1	_	250	250	250	1000	_	1750
2016 A2	_	250	250	250	750	250	1750
2016 A3	_	_	_	750	1000	_	1750
2016 A4	_	_	_	1000	750	_	1750
2016 A5	_	_	_	750	750	250	1750
2016 A6				500	1000	250	1750
2016 A7		250		750	1000		2000
2016 A8		500		500	1000		2000

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[10] **The NYCA compensatory MWs are the total MWs for that alternative for that year**

Table 5.3.6 LOLE Results with Compensatory MW additions for 2016 for the RNA study case

AREA	AREA-A	AREA-B	AREA-E	AREA-G	AREA-I	AREA-J	AREA-K	NYCA
2016 A1	-	0.034	0.013	0.002	0.090	0.114	0.059	0.138
2016 A2	-	0.035	0.013	0.002	0.092	0.138	0.031	0.148
2016 A3	-	0.041	0.015	-	0.061	0.082	0.052	0.105
2016 A4	-	0.041	0.015	-	0.061	0.102	0.049	0.124
2016 A5	-	0.042	0.015	-	0.061	0.102	0.027	0.112
2016 A6		0.042	0.015	.001	0.063	0.084	0.030	0.095
2016 A7		0.030	0.011		0.049	0.071	0.046	0.095
2016 A8		0.028	0.010	.001	0.062	0.086	0.049	0.109

Table 5.3.4 LOLE Results with Compensatory MW additions for 2012 through 2016 for the Study Period Base Case

AREA	AREA-A	AREA-B	AREA-E	AREA-G	AREA-I	AREA-J	AREA-K	NYCA
2012 A1	-	0.051	0.020	0.003	0.070	0.095	0.013	0.101
2012 A2	-	0.004	0.014	-	0.052	0.105	0.009	0.108
2013 A1	-	0.049	0.019	0.001	0.071	0.115	0.018	0.121
2013 A2	-	0.037	0.014	-	0.048	0.080	0.014	0.085
2014 A1	-	0.027	0.009	-	0.053	0.093	0.018	0.100
2014 A2	-	0.039	0.014	-	0.054	0.096	0.021	0.103
2015 A1	-	0.040	0.014	-	0.053	0.093	0.035	0.105
2016 A1	-	0.034	0.013	0.002	0.090	0.114	0.059	0.138
2016 A2	-	0.035	0.013	0.002	0.092	0.138	0.031	0.148
2016 A3	-	0.041	0.015	-	0.061	0.082	0.052	0.105
2016 A4	-	0.041	0.015	-	0.061	0.102	0.049	0.124
2016 A5	-	0.042	0.015	-	0.061	0.102	0.027	0.112
2016 A6		0.042	0.015	.001	0.063	0.084	0.030	0.095
2016 A7		0.030	0.011		0.049	0.071	0.046	0.095
2016 A8		0.028	0.010	.001	0.062	0.086	0.049	0.109

Review of the LOLE results indicate that there is a minimum amount of compensatory MW that must be located in load Zone J because of the existing transmission constraints into load Zone J. Potential solutions could also include a combination of additional transmission as well as resources located within the zone. Examination of the LOLE results and the transmission constraint summary indicate that there are also binding transmission constraints on UPNY/SENY and the export limit from Zone K to Zones I and J. These two constraints will limit the effectiveness of compensatory MWs in Zones A through F and K. This indicates that there is a minimum amount of compensatory MW that must be located on Zones G, H, or I in addition to the minimum in Zone J. Although the effectiveness of compensatory MW located in Zones A through F and K diminishes as the transmission constraints become more binding, these Compensatory MWs provide an initial benefit by removing the LOLE violations that are strictly related to capacity deficiencies. Due to the "lumpiness" of the 250 MW block resource additions and the nonlinearity of the results, comparisons of the effectiveness of compensatory MW location is difficult. There was no

attempt to calculate any minimum amount of compensatory MWs located in a specific area.

Finally, it should be noted that the above findings are based upon the bulk transmission system as modeled in the ~~Study Period Base Case~~RNA study case. In the 2005 Comprehensive Reliability Plan, an evaluation of the benefits of increasing the transfer capability across key transmission interfaces indicated that resources upstream of those transmission interfaces could then have a greater impact on reducing the LOLE to meet the overall NYCA reliability needs. The NYISO will evaluate any proposed solutions to increase transfer capability during the development of the CRP.

5.4   Scenarios

Scenarios are variations on key assumptions in the ~~Study Period Base Case~~RNA study case to assess the impact of possible changes in circumstances that could impact the RNA. The following scenarios were evaluated as part of the RNA.

5.4.1   Load Forecast Uncertainty - High Load Forecast

If actual load is higher than the levels forecast in this RNA, the LOLE criterion violation identified in this RNA may occur sooner. The following table illustrates the impact of the high load forecast on the Area and NYCA LOLE for the ~~Study Period Base C~~RNA study case. The table indicates that the year of need for the ~~Study Period Base C~~RNA study case occurs one year earlier for the high load forecast. Because the power analyses conducted by the NYISO is voltage constrained for the ~~Study Period Base C~~RNA study case load forecast by 2009, the system is likely to be voltage constrained at even lower transfer limits due to voltage constraints at an earlier date under the high-load forecast. The NYISO, however, has not calculated the voltage transfer limits associated with the high-load forecast scenario to determine such date.

Table 5.4.1.1 ~~Study Period Base~~RNA study ~~Case~~ case LOLE High Forecast

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
AREA-A		0.001							0.001	
AREA-B	0.003	0.012	0.045	0.081	0.109	0.174	0.204	0.303	0.432	0.569
AREA-C										
AREA-D										
AREA-E	0.001	0.004	0.016	0.031	0.044	0.008	0.102	0.16	0.257	0.368
AREA-F					0.001			0.001	0.001	0.002
AREA-G		0.001	0.002	0.006	0.006	0.009	0.011	0.024	0.034	0.053
AREA-H									0.001	0.001
AREA-I	0.004	0.013	0.059	0.111	0.142	0.27	0.367	0.573	0.832	1.203
AREA-J	0.003	0.012	0.091	0.163	0.254	0.448	0.643	0.914	1.292	1.833
AREA-K	0.001	0.003	0.004	0.009	0.014	0.037	0.056	0.111	0.201	0.410
NYCA	0.004	0.017	0.096	0.169	0.264	0.461	0.665	0.944	1.336	1.912

5.4.2   Coal Retirement/Environmental Scenario

Increasingly stringent air emission requirements such as the Regional Greenhouse Gas Initiative (RGGI), the New York State Acid Deposition Reduction Program (ADRP) and more restrictive mercury emission for generating plants will place increasing economic pressure on older generating plants as they incur increasing costs to meet these requirements. New York's older coal fired generating plants, in general, could be faced with an economic outlook that results in retirement in some number of the plants. The NYSPSC Staff recently reviewed the results of an internal study on the potential impacts of RGGI alone. Their study found that most of the nine –facilities which were reviewed showed net revenue reduction losses under the RGGI scenario, and that coal facilities were impacted significantly more than were oil or gas facilities. Therefore, to simulate the impact on LOLE and reliability if coal retirements were to occur, the NYISO constructed a scenario in which all NY coal units are retired as early as 2009 except for the Somerset and Cayuga units for a total of 1,545 MWs. The Somerset and Cayuga units were considered to be sufficiently efficient or their emissions sufficiently controlled that they may not be as significantly affected bysensitive to additional air emission requirements over time as other coal units.

In conducting this sensitivity, the NYISO is not predicting that any of these units will in fact retire in 2009 or in any later year. Indeed, it should be noted that stakeholders and the agencies involved do not agree among themselves on what the economic impact of air emission requirements will be. Rather, the NYISO is conducting a scenario to examine what the impact on resource adequacy would be, expressed in terms of the LOLE criterion, if these retirements were to occur. The NYISO calculated the LOLE results for the retirement of the coal units in New York except for Somerset and Cayuga in each year between 2009 and the end of the planning horizon. Table 5.4.2.1 presents the LOLE results for the coal retirement scenario.

Table 5.4.2.1 Coal Retirement Scenario LOLE Results

Year	2009	2010	2011	2012	2013	2014	2015	2016
AREA-A	0.001	0.002	0.001	0.002	0.001	0.001	0.001	0.001
AREA-B	0.194	0.279	0.268	0.382	0.428	0.564	0.671	0.804
AREA-C								
AREA-D								
AREA-E	0.067	0.102	0.100	0.166	0.205	0.272	0.376	0.450
AREA-F		0.002	0.002	0.002	0.002	0.002	0.003	0.003
AREA-G	0.033	0.054	0.050	0.077	0.083	0.117	0.162	0.204
AREA-H			0.001					
AREA-I	0.179	0.265	0.254	0.401	0.492	0.668	0.859	1.038
AREA-J	0.216	0.323	0.333	0.493	0.630	0.865	1.077	1.260
AREA-K	0.007	0.018	0.020	0.045	0.068	0.102	0.168	0.299
NYCA	0.257	0.371	0.389	0.539	0.67	0.914	1.139	1.340

The NYISO also conducted a sensitivity analysis in which the coal units in NY were retired until the LOLE exceeded 0.1 for the NYCA in 2009. Depending on the location, approximately 400 and 600 MW of coal retirements in 2009 resulted in an LOLE that exceeded 0.1 days per year.

5.4.3   Poletti Retirement Deferred to 2010

A sensitivity analysis was conducted to evaluate the impact on LOLE of deferring the Charles ~~Palette~~ Poletti unit until the end of 2009. The impact of the deferred retirement on transfer capability was not evaluated. Below are the resulting LOLEs ~~results of the impact of~~ for that ~~that~~ simulation for 2009.

Year	Area-A	Area-B	Area-C	Area-D	Area-E	Area-F	Area-G	Area-H	Area-I	Area-J	Area-K	NYCA
2009		0.007			0.002		0.001		0.008	0.009	0.001	0.011

5.4.4   NUG Retirement Scenario

A variety of non-utility generators were constructed in New York during the 1980s and early 1990s in response to the Public Utilities Regulatory Policy Act (PURPA) and state laws and regulatory initiatives. Many of these generators have   long-term purchase power agreements with load serving entities and/or steam hosts. As these contracts expire, it is possible that these generators could come under increasing economic pressure with respect to their ongoing economic viability. In analyzing this possibility, the NYISO is not making any prediction as to whether generators will continue to be economically viable or not.   Rather, the NYISO is conducting a scenario to examine what the impact on resource adequacy would be, expressed in terms of the LOLE criterion, if these retirements were to occur. A scenario was constructed in which capacity was retired or units derated in proportional to the amount that the expiring contracts represented of the total capacity in that load Zone. Below is the amount of capacity whose contracts ~~retire~~ expire by year and the ~~impact on~~ resulting LOLE if that amount of capacity were to retire.

Table 5.4.4.1 NUG Retirements

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Sum
AREA-A	167.1										167.1
AREA-B											
AREA-C	1.1		78.3						340	5.8	425.2
AREA-D			240								240
AREA-E	3.3			1.5					2.5	0.2	7.5
AREA-F	0.2		2.2		12.3	90		265	133.5	1	504.2
AREA-G											
AREA-H		8.5	55								63.5
AREA-I											
AREA-J					21						21
AREA-K		17.5	70.9	11.1		22.9		14		43.7	180.1
Total	171.7	26	446.4	12.6	33.3	112.9		279	476	50.7	1608.6

Table 5.4.4.2 NUG Retirement LOLE Results

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
AREA-A		0.001							0.001	
AREA-B	0.003	0.011	0.066	0.105	0.126	0.21	0.236	0.431	0.776	0.934
AREA-C										
AREA-D					0.001				0.001	0.001
AREA-E	0.001	0.003	0.025	0.041	0.051	0.091	0.108	0.210	0.443	0.543
AREA-F						0.001	0.001	0.001	0.008	0.029	0.042
AREA-G		0.001	0.003	0.006	0.008	0.012	0.011	0.025	0.049	0.064
AREA-H									0.001	0.001
AREA-I	0.003	0.011	0.077	0.126	0.148	0.257	0.318	0.527	0.928	1.154
AREA-J	0.003	0.01	0.1	0.166	0.225	0.381	0.473	0.716	1.127	1.377
AREA-K	0.001	0.002	0.006	0.013	0.019	0.043	0.06	0.125	0.261	0.477
Total	0.004	0.014	0.106	0.172	0.234	0.393	0.492	0.739	1.178	1.452

5.4.5 New York Power Authority (NYPA) New York City Purchase Power Agreement

NYPA is a major owner of transmission facilities in New York and a major load serving entity serving customers in New York City. Pursuant to a request for proposals (RFP) issued by NYPA, the Authority has contracted for 500 MW of unforced capacity (UCAP) in New York City in 2010. According to NYPA, this capacity will be provided by the construction of an alternating current (AC) transmission line between NYC and a back-to-back high-voltage direct current (HVDC) facility in New Jersey. A generator or generators in New Jersey under contract with NYPA will supply the capacity. A sensitivity was conducted to evaluate the impact on LOLE of a generator equivalent to 500 MW of UCAP in load Zone J was evaluated. Below are the LOLE results for that sensitivity.

Table 5.4.5.1 NYPA PPA LOLE Results

Year	2010	2011	2012	2013	2014	2015	2016
AREA-A							0.001
AREA-B	0.024	0.041	0.057	0.072	0.093	0.129	0.153
AREA-C							
AREA-D							
AREA-E	0.009	0.014	0.022	0.028	0.038	0.059	0.073
AREA-F				0.001			
AREA-G	0.001	0.003	0.004	0.005	0.007	0.010	0.014
AREA-H						0.001	
AREA-I	0.029	0.050	0.076	0.108	0.146	0.227	0.320
AREA-J	0.038	0.058	0.095	0.145	0.187	0.294	0.390
AREA-K	0.003	0.006	0.013	0.024	0.040	0.071	0.117
NYCA	0.042	0.063	0.101	0.152	0.201	0.314	0.417

5.4.6 *NYPA Clean Coal Initiative*

NYPA has announced that it intends to negotiate with NRG Energy Inc for a purchase power agreement to purchase the output of 680 MW coal gasification combined cycle unit or clean coal unit to be in service by the summer of 2013. The NYISO conducted a sensitivity to evaluate the impact of the construction of that facility on the ~~Study Period Base C~~RNA study case NYCA LOLE beginning in 2013. This facility is to be located at the Huntley unit site in load Zone A. Below is the LOLE results of that sensitivity.

Table 4.4.6.1 NYPA Clean Coal Initiative LOLE Results

Year	2013	2014	2015	2016
AREA-A				
AREA-B	0.041	0.055	0.07	0.074
AREA-C				
AREA-D				
AREA-E	0.016	0.026	0.031	0.038
AREA-F				
AREA-G	0.003	0.005	0.006	0.009
AREA-H				
AREA-I	0.131	0.198	0.297	0.400
AREA-J	0.266	0.378	0.522	0.668
AREA-K	0.015	0.029	0.053	0.094
NYCA	0.276	0.39	0.538	0.692

5.5   Observations and Recommendations

The NYISO's analysis of the ~~Study Period Base Case~~RNA study case system, compensatory MW~~s~~, scenarios, and the sensitivities and the resource adequacy deficiencies identified herein indicate that there are various combinations of resources located in different NYISO load Zones that could address the reliability needs. Following issuance of the RNA, the NYISO will solicit market-based solutions to the identified reliability needs pursuant to Section 6.2 Attachment Y. ~~identified in the NYCA beginning in 2011.~~

~~TT~~Since these combinations of resources which will address the reliability needs appear across NYISO load Zones located in the transmission districts of all of the New York Transmission Owners, . ~~Accordingly,~~ all NYCA Transmission Owners are designated as ~~responsible~~ Responsible Transmission Owners. Attachment Y requires the ~~responsible~~ Responsible Transmission Owners to develop a regulated backstop solution or combination of solutions to address ~~correct~~ the identified ~~unacceptable~~ statewide or NYCA LOLE needs ~~results~~ determined in this RNA~~.~~

The regulatory backstop solutions may take the form of alternative solutions of possible resource additions and system changes. Such proposals shall also provide an estimated implementation schedule so that ~~a~~ trigger date_s_ can be determined by the NYISO for purposes of beginning the regulatory approval and development

processes for the~~ose~~ backstop solutions ~~should~~ if market solutions do not ~~timely~~ materialize in time to meet the reliability needs.

6   Historic Congestion

The graph below presents cumulative historical congestion dollars as determined by the bid-production-cost-savings methodology for the years 2003, 2004, 2005 and the first quarters of 2006. The results through 2006 Q1 are below those of previous years. The favorable trend in congestion is the result of a reduction in natural gas prices and the addition of new efficient combined cycle capacity in Zone J or New York City. There were no unusual days in Q1 2006 and the binding constraints are similar to previous years. The detailed congestion information can be found on the NYISO web site under Services Planning.

Comparative Cumulative Congestion -- BPC impact