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Comprehensive Reliability Planning Process Supporting Document and Appendices For The 2007 Draft Reliability Needs Assessment

Prepared by the NYISO Planning Staff
for the
3/1/07 Management Committee Meeting
As approved at the 2/14/07 Operating Committee Meeting

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Table of Contents

Table of Tables

Table of Figures

1 Introduction

In general, restructuring of the electric power industry has led to the unbundling of generation and transmission development. Largely gone are the days of planning when generation and transmission plans were highly coordinated. In today's world, the reliability of the power system is dependent on a combination of resources provided by market forces and regulated wires companies. The NYISO's Comprehensive Reliability Planning Process (CRPP) provides a forum to evaluate reliability needs and to evaluate market-based and regulatory solutions to those needs. The objectives of the CRPP are stated in Section 1.1 of NYISO's Open Access Transmission Tariff (OATT) Attachment Y.

The first step in the CRPP is the development of the draft Reliability Needs Assessment (RNA) The RNA study case refers to the entire ten years of the Study Period encompassing the Five Year Base Case and the second five years. In addition to analysis of the RNA study case conditions, sensitivity and scenario analyses have been conducted to identify opportunities or risks that should be monitored or considered by the CRPP in the development of the final RNA. One of the primary objectives of the draft RNA is to provide an opportunity for the Electric System Planning Working Group (ESPWG) and the Transmission Planning Advisory Subcommittee (TPAS) to review the RNA study case, sensitivity, and scenario analyses that have been conducted, and to provide input into the development of the final RNA.

This report constitutes the supporting documentation for the second RNA prepared by the New York Independent System Operator. It represents the second in a series of CRPP plans that are conducted on an annual cycle to address the long-term reliability needs of the New York State bulk power system. The first RNA was dated 2005 to reflect the fact that is was based upon 2005 NYISO Gold Book data, even though the ten-year study period encompassed by that RNA was 2006 to 2015. The RNA should be dated based upon the first year of the Study Period rather than the year of the Gold Book date used. Accordingly, this second RNA is designated the 2007 RNA because it encompasses a study period of 2007 to 2016. 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 also provides information that is both informative and of value to the New York wholesale electricity marketplace.

This supporting documentation contains: (i) an overview of the CRPP; (ii) a recitation of the finding of reliability needs and scenarios set forth in the draft RNA; (iii) analysis that supports those findings and; (iv) the methodology used to perform the analysis.

2 The Comprehensive Reliability Planning Process

The following presents an overview and summary of the CRPP, the CRPP stakeholder process, and the reliability policies and criteria that are the foundation of the CRPP.

2.1 Summary of the CRPP

The CRPP is a long-range assessment of both resource adequacy and transmission reliability of the New York bulk power system conducted over a 10-year planning horizon. It is conducted in accordance with the existing reliability criteria of the North American Electric Reliability Council (NERC), the Northeast Power Coordinating Council (NPCC), and the New York State Reliability Council (NYSRC) as they may change from time to time. This process is anchored in the NYISO's philosophy in which market-based solutions are the first choice to meet identified reliability needs. However, in the event that market-based solutions do not appear to meet a reliability need in a timely manner, the NYISO will designate the Responsible Transmission Owner to proceed with a regulated backstop solution in order to maintain reliability. Under the CRPP, the NYISO also investigates whether market failure is the reason for the lack of a market-based solution, and explores changes in its market rules if that is found to be the case.

As the first step in the CRPP, the NYISO conducts a Reliability Needs Assessment (RNA) to determine whether there are any violations of existing reliability rules governing resource adequacy and transmission security. Following the review of the RNA by the NYISO committees and final approval by the NYISO Board of Directors, the NYISO will request solutions to the identified reliability needs from the marketplace. At the same time, the responsible Transmission Owners are obligated to prepare regulated backstop solutions for each identified need over the planning horizon, which will serve as the benchmark to establish the time by which a market-based solution must appear. Both market-based and regulated solutions are open to all types of resources: transmission, generation, and demand response. Non-transmission owner developers also have the ability to submit proposals for regulated solutions in the event that no valid market based solution is proposed. The NYISO evaluates all proposed solutions to determine whether they are viable and will meet the identified reliability needs in a timely manner. The NYISO does not conduct an economic evaluation of the proposed solutions.

Following its analysis of all proposed solutions, the NYISO prepares a Comprehensive Reliability Plan (CRP or Plan). The CRP identifies all proposed solutions that the NYISO determines are capable of meeting the identified reliability needs. If a viable market-based project or projects can satisfy the identified needs in a timely manner, the CRP will so state. If developers do not present viable market-based proposals and the NYISO determines that a regulated backstop solution must be implemented, the CRP will so state, and the NYISO will request the appropriate Responsible Transmission Owner(s) to proceed with regulatory approval and development of the backstop solution. The NYISO also monitors the continued viability of proposed projects to meet identified needs and reports its findings in subsequent Plans.

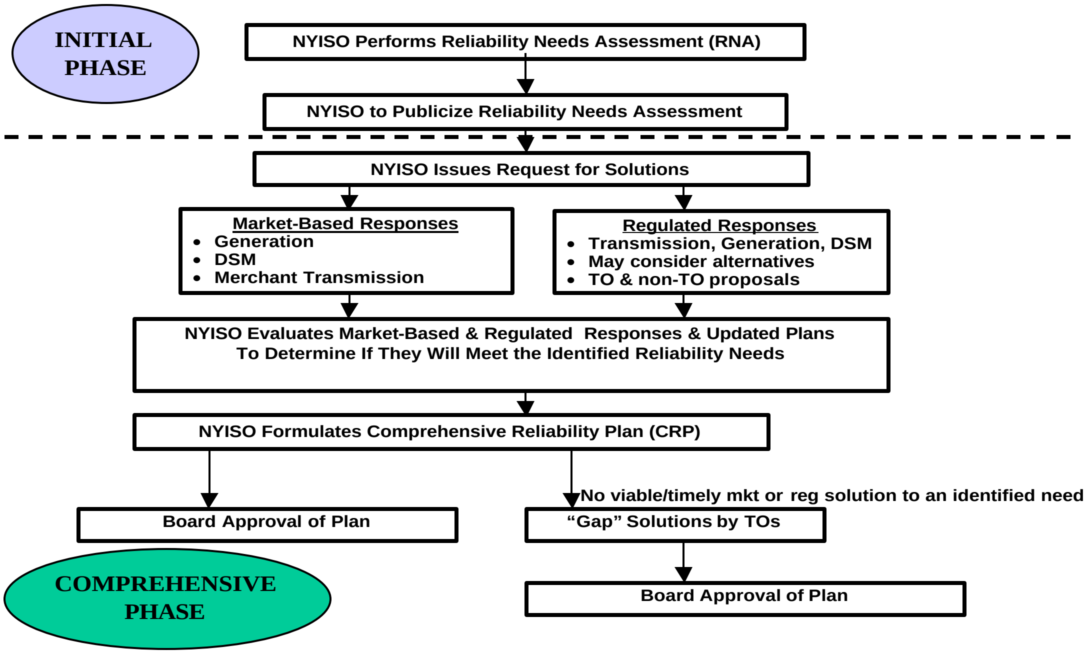
The CRPP also allows the NYISO Board to address the appearance of a reliability need on an emergency basis, whether during or in-between the normal CRPP cycle. In the event that there is an immediate threat to reliability, the NYISO will request the appropriate Transmission Owner(s) to develop a "gap solution" and to pursue its regulatory approval and completion in conjunction with the New York State Public Service Commission (NYSPSC). Gap solutions are intended to be temporary and not to interfere with pending market-based projects.

The CRPP also addresses the issues of cost allocation and cost recovery for regulatory backstop solutions to reliability needs. The Tariff contains a set of principles for cost allocation based upon the principle that beneficiaries should pay. The NYISO continues to be engaged in a stakeholder process to develop procedures for cost allocation. Cost recovery for regulated transmission solutions will be addressed through a separate rate schedule in the NYISO's Services Tariff, while cost recovery for non-transmission solutions will be subject to the NYSPSC's procedures.

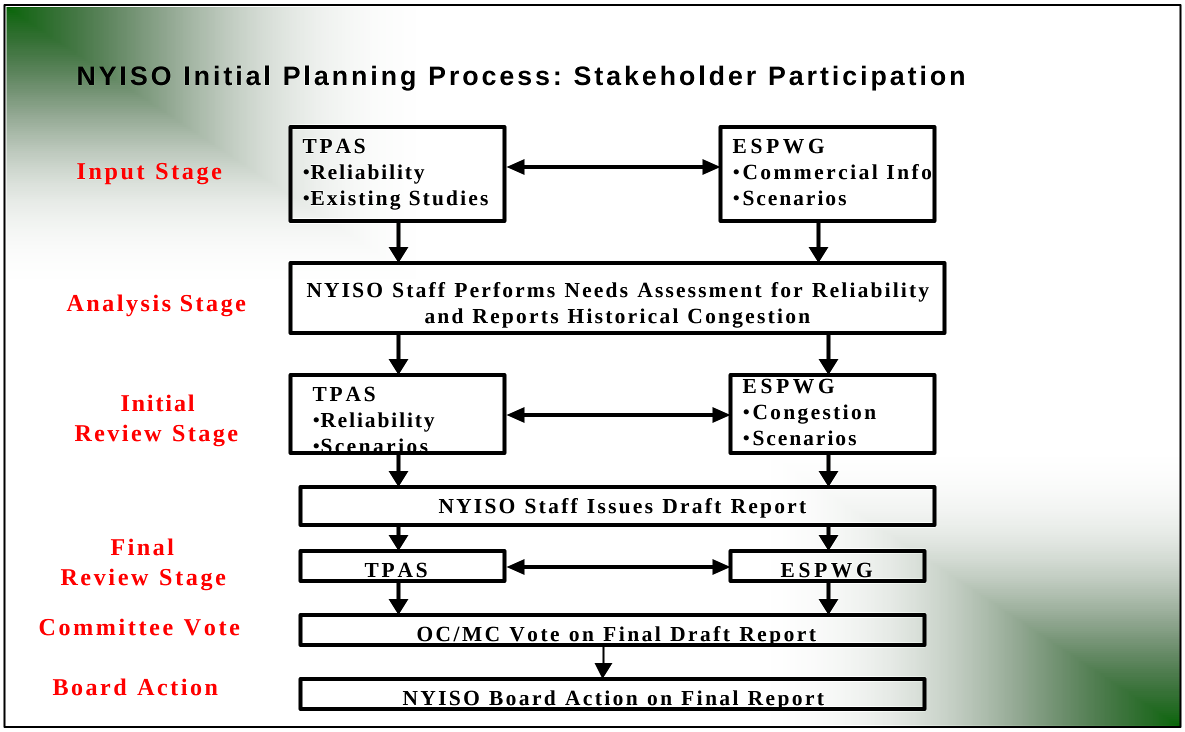
The CRPP also addresses the respective roles of the NYISO, the FERC and the NYSPSC with regard to the NYISO planning process. In the event of a dispute regarding the NYISO's findings in the RNA or the CRP that cannot be resolved through the normal NYISO governance procedures, the Tariff provides for disputes to be brought to either the FERC or the NYSPSC—depending upon the nature of the dispute. In the event that a Transmission Owner is unable to license or complete a regulated backstop solution that has been found necessary during the course of the CRPP, the NYISO is required to report this to the FERC. Upon request, the NYSPSC will review proposed regulated solutions from either a Transmission Owner or another developer prior to their submission to the NYISO.

A separate, FERC-approved agreement between the NYISO and the New York Transmission Owners addresses the Transmission Owner's rights and obligations for performance under the CRPP. This agreement also envisions the establishment of a separate rate recovery mechanism, to be approved by FERC, for the recovery of costs associated with the development and construction of a regulated transmission backstop solution required by the CRP. The process flow diagram below summarizes the CRPP Stakeholder Process.

NYISO Reliability Planning Process



Given that the CRPP addresses both reliability and business issues, it has been agreed that both the TPAS and the ESPWG participate in the implementation process. This participation consisted of parallel input and review stages as shown in the diagram below.



TPAS has primary responsibility for the reliability analyses, while the ESPWG has primary responsibility for providing commercial input and assumptions utilized in the development of reliability assessment scenarios and the reporting and analysis of historic congestion costs. Coordination between these two groups and NYISO Staff was established during each stage of the initial planning process.

The intent of this process is to achieve consensus at both TPAS and the ESPWG. While no formal voting process is established at this level, which is typical for NYISO working groups, an opportunity for reporting majority and minority views is provided in the absence of a consensus.

Following TPAS and ESPWG review, the draft RNA and CRP reports are forwarded to the Operating Committee for discussion and action, and subsequently to the Management Committee for discussion and action. Finally, the NYISO's Board of Directors reviews and approves the RNA and the CRP.

2.2 Summary of Reliability Policies and Criteria Applicable to the NYISO

The foundation of the CRPP and the RNA is the reliability policies and criteria applicable to the NYISO. The phrase "reliability policy and criteria" is used broadly to include standards, requirements, guidelines, practices, and compliance. The following presents an overview of these policies and criteria in the context of basic reliability concepts and the organizations that develop, promulgate, implement, and enforce the related policies and criteria.

2.2.1 Basic Reliability Concepts

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 refers to 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. A system is adequate if the probability of not 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). The New York State Power System is planned to meet a LOLE representative of an involuntary load disconnection event not more than once in every 10 years, or 0.1 days per year. This requirement forms the basis of New York's resource adequacy and installed capacity requirements.

Security is an operating and deterministic concept. This means that possible events are identified as having significant adverse reliability consequences and the bulk power 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 minus 1" (N-1) or "N minus 2" (N-2). In this definition, "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.

2.2.2 Organizational Structure

Reliability policies are developed, promulgated, implemented, and enforced by various organizations at different levels. These include federal and state regulators, industry-created organizations such as the North American Electric Reliability Council (NERC) and its member organizations, transmission owners, and energy market participants.

NERC was formed as a voluntary, not-for-profit organization in 1968 in response to the blackout of 1965. A ten-member Board of Trustees governs NERC with input from an industry Stakeholder Committee. NERC has formulated planning standards and operating policies. Pursuant to the Energy Policy Act of 2005, the Federal Energy Regulatory Commission approved NERC as the Electric Reliability Organization for North America in 2006. FERC is in the process of approving the governance structure and funding of NERC, as well as mandatory electric reliability standards that will be enforced by NERC.

Ten Regional Reliability Councils currently comprise NERCO's membership; and members of these councils come from all segments of the industry. New York State is an Area within the Northeast Power Coordinating Council (NPCC), which includes New England and northeastern Canada. NPCC implements broad-based, industry wide reliability standards tailored to its region. NERC and NPCC have requested FERC's approval of a delegation agreement by which NPCC will oversee and enforce compliance with NERC and NPCC standards in the northeastern regions of the United States and Canada.

New York State also has its own electric reliability organization, which is the New York State Reliability Council (NYSRC). The NYSRC is a not-for-profit organization that promulgates reliability rules and monitors compliance on the New York State Power System. The NYISO, and all organizations engaging in electric transactions on the state's power system must comply with these rules. Thirteen members from different segments of the electric power industry govern the NYSRC. New York-specific reliability rules may be more detailed or stringent than NERC Standards and Policies and NPCC Criteria. Local reliability rules that apply to certain zones within New York may be even more stringent than statewide reliability rules.

2.2.3 Reliability Policies and Criteria

Similar to the national, regional and state levels of reliability organizations, there are national, regional and state levels of documents comprising the reliability standards, policies and criteria that govern the New York bulk power system. Presently, NERC has two major types of such documents: Operating and Planning Standards.

Planning Standards documents provide the fundamental planning requirements. The interconnected bulk electric system must be planned so that the aggregate electrical demand and energy requirements of customers are satisfied, taking into account scheduled and reasonably expected unscheduled outages of system elements, and capable of withstanding sudden disturbances. Regional Councils may develop planning criteria that are consistent with those of NERC.

NERC's Operating Standards provide the fundamental operating requirements. The interconnected bulk electric system must be operated in secure state such that the aggregate electrical demand and energy requirements of customers are satisfied in real time. Primary responsibility for reliable operation is vested with the control area operators; for New York State, this is the NYISO. A "control area" is the basic operating unit of an exclusive portion of the interconnected power system. The thrust of these Operating Standards is to promote reliable interconnection operations within each of the three interconnections in North America without burdening other entities within the interconnection. The NYISO is within the Eastern Interconnection.

NPCC has three basic categories of documents: Criteria, Guidelines, and Procedures, respectively referred to as Type A, B, and C documents. The foundational NPCC document is A-2, Basic Criteria for Design and Operation of

Interconnected Power Systems, which establishes the principles of interconnected planning and operations.

The NYSRC Reliability Rules for Planning and Operating the New York State Power System includes the required rules and defines the performance that constitutes compliance. These rules include NERC Planning Standards and Operating Policies; NPCC Criteria, Guidelines and Procedures; New York-specific reliability rules; and local transmission owner reliability rules. The NYISO's implementation and compliance with NYSRC Reliability Rules are codified in its Operations, Planning, and Administrative manuals and other written procedures.

The NYSRC establishes the annual statewide installed capacity requirement (ICR) to maintain resource adequacy. Factors that are considered in establishing the ICR include the characteristics of loads, uncertainty in load forecast, outages and deratings of generation units, the effects of interconnections to other control areas, and transfer capabilities of the state's transmission system. The NYISO determines installed capacity (ICAP) requirements for load serving entities (LSEs), including any locational ICAP requirements.

3 Reliability Needs

3.1 Introduction

This reliability needs assessment for the New York State bulk-power system of the RNA study case indicates that the forecasted system exceeds the 0.1 days per year reliability criteria starting in the year 2011 with 2010 just meeting the 0.1 days per year criteria**.** Continued load growth with only transmission additions, increases the deficiency well above 0.1 for the years 2012 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 RNA study case. These additions have had major impact on the RNA 2007 finding of need, in particular, for load Zone K. In this RNA the NYISO has assumed a reasonable projection of load growth but has not included any capacity or demand-side resource assumptions beyond the Five Year Base Case.

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[1] transmission interface. In addition, approximately 52% of the NYCA load will be located in load Zones J and K, downstream of the Dunwoodie-South transmission interface, which is a slight increase from current load levels.

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 4.1, load growth, neighboring system changes and the lack of new capacity or transmission resources downstream of the UPNY-SENY interface, have and will continue to result in voltage criteria violations at much lower transfer levels than have previously occurred 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:

3.2 Reliability Needs

3.2.1 RNA study case:

The RNA study case refers to the entire ten years of the Study Period encompassing the Five Year Base Case and the second five years. The RNA study case transfer limits[2] (from the analysis conducted with the updated transmission topology) were employed to determine resource adequacy needs (defined as a

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[1] 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

[2] The 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.

loss-of-load-expectation or LOLE that exceeds 0.1 days per year). The first year that the NYCA is at or exceeds 0.1 days per year is 2011, with a LOLE of 0.15 days per year. The year 2010 is just at criteria. The LOLE for the NYCA increases to 0.76 days per year by 2016. The LOLE[3] results for the entire ten-year RNA study case are summarized in the table below:

Table 3.2.1.1 LOLE for the RNA study case Transfer Limits[4]Year

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
AREA-A										
AREA-B		0.01	0.03	0.04	0.06	0.09	0.10	0.13	0.17	0.19
AREA-C										
AREA-D										
AREA-E				0.02	0.02	0.04	0.04	0.06	0.08	0.10
AREA-F										
AREA-G							0.01	0.01	0.01	0.01
AREA-H										
AREA-I		0.01	0.04	0.06	0.08	0.14	0.18	0.27	0.37	0.46
AREA-J		0.01	0.05	0.010	0.14	0.25	0.32	0.44	0.59	0.74
AREA-K					0.01	0.02	0.02	0.05	0.08	0.12
NYCA		0.01	0.06	0.10	0.15	0.25	0.33	0.46	0.60	0.76

3.2.2 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 limits have on LOLE. The LOLE results for this sensitivity indicate the potential for a one-year deferral of the first year of need if the voltage limits are resolved. The detailed results are presented in the table below:

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[3] 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. The MARS logic prorates capacity to zones if more than one zone is capacity deficient.

[4] The 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.

Table 3.2.2.1 LOLE Results for the RNA study case System Based on Thermal Transfer Limits

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
AREA-A										
AREA-B		0.01	0.03	0.04	0.06	0.09	0.10	0.13	0.17	0.19
AREA-C										
AREA-D										
AREA-E			0.01	0.02	0.02	0.04	0.04	0.06	0.08	0.10
AREA-F										
AREA-G					0.01	0.01	0.01	0.02	0.02	0.03
AREA-H										
AREA-I		0.01	0.04	0.06	0.08	0.14	0.18	0.27	0.38	0.47
AREA-J		0.01	0.04	0.07	0.10	0.18	0.22	0.33	0.46	0.57
AREA-K				0.01	0.01	0.02	0.03	0.06	0.10	0.17
NYCA		0.01	0.05	0.07	0.10	0.19	0.23	0.35	0.48	0.60

3.2.3 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 resource need or strictly transmission limitations. The results indicate the first year of need to be 2012.

Table 3.2.3.1 LOLE for the RNA study case System Based on Free Flowing Conditions

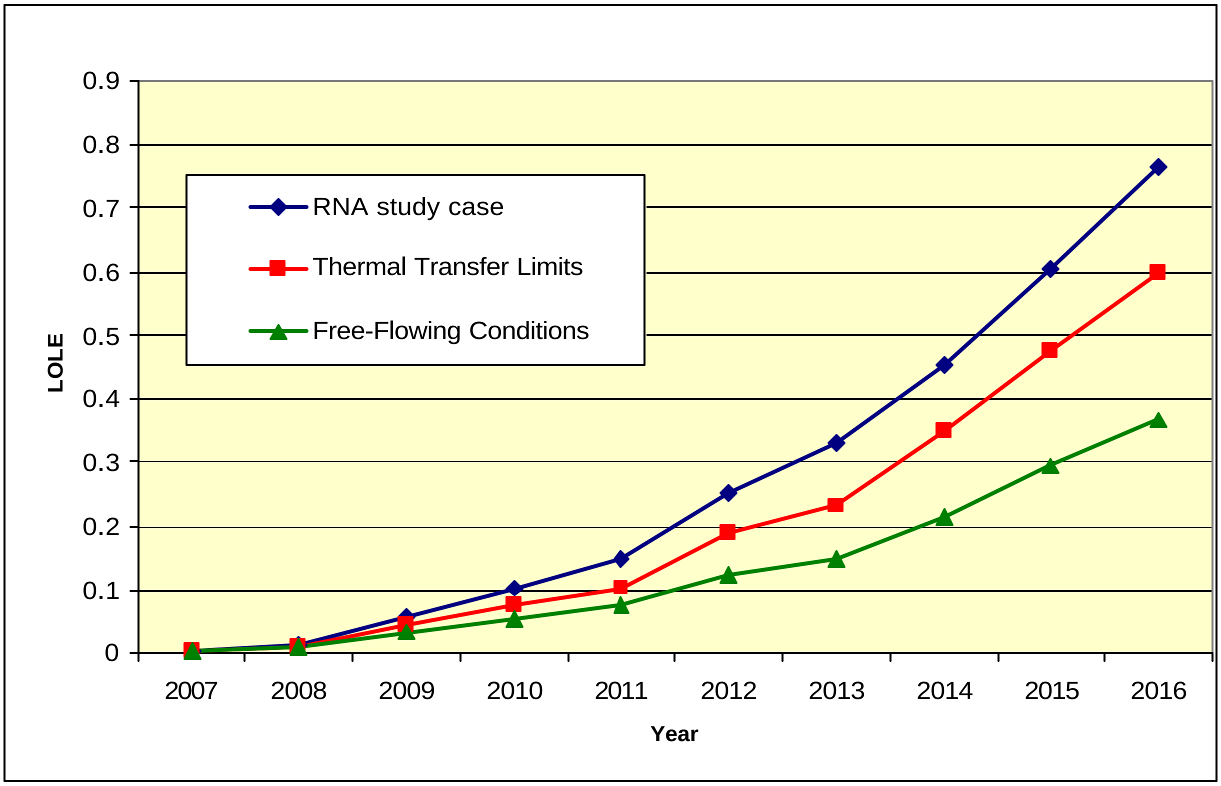
Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
AREA-A										
AREA-B		0.01	0.03	0.04	0.06	0.10	0.12	0.17	0.24	0.29
AREA-C										
AREA-D										
AREA-E				0.02	0.02	0.04	0.04	0.07	0.10	0.13
AREA-F										
AREA-G					0.01	0.01	0.01	0.01	0.02	0.03
AREA-H										
AREA-I		0.01	0.03	0.05	0.07	0.11	0.13	0.19	0.26	0.32
AREA-J		0.01	0.03	0.05	0.07	0.12	0.14	0.21	0.29	0.36
AREA-K					0.01	0.01	0.02	0.03	0.05	0.09
NYCA		0.01	0.03	0.05	0.08	0.12	0.15	0.21	0.30	0.37

3.2.4 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 result above 0.1 days per year indicates that resources are required to maintain reliability, and therefore triggers a need to identify resources. These results indicate the first definitive year of need is 2011for the RNA study case and 2012 for the two other sensitivities that were studied.

Further, the review of both the free-flowing transmission sensitivity (with LOLE of 0.08 in 2011, 0.12 in 2012 and 0.37 in 2016) and the thermally limited transmission sensitivity (with LOLE of 0.10 in 2011, 0.19 in 2012 and 0.60 in 2016) indicates that the need for 2011 results largely from transmission constraints and not an overall resource deficiency in NYCA. Beyond 2011, the need results from an overall resource deficiency in the NYCA as well as transmission constraints.

Chart 3.2.4.1 Presents A Summary of the LOLE Results for the RNA study case, thermal and "free flowing" sensitivities



3.3 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 transfer limit sensitivities, and scenario assessments provide information that can be used to guide the compensatory MWs analyses. It should be noted that there may be other combinations of compensatory MWs that 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 that 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 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 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. The compensatory MWs indicated for an area may also be provided by resources in other areas combined with additional transfer capability into the affected area. 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 3.3.1 Compensatory MW additions for the 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 3.3.2 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		0.04	0.02		0.05	0.09	0.01	0.09
2011 A2		0.03	0.01		0.04	0.10		0.10

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. Because the purpose of the analyses is 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 an LOLE of no greater than 0.1 days per year. Initially, sensitivity analysis was performed for the last year of the planning horizon, 2016 (see Table 3.3.4), to identify potential areas where compensatory MWs could be added to meet the reliability needs. A total of 1,750 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 3.3.5 below, in year 2016 for alternatives A1 through A6. In addition, a total of 2,000 MWs consisting of eight generic units were added for two more alternatives A7 and A8, the results for which are also presented in table 3.3.5. 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 3.3.3 Compensatory MW[5] additions for 2012 through 2015 for the 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

Table 3.3.4 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		0.05	0.02		0.07	0.10	0.01	0.10
2012 A2			0.01		0.05	0.11	0.01	0.11
2013 A1		0.05	0.02		0.07	0.12	0.02	0.12
2013 A2		0.04	0.01		0.05	0.08	0.01	0.09
2014 A1		0.03	0.01		0.05	0.09	0.02	0.10
2014 A2		0.04	0.01		0.05	0.10	0.02	0.10
2015 A1		0.04	0.01		0.05	0.09	0.04	0.11

Table 3.3.5 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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[5] The NYCA compensatory MWs are the total MWs for that alternative for that year.

Table 3.3.6 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		0.03	0.01		0.09	0.11	0.06	0.14
2016 A2		0.04	0.01		0.09	0.14	0.03	0.15
2016 A3		0.04	0.02		0.06	0.08	0.05	0.11
2016 A4		0.04	0.02		0.06	0.10	0.05	0.12
2016 A5		0.04	0.02		0.06	0.10	0.03	0.11
2016 A6		0.04	0.02		0.06	0.08	0.03	0.10
2016 A7		0.03	0.01		0.05	0.07	0.05	0.10
2016 A8		0.03	0.01		0.06	0.09	0.05	0.11

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. These circumstances indicate 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 non-linearity of the results, comparisons of the effectiveness of different compensatory MW locations 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 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.

3.4 Scenarios

Scenarios are variations on key assumptions in the 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.

3.4.1 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 will occur sooner. The following table illustrates the impact of the high load forecast on the Area and the NYCA LOLE for the RNA study case. The high load forecast scenario is postulated on higher than expected economic growth over the planning Study period. The peak load growth rate for this scenario is 1.25% vs. 0.93% for the expected growth rate. The prior historical ten-year growth rate was 1.88%. The table indicates that the year of need for the 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 RNA study case load forecast by 2009, the system is likely to be voltage constrained at even lower transfer limits due to voltage constraints before 2009 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 3.4.1.1 RNA study case LOLE High Forecast

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
AREA-A										
AREA-B		0.01	0.05	0.08	0.11	0.17	0.20	0.30	0.43	0.57
AREA-C										
AREA-D										
AREA-E			0.02	0.03	0.04	0.01	0.10	0.16	0.26	0.37
AREA-F										
AREA-G				0.01	0.01	0.01	0.01	0.02	0.03	0.05
AREA-H										
AREA-I		0.01	0.06	0.11	0.14	0.30	0.37	0.57	0.83	1.20
AREA-J		0.01	0.09	0.16	0.25	0.45	0.64	0.91	1.29	1.83
AREA-K				0.01	0.01	0.04	0.06	0.11	0.20	0.41
NYCA		0.02	0.10	0.17	0.26	0.46	0.67	0.94	1.34	1.91

3.4.2 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 limits for generating plants will place increasing economic pressure[6] 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 New York Department of Public Service (DPS) 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 under the RGGI scenario, and that coal facilities were impacted significantly more than were oil or gas facilities. Therefore, to simulate the potential impact on LOLE and reliability if such a

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[6] There are a number of other environmental compliance requirements such as the Clean Water Act which could impact the economic viability of older generating units. These factors are discussed in detail beginning on page 52 of the Supporting Document.

program were to result in coal retirements[7] beyond those in the base case, the NYISO constructed a scenario in which all New York coal units except for the Somerset and Cayuga units are retired during the course of 2009, 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 sensitive 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 state agencies involved do not agree among themselves on what the economic impact and as a result, the potential reliability impacts, 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 3.4.2.1 presents the LOLE results for the coal retirement scenario.

Table 3.4.2.1 Coal Retirement Scenario LOLE Results

Year	2009	2010	2011	2012	2013	2014	2015	2016
AREA-A								
AREA-B	0.19	0.28	0.27	0.38	0.43	0.56	0.67	0.80
AREA-C								
AREA-D								
AREA-E	0.07	0.10	0.10	0.17	0.21	0.27	0.38	0.45
AREA-F								
AREA-G	0.03	0.05	0.05	0.08	0.08	0.12	0.16	0.20
AREA-H								
AREA-I	0.18	0.27	0.25	0.40	0.49	0.67	0.86	1.04
AREA-J	0.22	0.32	0.33	0.49	0.63	0.87	1.08	1.26
AREA-K	0.01	0.02	0.02	0.05	0.07	0.10	0.17	0.30
NYCA	0.26	0.37	0.39	0.54	0.67	0.91	1.14	1.34

The NYISO also conducted a sensitivity analysis in which the coal units in New York 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.

3.4.3 Poletti Retirement Deferred to 2010

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

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[7] Currently, coal units account for 9% of NYCA installed capacity and approximately 14% of energy generated. Retirement of coal units could result in a major change in the NYISO current fuel mix and lessen its overall fuel diversity.

Table 3.4.3.1 Deferred Retirement of the Charles Poletti Generating Unit

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		0.01							0.01	0.01		0.01

3.4.4 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 Utility Regulatory Policies 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, some of which expire during the Study Period. 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 conducted 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 proportion to the amount that the expiring contracts represented of the total capacity in that load Zone. Below is the amount of capacity for which contracts expire, by year, and the resulting LOLE if that amount of capacity were to retire.

Table 3.4.4.1 NUG Retirements Year

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

Source of data is the New York Power Pool 1999 “Load and Capacity” report.

Table 3.4.4.2 NUG Retirement LOLE Results

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
AREA-A										
AREA-B		0.01	0.07	0.11	0.13	0.21	0.24	0.43	0.78	0.93
AREA-C										
AREA-D										
AREA-E			0.03	0.04	0.05	0.09	0.11	0.21	0.44	0.54
AREA-F								0.01	0.03	0.04
AREA-G				0.01	0.01	0.01	0.01	0.03	0.05	0.06
AREA-H										
AREA-I		0.01	0.08	0.13	0.15	0.26	0.32	0.53	0.93	1.15
AREA-J		0.01	0.10	0.17	0.23	0.38	0.47	0.72	1.13	1.38
AREA-K			0.01	0.01	0.02	0.04	0.06	0.13	0.26	0.48
Total		0.01	0.11	0.17	0.23	0.39	0.49	0.74	1.18	1.45

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

NYPA is a major owner of transmission facilities in New York outside New York City and a major load serving entity serving customers in New York City. Pursuant to a request for proposals (RFP) issued by NYPA, the Authority Board has authorized NYPA Staff to negotiate a contract 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 analysis 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 which indicate the first year of need to be 2013.

Table 3.4.5.1 NYPA PPA LOLE Results

Year	2010	2011	2012	2013	2014	2015	2016
AREA-A							
AREA-B	0.02	0.04	0.06	0.07	0.09	0.13	0.15
AREA-C							
AREA-D							
AREA-E	0.01	0.01	0.02	0.03	0.04	0.06	0.07
AREA-F							
AREA-G				0.01	0.01	0.01	0.01
AREA-H							
AREA-I	0.03	0.05	0.08	0.11	0.15	0.23	0.32
AREA-J	0.04	0.06	0.10	0.15	0.19	0.29	0.39
AREA-K		0.01	0.01	0.02	0.04	0.07	0.12
NYCA	0.04	0.06	0.10	0.15	0.20	0.31	0.42

3.4.6 NYPA Clean Coal Initiative

NYPA has announced that it has given a conditional award to NRG Energy Inc, subject to the accomplishment of certain goals contained in a MOU, to purchase the output of a 680 MW coal integrated gasification combined cycle unit (IGCC) 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 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 3.4.6.1 NYPA Clean Coal Initiative LOLE Results

Year	2013	2014	2015	2016
AREA-A				
AREA-B	0.04	0.06	0.10	0.07
AREA-C				
AREA-D				
AREA-E	0.02	0.03	0.03	0.04
AREA-F				
AREA-G		0.01	0.01	0.01
AREA-H				
AREA-I	0.13	0.20	0.30	0.40
AREA-J	0.27	0.38	0.52	0.67
AREA-K	0.02	0.03	0.05	0.09
NYCA	0.28	0.40	0.54	0.69

3.5 Observations and Recommendations

The NYISO's analysis of the RNA study case system, compensatory MWs, 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.

As stated above, the need for 2011 can be met through compensatory megawatts being located in load zones G through J , which are below the UPNY – SENY interface. Accordingly, the Transmission Owners in those Transmission Districts, namely Consolidated Edison, Orange and Rockland and Central Hudson, are designated as the Responsible Transmission Owners for purposes of identifying backstop regulated solutions for 2011. For 2012 through 2016, since the combinations of resources which can address the reliability needs can be located across NYISO load Zones located in the Transmission Districts of most of the New York Transmission Owners, all NYCA Transmission Owners, except for the New York Power Authority, are designated as Responsible Transmission Owners. Attachment Y requires the Responsible Transmission Owners to develop a regulated backstop solution or combination of solutions to address the identified statewide (NYCA) LOLE needs determined in this RNA. The NYISO expects that NYPA will work with the other Transmission Owners on the development of regulated backstop solutions to the statewide needs on a voluntary basis.

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 trigger dates can be determined by the NYISO for purposes of beginning the regulatory approval and development processes for the backstop solutions if market solutions do not materialize in time to meet the reliability needs.

The current New York ISO market rules recognize the need to have defined quantities of capacity specifically located on Long Island, within New York City and available as dedicated resources to the New York Control Area as a whole so that the system can perform reliably. The NYISO has implemented a capacity market that is designed to procure and pay for at least the minimum requirements in each area. If these mechanisms work as intended and continue to require resources at the same levels as have existed in the past, they should result in the addition of new resources to meet most or all of the New York City and Long Island needs identified in this RNA. The control area wide requirement would result in additions that are needed to meet statewide reliability requirements.

4 The New York Power Grid in Context

On December 1, 1999, the NYISO assumed responsibility for the operation of New York State's bulk power system and of the newly established electric energy markets. New York's wholesale energy markets were established coincident with the establishment of the NYISO. Prior to December 1, operation of the bulk power system was the responsibility of the New York Power Pool. The NYISO is charged with two overriding responsibilities: first, maintain the safe and reliable operation of New York's bulk power system; and second, operate fair, non-discriminatory and effective wholesale electric markets.

Geographically, the New York Control Area (NYCA) is situated in the center of the Northeastern North America electrical grid, which includes the Mid-Atlantic and New England States in the US and the Canadian Provinces of Ontario, Quebec, and Maritimes. Figure 4.1 displays the major electricity markets operating in the region along with their most recent peak loads. This area includes a customer load greater than the entire Western Interconnection and provides electric service to the capital cities of two members of the G-7 nations as well as the financial capital of the world. It should be noted that the total nominal transfer capability between the control areas in the Northeast is less than 5% of the total peak load of the region.

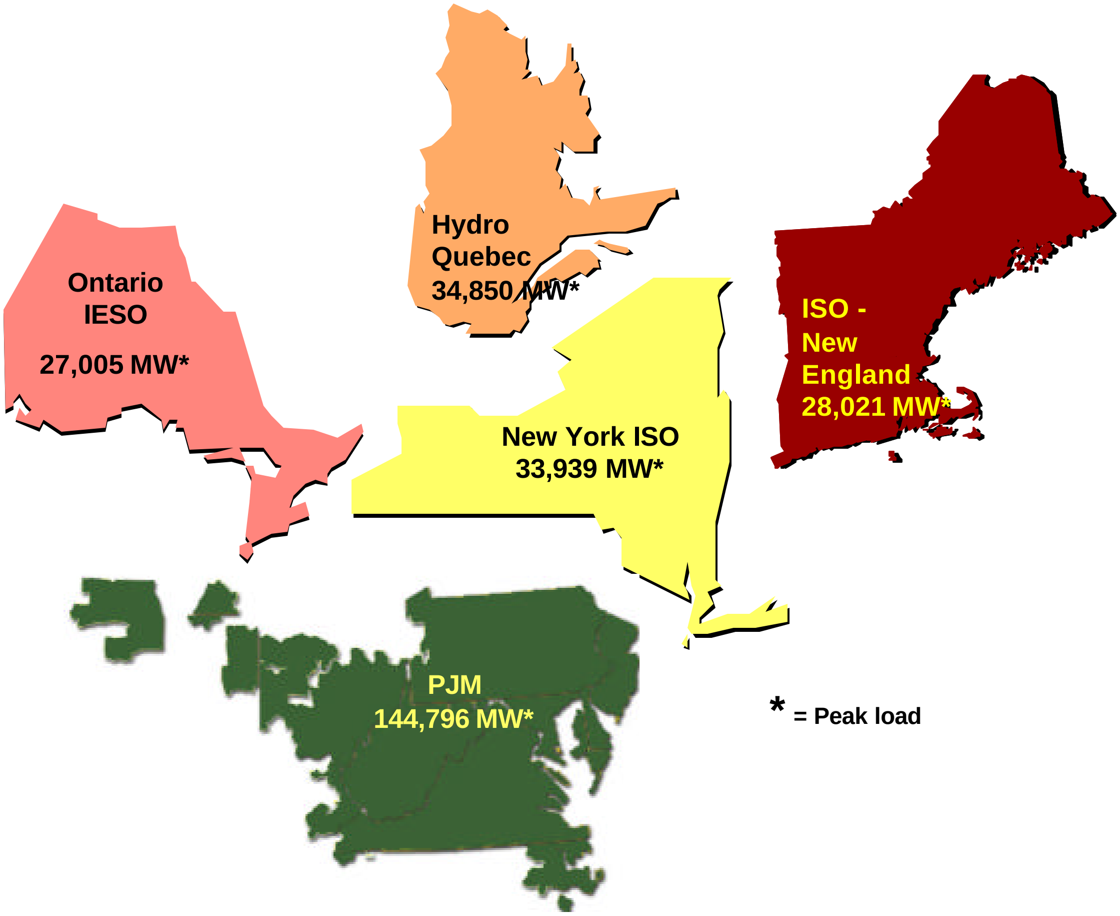

Figure 4.1: Northeast Grid in Context

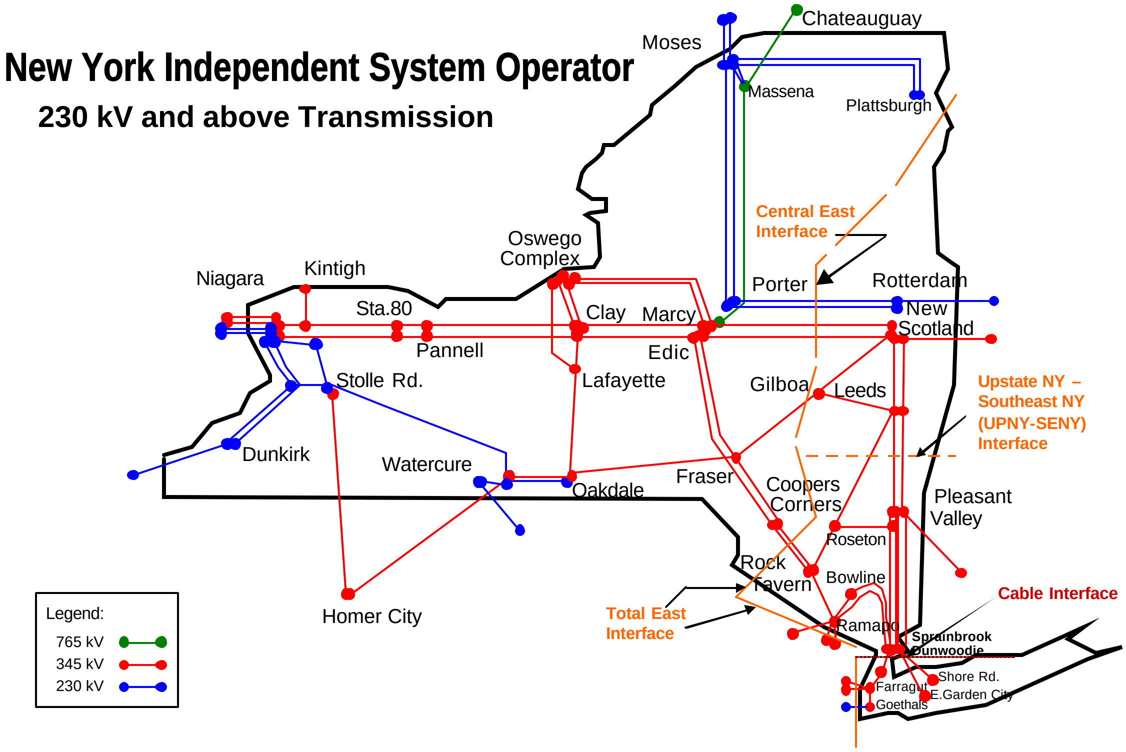

Figure 4.2: NYCA Bulk Transmission System

Figure 4.2 displays the bulk power transmission system for the NYCA. It shows facilities operating at 230 thousand volts (kV) and above. This represents more that 4,000 miles of high voltage transmission lines. If the underlying 138 and 115 kV transmission lines are included, the mileage exceeds 10,000 miles. Figure 4.2 also displays key NYCA transmission interfaces. Transmission interfaces are groupings of transmission lines which measure the transfer capability between regions.

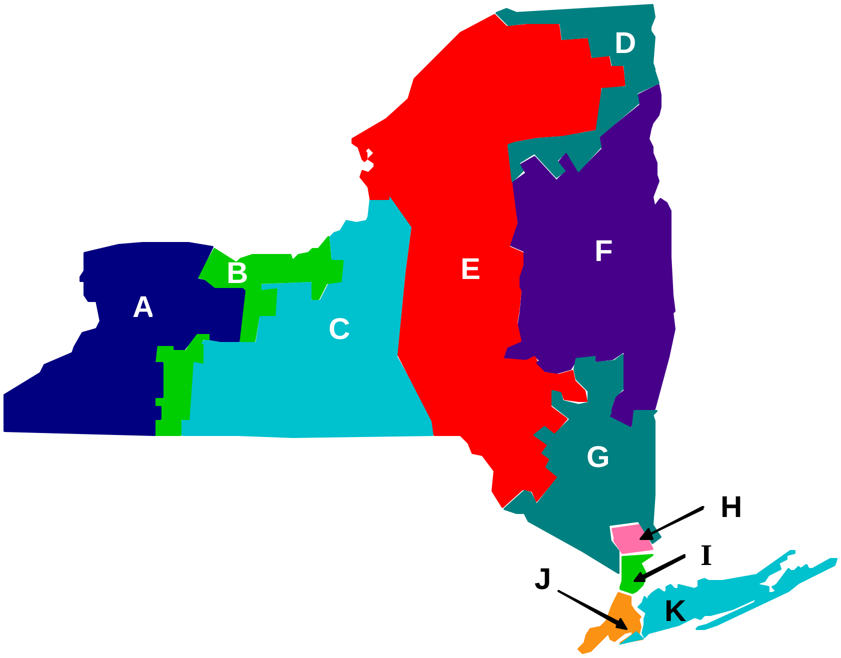

Figure 4.3: NYCA Load Zones or Area

The New York wholesale electricity market is divided into eleven pricing or load zones. Figure 4.3 presents the geographical boundaries for these pricing zones. The development of these load zones was driven primarily by the topology or configuration of the transmission system and secondarily by the franchise areas of the investor owned utilities. These load areas were initially developed by the New York Power Pool after the 1965 Northeast blackout as part of a process of identifying critical bulk power system transmission interfaces. Subsequently, these load zones were utilized to define pricing zones for the wholesale electricity market.

On a pricing basis, Zones A-E have relatively homogeneous prices and can be defined as one super zone called West NY, while the balance of the zones can be defined as East NY. Pricing is not homogeneous within the eastern zones. Zones F – I are defined as the Hudson Valley, Zone J as New York City and Zone K as Long Island. The boundary between West NY and East NY, including the boundary between PJM and the East zones, defines the Total East transmission interface. This interface is represented by the orange line on Figure 4.2. The upper half of the Total East interface is defined as the Central East interface while the lower half including the dotted part of the orange line is known as the interface between Upstate NY and Southeast NY or the UPNY – SENY interface. The dotted part of the line effectively divides the Hudson Valley into a lower and upper part electrically. Below the UPNY – SENY interface is the *cable interface* which includes the red dotted line on the transmission map and also the lower end of the total east interface. The cable interface contains all the major underground and/or submarine cables supplying New York City and Long Island.

Table 4.1 presents the approximate non-coincident peak loads and capacity contained in the super zones defined above for summer 2006. Table 4.2 below presents the nominal transfer capability across the major transmission interfaces defined above. The transmission facilities that make up the interfaces are the facilities that tie the zones together electrically.

Table 4.1: Approximate Summer Peak Load/Capacity

Zone	Peak Load (MW)	Capacity (MW)
West (A-E)	10,200	14,800
Upper Hudson Valley (F)	2,380	3,765
Lower Hudson Valley (G-I)	4,630	5,575
New York City (J)	11,350	10,000
Long Island (K)	5,750	5,290

Note: Numbers are approximate and based on the summer of 2006

Table 4.2: Nominal Transfer Capability[8]

Transmission Interface	Transfer Capability (MW)
Total East	6,100
Central East	2,850
UPNY – SENY	5,100
Cable Interface	
• New York City	4,970
• Long Island	1,290

As a result of the distribution of load and capacity on the NYCA power system, power flows are primarily west to east and then southeast or predominantly from the northwest to the southeast into the high load urban zones of New York City and Long Island. All power flows from the west including the transmission ties to the neighboring control areas of Ontario, Hydro Quebec and PJM must cross the Total East Interface with large portions flowing across the Central East portion of the interface and then across the UPNY – SENY interface to reach the cable interface.

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[8] Nominal transfer limits are based on the thermal capability of the lines and cables for the interface.

5 NYCA Load and Energy Forecast: 2006 – 2016

Introduction

Overview

This section describes the annual energy and seasonal peak demand forecasts for the ten year period beginning with 2006 and extending through 2015. It begins with this Executive Summary, continues with an overview of historic electricity and economic trends in New York State, and concludes with the ten-year forecasts of summer and winter peak demands and annual energy requirements.

Executive Summary

The NYISO has initiated the CRPP to assess the adequacy of New York's electricity infrastructure for meeting reliability and market needs over the 2006 – 2016 horizon. As part of this assessment, a ten year forecast of summer and winter peak demands and annual energy requirements was performed.

The electricity forecast is based on projections of New York's economy performed by Economy.com in the Fall of 2005. The Economy.com forecast includes detailed projections of employment, output, income and other factors for twenty three regions in New York State.

A summary of the electricity forecast and the key economic variables that drive it follows:

Table 5.1.1: Summary of Econometric Forecasts

Economic Indicators	Average Annual Growth		
	85-95	95-05	05-15
Total Employment	0.16%	0.78%	0.85%
Gross State Product	1.66%	3.70%	2.74%
Population	0.41%	0.39%	0.20%
Total Income	2.02%	2.48%	2.49%
Average Electric Price	-1.33%	0.67%	-1.86%
Summer Peak (actual data through 2005)	1.73%	1.66%	1.27%
Winter Peak (actual data through 2005)	1.15%	0.75%	1.32%
Annual Energy (actual data through 2005)	1.61%	1.27%	0.91%
Employment Trends	**Shares of Total Employment**		
	1995	**2005**	**2015**
Business, Services & Retail	40.1%	39.8%	39.8%
Health, Education, Government, Agriculture	48.5%	52.4%	53.3%
Manufacturing	11.5%	7.8%	6.9%

5.1 Historical Overview

NYCA System

Table 5.2.1 shows the New York Control Area's (NYCA) historic peak and energy growth since 1985.

Table 5.2.1: 21-Year Historic Peak and Energy Data[9] and Growth Rates

			Summer Capability Period		Winter Capability Period		
Year	Annual GWh	Percent Growth	Summer MW	Pct Growth		Winter MW	Pct Growth
1985	126,290		22,926		85 - 86	20,664	
1986	128,748	1.95%	22,942	0.07%	86 - 87	20,247	-2.02%
1987	133,531	3.71%	24,427	6.47%	87 - 88	22,593	11.59%
1988	140,048	4.88%	25,720	5.29%	88 - 89	23,227	2.81%
1989	141,883	1.31%	25,390	-1.28%	89 - 90	23,003	-0.96%
1990	140,919	-0.68%	24,985	-1.60%	90 - 91	22,579	-1.84%
1991	145,019	2.91%	26,839	7.42%	91 - 92	22,981	1.78%
1992	143,421	-1.10%	24,951	-7.03%	92 - 93	22,806	-0.76%
1993	146,915	2.44%	27,139	8.77%	93 - 94	23,809	4.40%
1994	147,777	0.59%	27,065	-0.27%	94 - 95	23,345	-1.95%
1995	148,429	0.44%	27,206	0.52%	95 - 96	23,394	0.21%
1996	148,527	0.07%	25,585	-5.96%	96 - 97	22,728	-2.85%
1997	148,896	0.25%	28,699	12.17%	97 - 98	22,445	-1.25%
1998	151,377	1.67%	28,161	-1.87%	98 - 99	23,878	6.38%
1999	156,356	3.29%	30,311	7.63%	99 - 00	24,041	0.68%
2000	156,636	0.18%	28,138	-7.17%	00 - 00	23,774	-1.11%
2001	156,787	0.10%	30,982	10.11%	01 - 01	23,713	-0.26%
2002	158,745	1.25%	30,664	-1.03%	02 - 02	24,454	3.12%
2003	158,014	-0.46%	30,333	-1.08%	03 - 03	25,262	3.30%
2004	160,209	1.39%	28,433	-6.26%	04 - 04	25,541	1.10%
2005	166,732	4.07%	32,075	12.81%	05 - 06	25,060	-1.88%
Annual Avg Growth:		1.40%		1.69%			0.97%

NYCA is a summer peaking system and its summer peak has grown faster than its winter peak or its annual energy over this period. Both summer and winter peaks show considerable year-to-year variability due to the influence of extreme weather conditions on the seasonal peaks. Annual energy is influenced by weather conditions over an entire year, which is much less variable.

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[9] Note: Historic peaks do account for the impacts of demand-side programs

Table 5.2.2 shows trends in weather-normalized annual energy and seasonal peaks for the NYCA system. Summer peak is the fastest growing and winter peak the slowest. This pattern has two main causes. Air conditioning has become ubiquitous while electric space heating load has declined, and load has grown much more in NYCA zones G – K than in zones A – F (where it has actually declined). The former zones are in the southeastern part of the state where the climate is warmer and where peak demands have always occurred in summer.

Table 5.2.2: Weather Normalized Annual Energy and Seasonal Peak Loads

Year	Annual GWh	Percent Change	Summer MW	Percent Change	Winter MW	Percent Change
1993	145,595		26,204		23,685	
1994	147,073	1.0%	27,161	3.7%	23,654	-0.1%
1995	146,889	-0.1%	27,167	0.0%	23,554	-0.4%
1996	148,869	1.3%	27,938	2.8%	22,788	-3.2%
1997	149,797	0.6%	28,488	2.0%	22,762	-0.1%
1998	152,019	1.5%	28,999	1.8%	24,031	5.6%
1999	155,117	2.0%	28,925	-0.3%	23,909	-0.5%
2000	157,937	1.8%	28,974	0.2%	24,218	1.3%
2001	156,859	-0.7%	29,767	2.7%	25,045	3.4%
2002	157,159	0.2%	30,028	0.9%	24,294	-3.0%
2003	157,951	0.5%	30,450	1.4%	24,849	2.3%
2004	160,986	1.9%	29,901	-1.8%	25,006	0.6%
2005	163,368	1.5%	31,821	6.4%	24,770	-0.9%
Avg		1.0%		1.6%		0.4%

Regional Energy and Seasonal Peaks

Table 5.2.3 shows historic and forecast growth rates of annual energy for the different regions in New York. (Actual zonal energy is shown in Table 5.4.1 below.) The West region is NYCA Zones A – E. The East region is Zones F - I. Zones J and K, NYCA's most critical load centers, are shown individually. These groupings are meant to combine Zones that have similar economies. West is the part of the State that has historically been the most associated with manufacturing, particularly heavy manufacturing. The East region includes Albany, the State capitol, and comprises both the Upper and Lower Hudson Valley areas. The East economy is strongly influenced by state government employment and industries along the Hudson. It has also benefited from the spillover of New York City's economy, as suburban development has spread inexorably up the Hudson Valley, much as Long Island's economy benefited earlier.

These regions are also separated by the most important electrical interfaces in New York. West is separated from the East by the Central-East interface. Upper Hudson Valley (Zone F) and Lower Hudson Valley (Zones G, H and I) are separated by the UPNY/SENY interface. Lower Hudson Valley and J are separated by Dunwoodie South. Zones J and K are separated by the Con Ed – LIPA interface.

Table 5.2.3: Actual and Forecast Weather-Normalized Annual Energy

Year	West	East	Zone J	Zone K	NYCA
1993	56,392	29,968	41,658	17,577	145,595
1994	55,395	30,509	43,211	17,958	147,073
1995	54,739	30,974	43,306	17,870	146,889
1996	55,886	30,634	44,368	17,982	148,869
1997	57,076	29,659	44,898	18,164	149,797
1998	57,038	30,198	46,036	18,746	152,019
1999	57,437	30,371	47,965	19,344	155,117
2000	57,599	30,254	49,880	20,205	157,937
2001	55,891	30,236	50,047	20,684	156,859
2002	55,806	29,386	50,648	21,318	157,159
2003	55,326	29,752	51,070	21,804	157,951
2004	56,016	30,291	52,327	22,353	160,986
2005	57,588	30,724	52,736	22,320	163,368
2006	60,099	32,003	52,276	22,515	166,893
2007	61,422	32,685	53,230	22,796	170,133
2008	62,307	33,212	54,275	23,122	172,916
2009	62,474	33,437	55,179	23,544	174,634
2010	62,482	33,613	56,158	23,892	176,145
2011	62,249	33,695	57,136	24,261	177,341
2012	61,876	33,703	57,993	24,710	178,282
2013	61,637	33,766	58,863	25,036	179,302
2014	61,503	33,852	59,628	25,439	180,422
2015	62,069	34,212	60,403	25,904	182,588
95-05	0.5%	-0.1%	2.0%	2.2%	1.1%
05-15	0.3%	0.7%	1.5%	1.4%	0.9%

Since 2001, LHV has been New York's fastest growing region. While growth in the Lower Hudson Valley is expected to continue at a moderate pace, growth rates in NYC and on Long Island are slightly higher. Growth upstate continues to lag behind the downstate regions. Zone F annual energy use in 2005 is still less than was used in 1999. The Western zones have in 2005 nearly equaled the energy usage of 2000.

Table 5.2.4: Actual and Forecast Growth Rates of Annual Energy

	West	Upper Hudson Valley	Lower Hudson Valley	New York City	Long Island
	Zones A-E	Zone F	Zones G-H-I	Zone J	Zone K
95-05	0.6%	-1.2%	1.9%	2.1%	2.5%
05-15	0.6%	0.2%	1.0%	1.1%	1.2%

Table 5.2.5: Weather Normalized Zonal Summer Peaks and Forecast

	West	East	Zone J	Zone K	NYCA
1993	8,980	5,531	8,313	3,380	26,204
1994	9,314	5,735	8,594	3,518	27,161
1995	9,021	5,477	9,003	3,666	27,167
1996	9,429	5,913	8,809	3,787	27,938
1997	9,200	5,628	9,570	4,090	28,488
1998	9,045	5,966	9,708	4,280	28,999
1999	8,868	5,806	10,022	4,229	28,925
2000	8,886	5,782	9,878	4,428	28,974
2001	8,494	5,976	10,454	4,844	29,767
2002	9,105	5,808	10,224	4,892	30,028
2003	9,038	6,044	10,362	5,006	30,450
2004	8,798	5,896	10,192	5,015	29,901
2005	9,516	6,330	10,678	5,297	31,821
2006	9,662	6,655	11,630	5,348	33,295
2007	9,822	6,782	11,800	5,427	33,831
2008	9,951	6,889	11,970	5,504	34,314
2009	9,992	6,944	12,140	5,612	34,688
2010	10,043	6,998	12,290	5,711	35,042
2011	10,069	7,034	12,440	5,805	35,348
2012	10,068	7,051	12,570	5,904	35,593
2013	10,041	7,051	12,705	6,006	35,803
2014	10,069	7,082	12,815	6,111	36,077
2015	10,101	7,122	12,925	6,232	36,380
95-05	0.5%	1.5%	1.7%	3.7%	1.6%
05-15	0.4%	0.7%	1.1%	1.5%	0.9%

5.2 Trends Effecting Electricity in New York

5.2.1 Employment

2005 Forecast

The economic outlook for employment projects a growing economy through 2006 followed by slower growth in 2007. Employment growth picks up from 2008 to 2010 before declining again.

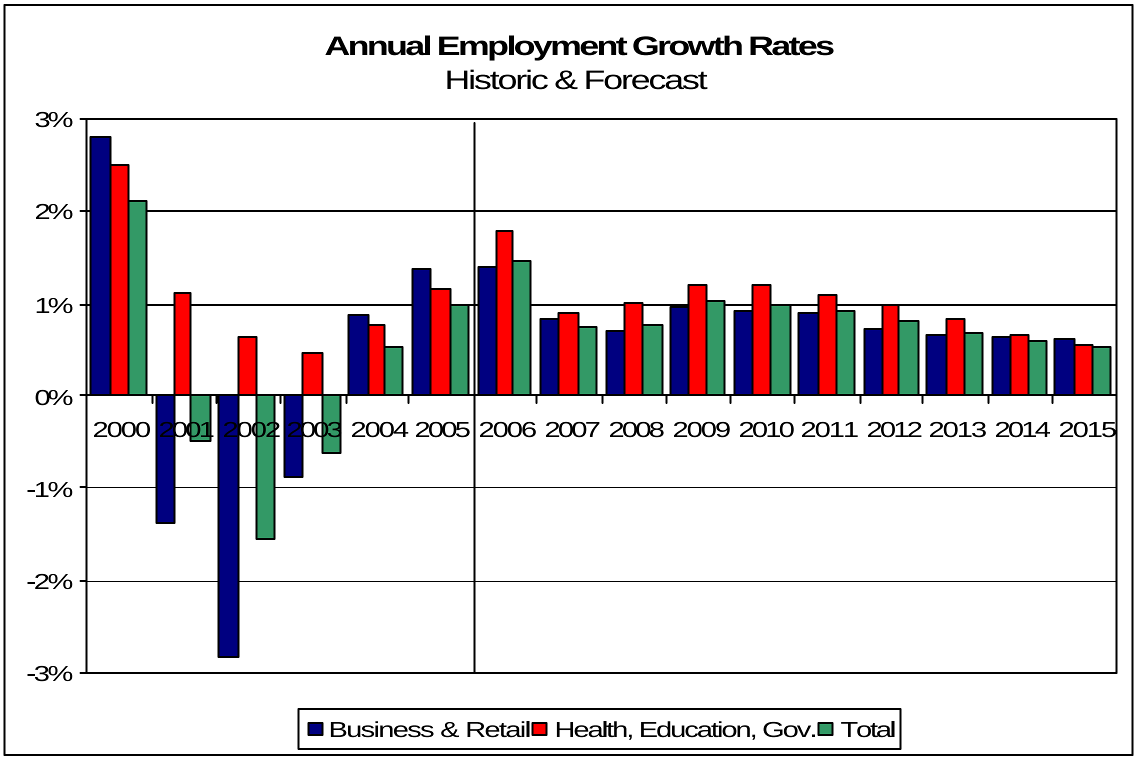

Figure 5.1: Annual Employment Growth Rates

5.2.2 Population

The economic trends the regions have experienced are reflected in their population growth. In the West, which it basically all of New York State west of Schenectady, population is 1.4% lower today than it was in 1975. The Lower Hudson Valley has seen the most population growth, increasing by 20% since 1975. Other regions fall in between. New York State's population base has grown over 8% since 1975. Prior to 2000, population grew in every part of the state except the western section. However, since 2000 forward, annual growth in population has slowed.

2005 Forecast

The 2006 population forecast projects slower population growth in every region. By 2014, the population in New York City is expected to decline. Population in Long Island is expected to decline by the year 2017.

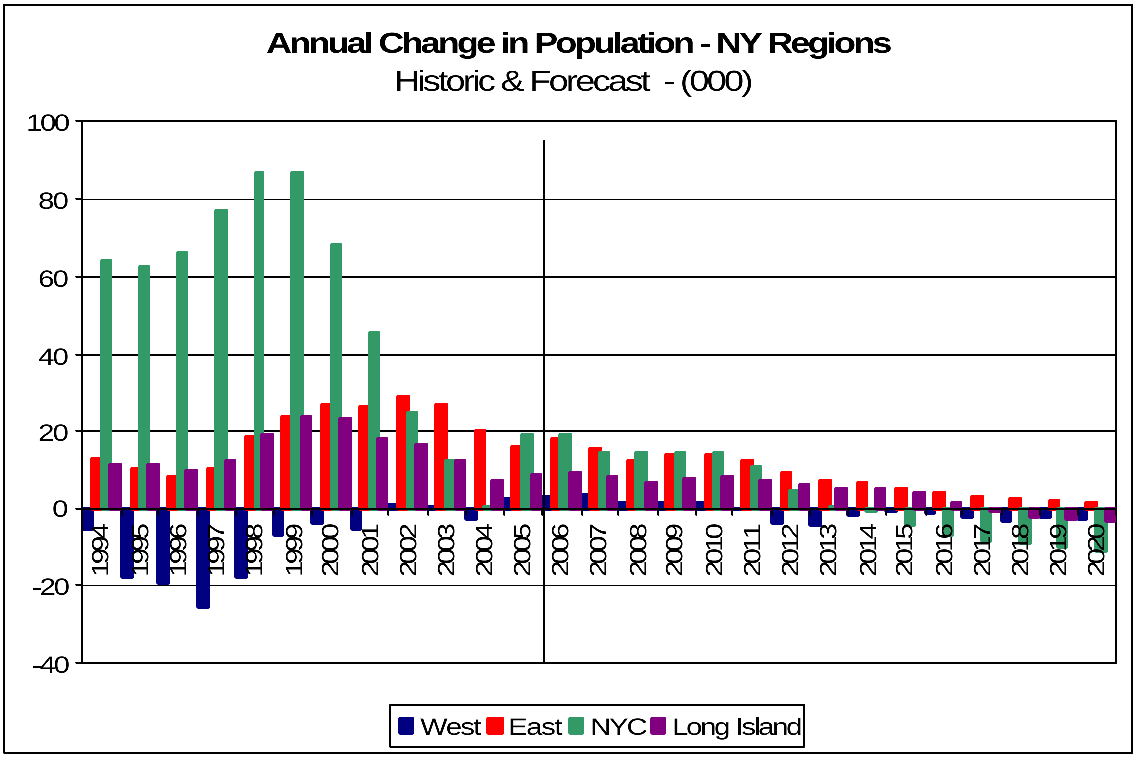

Figure 5.2: Annual Change in Population by Region

5.2.3 Real Output & Real Income

Two key economic indicators in the state are measured by real gross output and total income. One index measures the prosperity of business and the other the prosperity of households. The period from 2001 to 2002 showed erosion in buying power and economic output. Output recovered by 2003 but income did not recover until 2004.

2005 Forecast

The 2005 forecast projects economic growth in the range of 2.5% to 3.2% until 2008. Afterwards, economic output continues to grow, but at a gradually slowing rate. Real income growth decreases from 3% through 2005 to just 2% in 2006 and 2007. It increases again through 2009 to 3% but the growth gradually slows thereafter. Both indexes are characterized by faster growth in the near term followed by slower growth in the long term.

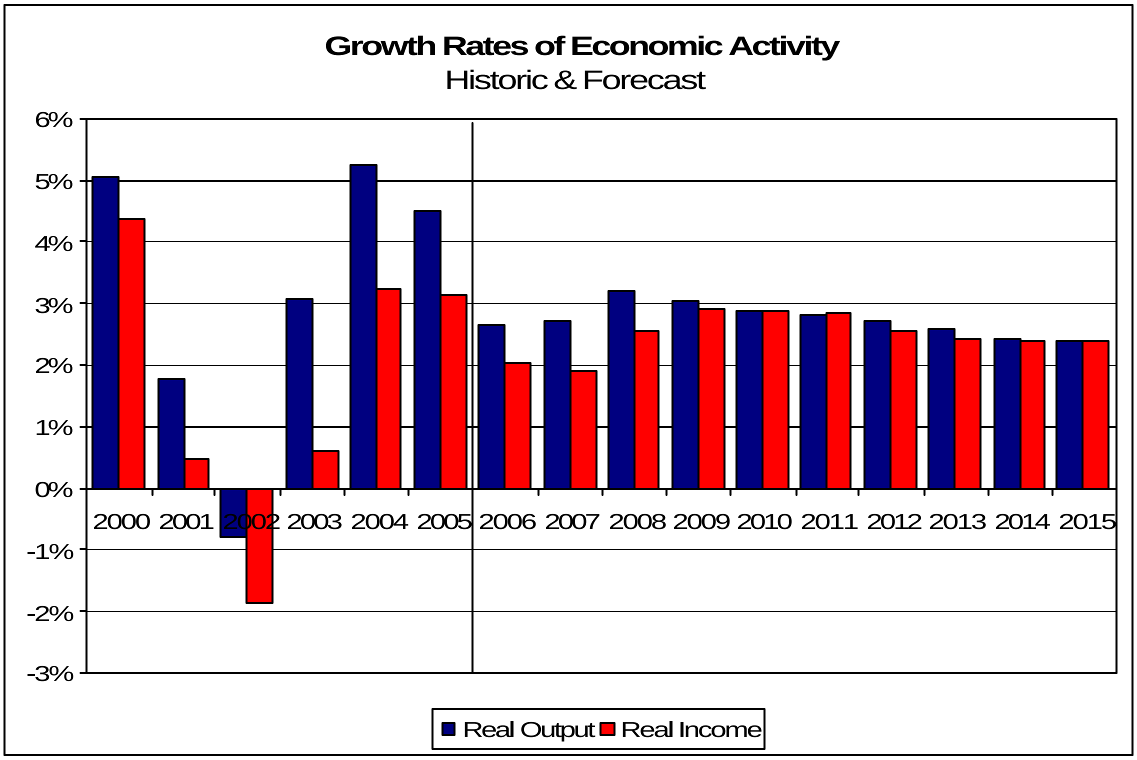

Figure 5.3: Annual Growth Rates in Real Output and Income

5.2.4 Electric and Natural Gas Prices

Electric prices in New York are expected to follow the trend predicted by the Energy Information Administration's "Annual Energy Outlook – 2006, Mid-Atlantic Region", modified to line up with New York actual data for 1990 – 2002. Prices for individual regions of the state are not available. The primary difference in the 2006 forecast compared to the previous is a more realistic projection of world oil prices, which are expected to remain above $50 per barrel until after 2008. This price forecast is approximately double that of the EIA's 2005 oil price forecast. Translating the EIA growth rates to the historic trends of New York energy prices results in the price forecasts for the state through 2020.

2006 Forecast

The real price of residential electricity has remained within the range of $140 to $150 per MWh since 1990. During this same period of time, the real price of residential natural gas has increased by 50% from $90/MMBtu to $140/MMBtu. Both commodities are expected by the EIA to decrease in real terms from 2005 through 2010. The EIA 2006 forecast, in comparison to 2005's, includes the following features:

- decreases in oil imports
- higher energy efficiency & slower economic growth
- decreased electricity consumption

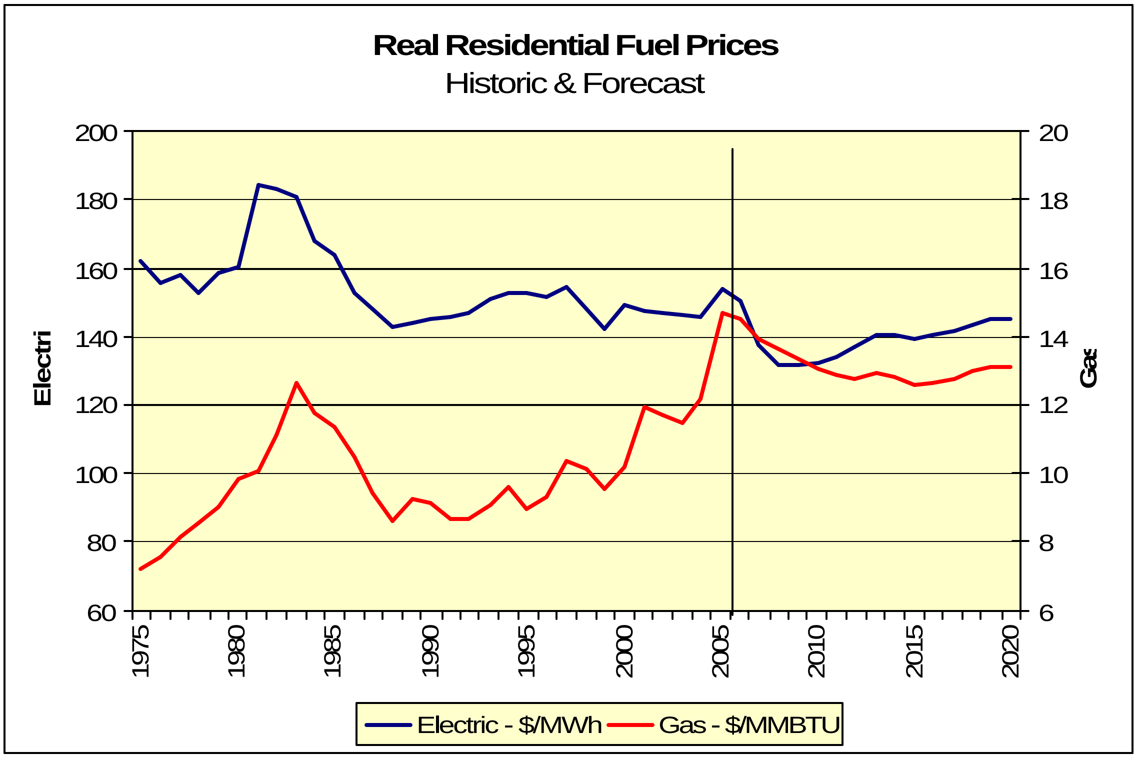

Figure 5.4: Real Electric and Natural Gas Prices

Given the assumptions embedded in the EIA forecast, the EIA considers it likely that real decreases in natural gas and electricity prices will occur. To the extent this does occur, then the effect of the real decrease in electricity price is to increase the state's annual electric consumption by a small amount. (A 1% decrease in the real price of electricity is expected to increase annual electricity usage by about 0.1%.)

5.2.5 Regional Economic Trends

There is a wide variation in the economic and energy growth throughout the state. The development of long term zonal energy and demand forecasts cannot be performed unless these regional differences are accounted for. Zones A through E are defined as the West region; Zones F-I are defined as the East; Zone J corresponds to New York City and Zone K to Long Island. This section discusses the regional variation for a series of economic indicators.

Total Employment & Employment Shares

Total employment growth rates are the weakest in the West, with an annual average growth rate from 2005 to 2015 of just 0.1%. All other regions have growth rates of 0.8% for the same period. In every region, the employment growth is the most rapid in the early years of the forecast and declines thereafter. The relative shares of employment for business/retail/services and health/education/government remain essentially constant throughout the forecast horizon. While the share of manufacturing employment continues to decline over time, the decline is slow. Manufacturing as a share of total employment drops only by about 1% in each region.

Table 5.3.1: Regional Economic Growth Rates of Key Economic Indicators

West

	Average Annual Growth	
Economic Indicators	95-05	05-15
Total Employment	0.3%	0.1%
Gross Product	2.9%	1.3%
Population	-0.2%	0.0%
Total Income	1.8%	1.5%

	Employment Shares	
Employment Trends	2005	2015
Business/Services/Retail	37.0%	37.6%
Health/Educ/Gov/Ag.	49.5%	50.4%
Manufacturing	13.5%	12.0%

New York City

	Average Annual Growth	
Economic Indicators	95-05	05-15
Total Employment	0.7%	0.8%
Gross Product	3.8%	2.2%
Population	0.6%	0.1%
Total Income	2.5%	1.7%

	Employment Shares	
Employment Trends	2005	2015
Business/Services/Retail	42.1%	41.7%
Health/Educ/Gov/Ag.	53.3%	54.1%
Manufacturing	4.6%	4.2%

East

	Average Annual Growth	
Economic Indicators	95-05	05-15
Total Employment	1.2%	0.8%
Gross Product	3.8%	2.1%
Population	0.6%	0.3%
Total Income	3.0%	1.9%

	Employment Shares	
Employment Trends	2005	2015
Business/Services/Retail	38.9%	39.2%
Health/Educ/Gov/Ag.	53.4%	53.9%
Manufacturing	7.7%	6.8%

Long Island

	Average Annual Growth	
Economic Indicators	95-05	05-15
Total Employment	1.3%	0.8%
Gross Product	3.9%	2.2%
Population	0.5%	0.2%
Total Income	2.8%	1.6%

	Employment Shares	
Employment Trends	2005	2015
Business/Services/Retail	43.5%	42.8%
Health/Educ/Gov/Ag	48.8%	50.3%
Manufacturing	7.8%	7.0%

Real Gross Product

Real gross product is a measure of the economic value of all goods and services produced in a geographic region, after allowing for the effects of inflation. Gross product increases at an annual average rate of about 2.2% per year in every region except the West, where it is only 1.3%. The growth rate during the next ten years is 1% to 1.5% less than the annual average growth in the preceding 10 years. We find that economic growth is highest in the earliest years of the forecast and lowest in the furthest years.

Population

Population growth rates are slowing throughout the state except in the West. In the West, population growth is 0.0%, whereas it was negative during the preceding 10 years. Population growth rates are just 0.1 to 0.3% in other areas of the state. As with the other economic indicators, population growth is highest in the earliest years of the forecast and lower thereafter.

Real Total Income

Real total income is growing at approximately the same rate throughout all regions of the state, ranging from a low of 1.5% in the West to a high of 1.9% in the East. But this is a decline of about 1% per year in every region except the West compared to the period from 1995 to 2005. There is not as great a variation in the rate of income growth throughout the forecast. Instead, the forecast shows a drop in the rates of growth in 2006 and 2007 followed by an increase thereafter.

5.3 Forecast Methodology

The NYISO methodology for producing the long term forecasts for the Resource Needs Assessment consists of the following steps. Econometric forecasts were developed for system energy and seasonal peaks. (Model specifications are included in an appendix.) The summer coincident peak forecast was scaled up or down as appropriate to coincide with the most recent ICAP forecast. Zonal forecasts were developed independently consistent with historical trends and future expectations for regional growth. The zonal forecasts were then reconciled to the system forecasts to obtain zonal peaks coincident with the New York control area.

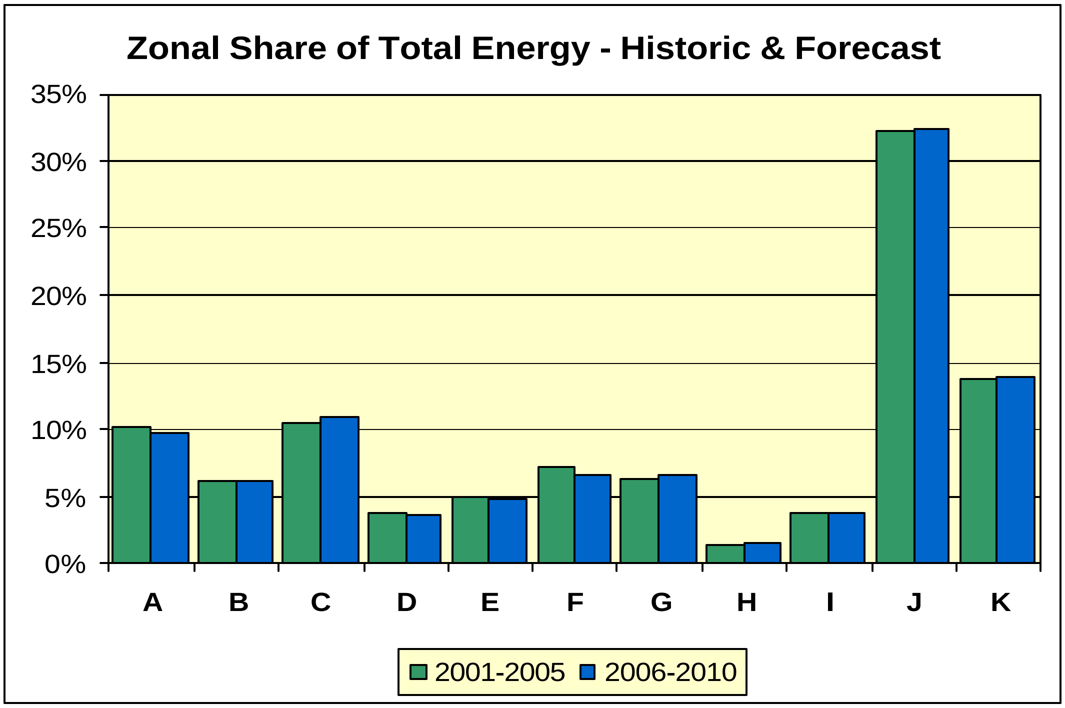

Figure 5.5: Zonal Energy Shares - Historic and Forecast

Zonal Energy Forecasts

For each zone, we produced an ensemble of forecasts driven by either a linear model, a log-log model, or a simple trend model. The forecast drivers were population, households, employment, cooling degree days and heating degree days. Each member of the ensemble was evaluated and the best forecast model chosen.

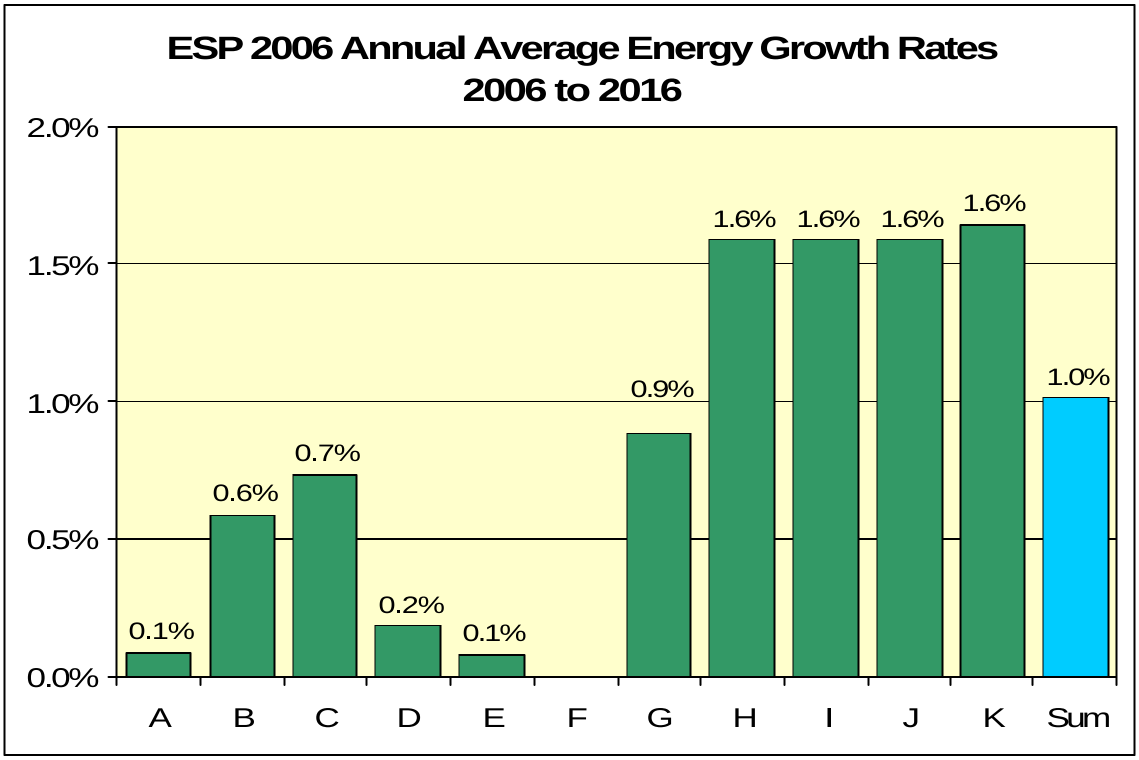

Figure 5.6: Zonal Energy Forecast Growth Rates - 2006 to 2016

Zonal Summer Coincident Peak Demand Forecasts

For each zone, we produced an ensemble of forecasts. One was based on just energy, another on energy and maximum temperature, while the third was a simple trend model. Each member of the ensemble was evaluated and the best forecast model chosen.

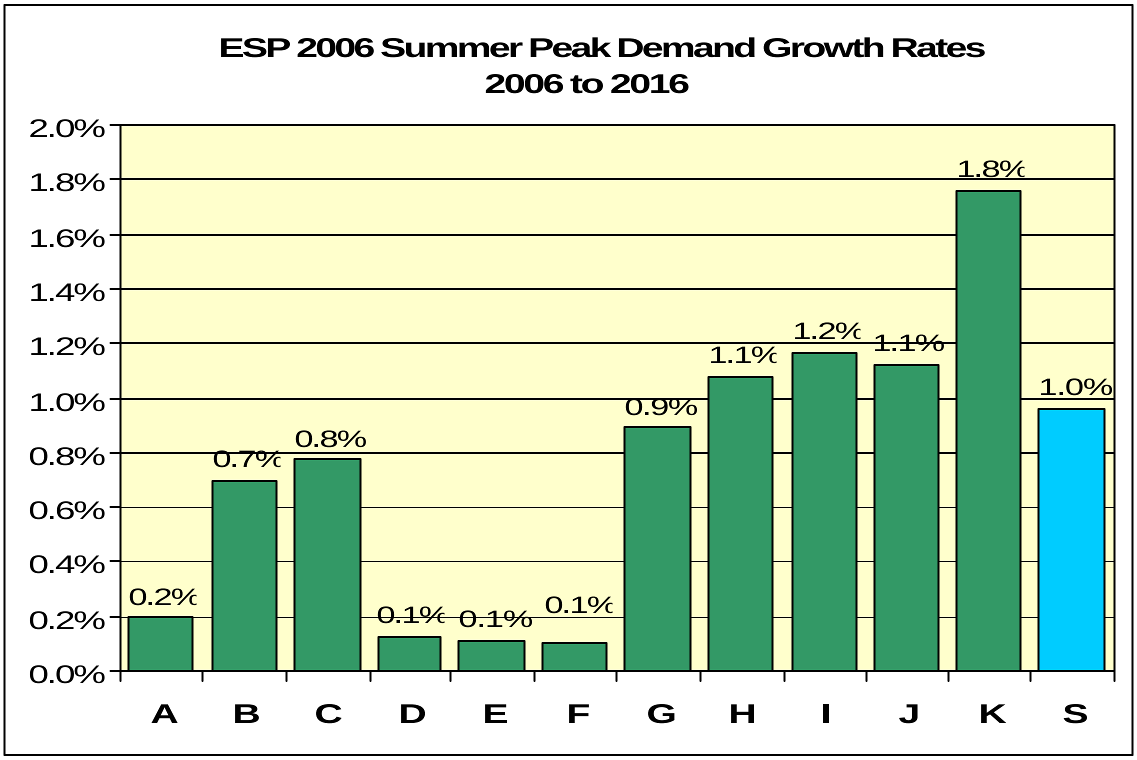

Figure 5.7: Zonal Summer Peak Demand Forecast Growth Rates - 2006 to 2016

Zonal Winter Coincident Peak Demand Forecasts

For each zone, we produced an ensemble of forecasts. One was based on just energy, another on energy and temperature, another on energy and heating degree days, and the last was a simple trend model. Each member ensemble was evaluated and the best forecast model chosen.

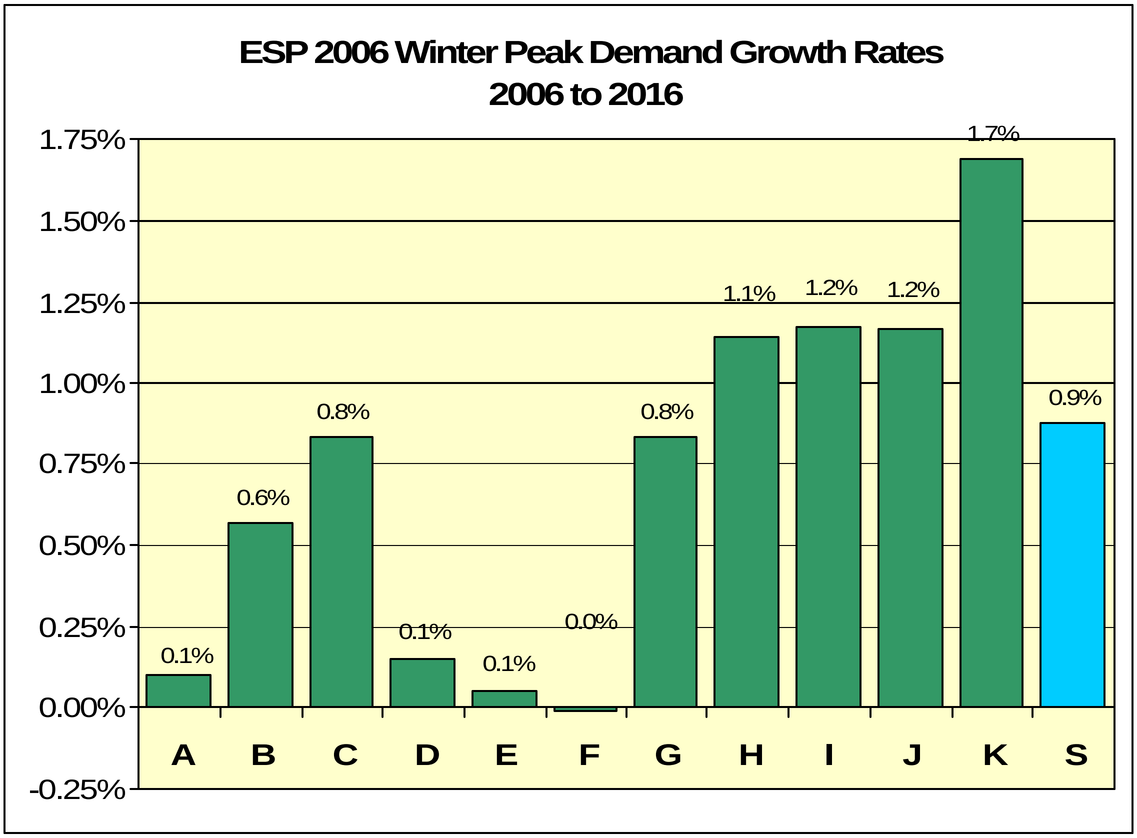

Figure 5.8: Zonal Winter Peak Demand Forecast Growth Rates - 2006 to 2016

Reconciliation of Zonal Forecasts to System Level Forecasts

The zonal forecasts are reconciled to the system forecasts by summing over the zones, finding the difference (high or low) and distributing the difference to each zonal in proportion to its share of energy or seasonal peak demand. The charts below show the results of the zonal forecasts.

Table 5.4.1: Actual and Forecast Annual Energy by Zone - GWh

Year	A	B	C	D	E	F	G	H	I	J	K	NYCA
1993	18,725	7,798	18,177	4,925	7,106	12,172	9,202	1,658	5,694	42,084	17,853	145,394
1994	18,528	7,864	17,264	4,484	7,477	12,554	9,040	1,796	5,812	43,386	18,050	146,255
1995	18,109	7,631	17,278	4,701	7,542	13,331	9,102	1,792	5,691	43,734	17,996	146,907
1996	18,383	8,003	16,541	4,670	8,437	12,819	9,032	1,820	5,514	43,853	17,931	147,003
1997	18,450	8,225	16,223	4,708	9,201	11,777	8,698	1,954	5,436	44,463	18,241	147,376
1998	18,207	8,408	14,878	5,488	9,545	11,781	8,957	1,958	5,702	46,076	18,856	149,856
1999	18,210	8,611	15,713	6,184	8,956	11,994	9,256	1,894	6,060	48,281	19,671	154,830
2000	16,785	9,635	16,182	6,527	8,182	11,398	9,270	1,942	5,929	49,183	20,072	155,105
2001	16,209	9,661	16,034	6,374	7,403	11,429	9,436	2,003	5,782	50,227	20,723	155,281
2002	16,355	9,935	16,356	6,450	7,116	11,302	9,978	2,162	5,962	51,356	21,544	158,516
2003	15,942	9,719	16,794	5,912	6,950	11,115	10,463	2,219	6,121	50,829	21,960	158,024
2004	16,102	9,888	16,825	5,758	7,101	11,161	10,696	2,188	6,216	52,073	22,203	160,211
2005	16,498	10,227	17,568	6,593	7,594	11,789	10,924	2,625	6,435	54,007	22,948	167,208
2006	16,905	10,532	18,119	6,762	7,781	12,069	11,283	2,193	6,458	52,276	22,515	166,893
2007	17,227	10,786	18,583	6,897	7,929	12,287	11,589	2,233	6,576	53,230	22,796	170,133
2008	17,424	10,963	18,917	6,983	8,020	12,415	11,815	2,277	6,705	54,275	23,122	172,916
2009	17,419	11,015	19,034	6,989	8,017	12,399	11,906	2,315	6,817	55,179	23,544	174,634
2010	17,370	11,038	19,103	6,976	7,995	12,352	11,967	2,356	6,938	56,158	23,892	176,145
2011	17,254	11,019	19,098	6,937	7,941	12,257	11,982	2,397	7,059	57,136	24,261	177,341
2012	17,099	10,975	19,051	6,881	7,870	12,136	11,969	2,433	7,165	57,993	24,710	178,282
2013	16,982	10,955	19,043	6,841	7,816	12,041	11,983	2,470	7,272	58,863	25,036	179,302
2014	16,896	10,952	19,068	6,812	7,775	11,967	12,016	2,502	7,367	59,628	25,439	180,422
2015	17,000	11,075	19,310	6,861	7,823	12,029	12,187	2,534	7,462	60,403	25,904	182,588
2016	17,051	11,164	19,493	6,888	7,846	12,053	12,321	2,567	7,559	61,188	26,500	184,630

Table 5.4.2: Actual and Forecast Summer Coincident Peak Demand - MW

Year	A	B	C	D	E	F	G	H	I	J	K	NYCA
1993	3,203	1,438	2,768	760	1,113	2,334	1,736	353	1,086	8,602	3,528	26,921
1994	3,194	1,434	2,761	758	1,110	2,328	1,684	352	1,083	8,578	3,518	26,800
1995	2,809	1,342	2,575	662	1,216	2,340	1,684	354	1,088	9,024	3,837	26,931
1996	3,019	1,356	2,610	716	1,049	2,200	1,522	333	1,023	8,111	3,326	25,265
1997	2,837	1,529	2,718	559	1,411	2,188	1,886	349	1,198	9,596	4,205	28,476
1998	2,643	1,442	2,381	623	1,465	1,998	1,791	419	1,168	9,581	4,396	27,907
1999	2,769	1,564	2,615	669	1,273	2,169	2,027	429	1,277	10,467	4,758	30,017
2000	2,462	1,644	2,459	757	1,185	1,872	1,844	417	1,265	9,771	4,130	27,806
2001	2,519	1,889	2,719	780	1,260	2,068	2,027	537	1,347	10,602	4,900	30,648
2002	2,631	1,842	2,787	777	1,252	2,073	2,076	498	1,335	10,321	5,072	30,664
2003	2,510	1,782	2,727	671	1,208	2,163	2,146	498	1,395	10,240	4,993	30,333
2004	2,493	1,743	2,585	644	1,057	1,953	2,041	475	1,280	9,742	4,420	28,433
2005	2,726	1,923	2,897	768	1,314	2,164	2,236	592	1,409	10,810	5,236	32,075
2006	2,823	1,953	2,771	805	1,310	2,257	2,247	636	1,515	11,630	5,348	33,295
2007	2,885	2,007	2,795	811	1,324	2,292	2,306	643	1,541	11,800	5,427	33,831
2008	2,929	2,048	2,822	816	1,336	2,317	2,354	652	1,566	11,970	5,504	34,314
2009	2,933	2,060	2,845	817	1,337	2,319	2,374	659	1,592	12,140	5,612	34,688
2010	2,936	2,073	2,875	819	1,340	2,322	2,394	668	1,614	12,290	5,711	35,042
2011	2,926	2,076	2,906	821	1,340	2,317	2,405	677	1,635	12,440	5,805	35,348
2012	2,906	2,072	2,932	821	1,337	2,306	2,408	685	1,652	12,570	5,904	35,593
2013	2,881	2,064	2,948	818	1,330	2,289	2,406	691	1,665	12,705	6,006	35,803
2014	2,874	2,069	2,977	819	1,330	2,285	2,419	700	1,678	12,815	6,111	36,077
2015	2,882	2,086	2,986	818	1,329	2,286	2,441	704	1,691	12,925	6,232	36,380
2016	2,880	2,094	2,993	815	1,325	2,281	2,455	708	1,701	13,003	6,368	36,623

Table 5.4.3: Actual and Forecast Winter Coincident Peak Demand

Year	A	B	C	D	E	F	G	H	I	J	K	NYCA
1993	2,726	1,205	2,863	821	1,377	2,097	1,612	364	966	6,563	3,008	23,602
1994	2,816	1,259	2,848	701	1,260	2,297	1,461	395	866	6,221	3,013	23,137
1995	2,785	1,240	2,687	680	1,259	2,012	1,452	404	836	6,766	3,041	23,162
1996	2,849	1,250	2,488	678	1,359	1,927	1,348	353	844	6,502	2,915	22,513
1997	2,752	1,289	2,337	651	1,516	1,816	1,322	401	787	6,491	2,866	22,228
1998	2,616	1,273	2,330	849	1,555	2,030	1,508	369	852	7,161	3,131	23,674
1999	2,454	1,499	2,497	870	1,443	1,906	1,505	420	976	7,072	3,177	23,819
2000	2,489	1,510	2,506	880	1,263	1,798	1,459	366	877	7,206	3,188	23,542
2001	2,248	1,455	2,340	843	1,129	1,742	1,417	344	860	7,013	3,198	22,589
2002	2,418	1,507	2,679	925	1,223	1,903	1,590	437	927	7,373	3,472	24,454
2003	2,433	1,576	2,755	857	1,344	1,944	1,720	478	981	7,527	3,647	25,262
2004	2,446	1,609	2,747	918	1,281	1,937	1,766	474	939	7,695	3,729	25,541
2005	2,450	1,544	2,700	890	1,266	1,886	1,663	515	955	7,497	3,581	24,947
2006	2,526	1,623	2,756	931	1,308	2,010	1,779	457	1052	8098	3771	26,311
2007	2,581	1,661	2,837	946	1,324	2,036	1,824	463	1069	8231	3811	26,783
2008	2,614	1,687	2,895	956	1,333	2,051	1,858	470	1087	8363	3883	27,197
2009	2,613	1,695	2,915	957	1,333	2,049	1,871	476	1104	8496	3944	27,453
2010	2,605	1,698	2,927	955	1,331	2,044	1,880	482	1115	8575	4004	27,615
2011	2,585	1,695	2,926	951	1,325	2,032	1,882	488	1128	8681	4065	27,759
2012	2,559	1,689	2,917	944	1,318	2,018	1,881	493	1140	8772	4129	27,860
2013	2,539	1,686	2,917	940	1,312	2,006	1,883	498	1151	8863	4195	27,990
2014	2,525	1,686	2,921	936	1,308	1,998	1,887	503	1162	8938	4277	28,140
2015	2,542	1,704	2,963	942	1,313	2,005	1,913	507	1171	9014	4364	28,438
2016	2,551	1,717	2,994	945	1,315	2,008	1,933	512	1182	9092	4459	28,708

6 Description of RNA study case 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 incorporates TO and neighboring system plans not incorporated in the Five Year Base Case. In addition, 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 RNA study assumes that no additional market-based resources are added during the second five years of the Study Period.

6.1 Project Screening

NYISO RNA study case Screens

The NYISO reviewed the ATRA, the plans submitted by the TOs, and other information submitted as part of the input phase of the CRPP.

The following three categories of projects were considered for inclusion in the RNA study case:

1. All projects and plans that have completed the NYISO interconnection process (cost allocation accepted).
2. All other merchant projects and plans.
3. All projects and plans that are part of a Transmission Owner's plan.

Projects and plans falling in these categories will be included or excluded from the RNA RNA study case as follows:

A. TO projects on non-bulk power facilities;

.

B. Projects that are in service or under construction;.

C. For those projects and plans not already in-service or under construction:

- Category 1 projects were included, and modeled at the contracted-for capacity, if they have a PSC certificate, or approval under SEQRA in a case where the PSC process is not applicable, and an executed contract with a credit worthy entity.
- Category 2 projects were included, and modeled at the contracted-for capacity, if they have a PSC certificate (or SEQR approval) and an approved SRIS (if applicable), and an executed contract with a credit worthy entity.
- Category 3 bulk power system projects were included if they satisfy one of the following conditions:
  1. The project is a Backstop Regulated Solution triggered in a prior year's Comprehensive Reliability Plan; or
  2. The project is related to any projects and plans that are included in the RNA study case; or
  3. The project is expected to be in service within 3 years, has an approved SRIS (if applicable), and has received PSC certification (or SEQRA approval), if required.

All other TO plans and projects on the bulk power system will be addressed in a scenario analysis. Table 6.1.1 presents the projects considered or modeled in the RNA study cases.

Table 6.1.1: Projects Considered or Modeled in the RNA study

Project	In-service	MW CAP	Status	ATBA	ATRA	RNA				
	Dates	Summer				2007	2008	2009	2010	2011
I. Generation Included in ATRA										
A. Additions										
SCS Energy-Astoria Energy	I/S	500	I/S	X	X	X	X	X	X	X
SCS Energy-Astoria Energy	2007/Q2	500		X	X					
NYC Energy-Kent Ave	2007/06	79.9		X	X	X	X	X	X	X
LMA-Lockport II	2007/Q2	79.9		X	X					
Calpine-JFK Expansion	2006/06	45		X	X	X	X	X	X	X
Entergy-Indian Point 2 Uprate	I/S	1078	I/S	X	X	X	X	X	X	X
Entergy-Indian Point 3 Uprate	I/S	1080	I/S	X	X	X	X	X	X	X
Besicorp-Empire State Newsprint	2007/Q2	603		X	X					
Flat Rock Windpower	I/S	198	I/S	X	X	X	X	X	X	X
Flat Rock Windpower	2006/12	123.75		X	X			X	X	X
Global Winds-Prattsburgh	2006/10	75		X	X	X	X	X	X	X
ECOGEN-Prattsburgh Wind Farm	2006/07	79		X	X	X	X	X	X	X
Constellation-Ginna Plant Uprate	2006/11	610		X	X	X	X	X	X	X
KeySpan Spagnoli Road	2008/2009	250			X					
Fortistar VP	2007/Q2	79.9			X					
Fortistar VAN	2007/Q2	79.9			X					
PSEG Cross Hudson Project	2008	550			X					
TransGas Energy	2008/2009	1100			X					
Caithness Bellport	2009/Q2	326			X			X	X	X
East Coast Power--Linden VFT Inter-Tie	2007/Q1	300			X					
Airtricity-Munnsville	2007/09	40			X					
UPC Wind-Canandaigua Wind Farm	2006/10	81			X					
Invenergy Wind-High Sheldon Windfarm	2006/08	129			X					
NY Windpower-West Hill Windfarm	2007/F	40			X					
Atlantic Renewable-Fairfield Wind Project	2006/09	120			X					
AES-EHN NY Windpower-Marble River Windfarm	2006/09	84			X					
Clinton County Wind Farm	2007/12	134			X					
Noble-Clinton Windfield	2006/10	80			X					
Noble-Bliss Windfield	2006/10	71			X					
Noble-Altona Windfield	2006/10	99			X					
Noble-Ellenburg Windfield	2006/10	79.5			X					
NYPA-Blenheim Gilboa Storage	2010	120			X					
Community Energy-Jordanville Wind	2007/10	150			X					

Table 6.1.1 Continued

Project	In-service Dates		Status	ATBA	ATRA	RNA				
						2007	2008	2009	2010	2011
II. Transmission Projects in ATRA		**Miles**								
AE Neptune PJM –LI DC Line (660 MW)	2007	65.00	UC	X	X	X	X	X	X	X
LIPA-Duffy Convrtr Sta-Newbridge Rd. 345kV	2007/S	1.70	UC	X	X		X	X	X	X
LIPA-Newbridge Rd. 345kV-138kV (2-Xfmrs)	2007/S	N/A	UC	X	X		X	X	X	X
LIPA-E. Garden City-Newbridge Rd. 138kV	2007/S	4.00	UC	X	X		X	X	X	X
LIPA-Ruland Rd.-Newbridge Rd. 138kV	2007/S	9.10	UC	X	X		X	X	X	X
LIPA-Northprt-Norwalk Hrbr. 138kV Replcmnt(2)	2008/S	11.00		X	X		X	X	X	X
LIPA-Riverhead-Canal 138 kV (ckt #2)	2008/S	16.40		X	X		X	X	X	X
LIPA-Great Neck-Shore Rd 138 kV (ckt #1)	2009/S	5.30		X	X					
LIPA-Great Neck-Lake Success 69kV (ckt #1) conversion to 138 kV	2009/S	-		X	X					
Rochester Transmission-Sta. 80 & various	2007/12	N/A	UC	X	X	X	X	X	X	X
ConEd-Mott Havn-Dunwoodie 345kV Reconfig.(2)	2007/S	9.99	UC	X	X	X	X	X	X	X
ConEd-Mott Havn-Rainey 345kV Reconfig. (2)	2007/S	4.08	UC	X	X	X	X	X	X	X
ConEd-Sherman Crk 345kV-138kV (2-Xfmrs)	2007/S	N/A	UC	X	X			X	X	X
ConEd-Sprn Brk-Sherman Crk 345kV (M29)	2007/S	10.00	UC	X	X			X	X	X
O&R-Ramapo-Tallman 138kV Reconfig.	I/S	3.24	I/S	X	X	X	X	X	X	X
O&R-Tallman-Burns 138kV	2007/S	6.08	UC	X	X	X	X	X	X	X
O & R Ramapo-Sugarloaf 138 kV 2nd Line	2009/S	16.71		X	X			X	X	X
O & R Shoemaker 138-69 kV Transformer	2009/S	N/A		X	X			X	X	X
CHG&E-East Fishkill 345/115 kV Xfmr	2007/S	N/A		X	X	X	X	X	X	X
CHG&E-East Fishkill-Wiccopee 115 kV	2009/S	3.32		X	X			X	X	X
Besicorp-Reynolds Rd. 345kV	2007/S	9.00		X	X					
PSEG-Bergen-W. 49th St. 345 kV Cable	2008	7.5			X					
Spagnoli Rd-Ruland Road	2008/S	1.0			X					
Fairfield windfarm to Fairfield 115 kV sub- 115 kV line	2006/09	5.5			X					

Table 6.1.1 Continued

III. Prior CRPP Solutions and Plans						
A. Capacity Additions		**MWs**				
DSM: LIPA Edge & Peak Reduction	2006	111				
DSM: NYSERDA	2009	90				
DSM: Con Ed Targeted	2009	30				
DSM: NYISO	2009	15				
DSM: NYSERDA	2010	135				
DSM: Con Ed Targeted	2010	45				
DSM: NYISO	2010	25				
B. Transmission Additions						
O&R CapacitorBanks	2006	64 MVAr				
LIPA Capacitor Banks	2006	133 MVAr				
O&R CapacitorBanks	2007	48 MVAr				
LIPA Capacitor Banks	2007	357 MVAr				
LIPA Other Reactive Resources	2007	75 MVAr				
LIPA Capacitor Banks	2008	39 MVAr				
O&R CapacitorBanks	2009	64 MVAr				
LIPA Capacitor Banks	2009	39 MVAr				
LIPA Other Reactive Resources	2009	17 MVAr				
LIPA Capacitor Banks	2010	39 MVAr				

IV. Additional TO Plans		**Miles/Capability**				
O & R Capacitor Banks	2008	112 MVAr				
O & R Capacitor Banks	2009	64 MVAr				
O & R Capacitor Banks	2010	64 MVAr				

Notes

UC: Under construction

I/S: In-Service

6.1.1 RNA study case Load & Resource Summary

The table 6.2.1 below presents a load and resource summary for the RNA study case for 2007 through 2016. The summary is consistent with the load and capacity table contained in the "2006 Load and Capacity Data" book or "Gold Book" except that it includes the Long Island HVDC ties to neighboring control areas as unforced delivery rights or UDRs, which are counted as resources in determining reserve margins and resource to zonal load ratios.

Table 6.2.1: RNA study case Load and Resource Summary for the NYCA, Zones J and K

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"	38,894	38,496	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"	990	990	990	990	990	990	990	990	990	990
Total	40,964	40,566	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 % (1)	121.1%	118.2%	115.7%	114.5%	113.5%	112.7%	112.1%	111.2%	110.3%	109.6%
Resource Margin w/o UDR	118.2%	115.3%	112.8%	111.7%	110.7%	110.0%	109.3%	108.5%	107.6%	106.9%
Zons J Res/Load/ Ratio	87.5%	86.2%	77.7%	76.8%	75.8%	75.0%	74.2%	73.6%	73.0%	72.5%
Zons 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 table shows a steady decline in the NYCA reserve margin from 121.1% in 2007 to 109.6% by the end of the planning period. Likewise, the Zone J resource to load ratio declines throughout the planning horizon from 87.5% to 72.5%, while Zone K peaks at 119.9% with the addition of the Neptune project in 2007 but declines to 105.7% by the end of the planning horizon.

7 Analysis Methodology

The CRPP was performed in three stages, an Input Stage, an Analysis Stage, and a Review Stage. During the Input Stage information was gathered from various Stakeholder Groups, Neighboring Control Areas, existing reliability assessments, and NYISO publications and reports. Results from the Input Stage regarding methodology, identification of scenario drivers, and initial identification of scenarios were presented to ESPWG and TPAS. The findings from the Input Stage are summarized in the next three sections, which follow the same outline as the initial presentation of the Input Stage. These findings reflect the fact that, based on intermediate results in the Analysis Stage, modifications to the Input Stage were made as appropriate.

For the RNA study case System, reliability simulations were performed for each year from 2007 to 2016. Load and generation projections were determined from the 2006 NYISO Load & Capacity Report. The reliability simulation started from the latest Installed Reserve Margin (IRM) study and was updated as described in Section 11.1.4.2. NYISO Voltage and thermal emergency transfer limit analysis was performed to determine transfer limits used in the MARS transmission constraints model.

Short circuit analysis was performed to ensure that potential increases in future fault currents would not exceed available circuit breaker interruption capabilities.

7.1 Transmission System Screening Analysis

A comprehensive transmission reliability analysis would include steady-state voltage, thermal, and transfer limit analysis, as well as first-swing stability and short circuit analyses at a minimum. It could also include steady-state or dynamic voltage stability analysis, three-phase cycle-by-cycle electro-magnetic transients (EMT) analysis to investigate power quality, control and/or machine torsional interactions, as well as longer time-frame analyses of second-to-second voltage and frequency regulation. Many of these analyses (e.g., fundamental frequency steady-state, dynamic and short circuit analyses) may be performed annually to ensure a reliable transmission system. Others (e.g., sub-synchronous resonance analysis) may be performed only for specific situations (e.g., addition of significant series compensation to a radial transmission line connecting a large thermal plant to the rest of the power system).

Similarly, some analyses are more likely to uncover significant transmission constraints than others. For instance, a steady-state thermal or transfer limit analysis could identify the need for additional transmission lines between different regions of the state, while a first-swing stability analysis could identify the need for faster relaying on an existing transmission line. In general, additional transmission lines are capital intensive, require a longer construction time, and cross multiple administrative districts with each requiring its own permits. By contrast, a relay upgrade is frequently located at a single existing substation and can be installed relatively quickly and inexpensively. Therefore, any evaluation of the transmission reliability of an uncertain future system should focus on those analyses most likely to uncover significant problems.

Such a screening level evaluation should focus first on steady-state thermal and voltage analyses. Stability and short circuit analyses can be deferred until the future system configuration is more certain. Specialty EMT and other analysis can be ignored until required of individual developers or manufacturers for particular projects. A detailed description of this type of screening level analysis is contained in the following sections.

Objective

The objective of the screening analysis was to determine the emergency thermal and voltage transfer limitations of the RNA study case systems. These transfer limits were used in the MARS program to identify the reliability needs of the proposed RNA study case Systems.

7.1.1 RNA study case System Case Development

The power flow cases were developed to represent the RNA study case System assumptions for transmission system upgrades, generation additions and/or retirements, and load levels for each year from 2007 to 2016. Available generation was dispatched to mitigate any pre-contingency thermal, voltage, and/or interface transfer violations. For the cases where there was insufficient generation to achieve a power flow solution, the reactive power load was reduced in the Area of the voltage violations or power flow solution bus mismatch. Any remaining pre-contingency violations were flagged as potential components of a required transmission system upgrade to a particular region or corridor.

7.1.2 Emergency Thermal Transfer Analysis

Emergency thermal transfer analysis was performed using the Transfer Limit Table Generator (TLTG) linear power flow analysis software for the following transmission interfaces:

- Dysinger East Open
- West Central Open
- Moses South
- Volney East
- Total East
- Central East
- Central East + Fraser-Gilboa
- Central East Group
- F to G
- UPNY-SENY
- UPNY-ConEd
- Millwood South Closed
- Dunwoodie South (Planning Definition)
- Dunwoodie South (Operating Definition)
- I to J
- LIPA Imports

The monitored line, contingency data, and subsystem definitions was based on the thermal analysis data used in the Summer Operating Study and modified for the transmission configurations changes and study period. The transmission interface definitions are included in Appendix 5.1.

7.1.3 Voltage Transfer Limit Analysis

Emergency voltage and voltage collapse analysis was performed using the VCAP analysis software for the transmission interfaces identified in 7.1.2.

In order to determine transfer limits, it was necessary to increase the power flow across the interface(s) under study by adjusting generation on the system. The assumed location for adjusting generation for evaluating transfer limits was similar to the study assumptions for the 2006 ATRA.

7.1.4 Evaluation of Analytical Results

The results of the analysis described in 7.1.2 and 7.1.3 were evaluated to develop the transmission constraint model used in the MARS analysis.

7.1.5 Scenario Database Development

The RNA study case System power flow was modified to represent the scenario case assumptions for transmission system upgrades, generation additions and/or retirements, and load levels. The resulting power flows were reviewed to identify any pre-contingency thermal, voltage, and/or interface transfer violations. Available generation was dispatched to mitigate any pre-contingency thermal, voltage, and/or interface transfer violations. For the cases where there was insufficient generation to achieve a power flow solution, the reactive power load in the area of the voltage violations or power flow solution bus mismatch was reduced. Any remaining pre-contingency violations were flagged as potential components of a required transmission system upgrade to a particular region or corridor.

7.2 Resource Adequacy Analysis

Introduction

This task focused on evaluating the adequacy of the NYCA transmission system as it affects the generation system reliability and the determination of the state-wide installed reserve requirements. NYSRC Reliability Rule AR-1 states that the state-wide installed reserve requirements will provide that "Adequate resource capacity shall exist in the NYCA such that, after due allowance for scheduled outages and deratings, forced outages and deratings, assistance from neighboring systems, NYS Transmission System transfer capability, uncertainty of load forecasts, and capacity and/or load relief from available operating procedures, the probability of disconnecting firm load due to a resource deficiency will be, on the average, no more than once in ten years." (NYSRC Reliability Rules Manual (www.nysrc.org/documents.html)). This requirement is often stated in terms of maintaining an LOLE of 0.1 days per year.

MARS

The primary tool used for the performance of the resource adequacy analysis was GE's MARS program. MARS uses a Monte Carlo simulation to compute the reliability of a generation system comprised of any number of interconnected areas or zones. MARS is able to reflect in its reliability calculations each of the factors listed in NYSRC Reliability Rule AR-1, including the impacts of the transfer capability of the transmission system.

Data

A RNA study case System was developed that modeled the existing system including the generation and transmission system additions and upgrades that are projected to occur throughout the Study Period as well as unit retirements. Because emergency assistance from neighboring systems contributes to the reliability of the NYCA system, the load and generation of the neighboring systems was modeled. The source for the data on the existing system was the MARS database maintained by NYISO staff for use in determining the annual installed reserve requirements. The load and generation was updated through the Study Period based on data from the 2006 NYISO Load & Capacity Data report. Similar reports for the neighboring systems were referenced for updating the data in those regions.

Methodology

The first step in the analysis was to calculate the NYCA LOLE for the RNA study case assuming no transmission system transfer limitations within the NYCA system. This analysis indicated whether the installed generation is sufficient to satisfy the load demand.

The NYCA LOLE was then computed including the effects of the internal transfer limitations. This will indicate whether the NYCA transmission system was adequate to deliver the generation to the load.

If the system failed to meet the LOLE criterion of 0.1 days per year, additional combined cycle generation units with 250 MW capacities were added until the LOLE criterion was satisfied.

Underground cables generally have much longer repair times than overhead lines. Because of the potential impact of these extended cable outages on transfer capability, interfaces that include transmission circuits that are comprised of cables were modeled in the MARS simulation with discrete transition rates, based on historic forced outage rates. This captures the effect of reduced transfer capability across such interfaces when the cables are modeled as out-of-service.

7.3 Short Circuit Analysis

A fault duty study was performed using ASPEN OneLiner (Advanced Systems for Power Engineering) to determine the impact of the 2016 maximum generation scenario on local circuit breakers. Additional analyses of other generation scenarios were not necessary because excessive short circuit currents were only analyzed for the maximum generation scenario. The NYISO "Guideline for Fault Current Assessment" was used. Three-phase, single-phase and line-line-ground short-circuit currents were determined for the same substations as in the 2006 ATRA. A screening was performed to identify significant changes in fault levels.

8 System Planning Issues

8.1 Introduction

There are many issues that could impact the RNA study case assumptions over the 10-year study period. These issues could have positive or negative impacts on the existing NY power system. Below is a description of the many issues that NYISO has identified as potential impact on the RNA study case assumptions. These issues are reviewed not only for the development of future alternative scenarios but also as issues that need to be monitored on an ongoing basis for consideration in the next cycle of the CRPP.

8.2 Issues

Wind/Renewable Additions

Renewable Portfolio Standards (RPS) are state standards that establish requirements that a specific percent of the total retail electric energy consumption for the state be supplied each year by renewable forms of energy. New York has adopted a standard which requires that 25% of the State's energy requirements come from eligible renewable resources by 2013. The current, level which includes the State's hydroelectric resources, is 19.5%.

It is expected the majority of the additional requirement will be supplied by wind generators. The NYISO interconnection queue includes proposals for wind generation that now total in excess of 5,000 MW. Wind generators are intermittent resources and have unique electrical characteristics that pose challenges for planning and operations of the interconnected system. The NYISO has completed a study conducted with GE Energy which evaluated the reliability and operating implications of the large scale integration of wind generation. The study concluded that if state-of-the-art wind technology is utilized, wind generation can reliably interconnect with only minor adjustments to existing planning, operating, and reliability practices.

Environmental Compliance

There are a host of new air quality and water quality rules that will apply to power plants in New York State from the present to within the next decade. These initiatives could have a significant future impact on resource availability and, thus, the reliability of the interconnected system. These initiatives include the following:

1. NYS Acid Deposition Reduction Program (ADRP): ADRP, which is a New York-only power plant cap-and-trade program for nitrogen oxides (NOx) and sulfur dioxide (SO2), began October 1, 2004 for NOx and January 1, 2005, for SO2. The regulations require an approximate 40 percent reduction in NOx emissions from 2002 levels and a 50 percent reduction in SO2 emissions from current federal acid rain program levels.
2. Clean Water Act (CWA) Section 316(b) – Cooling Water Intake Structure Best Technology Available (BTA): This rule primarily applies to existing power plants (fossil fuel and nuclear) that rely on once-through cooling for steam condensers (about 20 plants in New York). The United States Environmental Protection Agency (EPA) had promulgated its 2004 final Phase II existing cooling water intake structures rule ("Phase II Rule"), which would have been

implemented by NYSDEC through their own rules and permitting actions. However, on January 25, 2007, the United States Court of Appeals for the Second Circuit issued its decision in Riverkeeper, Inc. v. EPA regarding the Phase II Rule EPA promulgated pursuant to section 316(b) of the Clean Water Act. The court remanded back to EPA for consideration many of the substantive parts of the rule. As such, compliance with 316(b) rules at this time appears to fall back on state rules pending further action on its Phase II Rule by the EPA. Though it would have been allowed by the EPA rule, the New York State Department of Environmental Conservation (NYSDEC) has indicated that they will not consider economic viability in the determination of BTA. This policy could force existing power plants to install cooling towers or retire.

3. New Source Review (NSR): NSR regulations require existing facilities that undergo a major modification to install modern air emission control equipment for air contaminants impacted by the modification. In the late 1990s, the EPA and the NYSDEC began enforcement actions against the coal-fired power plants in New York and several other states for allegedly violating NSR requirements. The basis for the enforcement actions was the interpretation of what constitutes routine maintenance, repair and replacement, which is exempt from the definition of major modification. Several companies have agreed to settle the enforcement actions. In New York, the settlements include power plants owned by Mirant, AES and NRG and have resulted in the commitment to install millions of dollars in emission controls or retirement of certain units. Enforcement actions are still outstanding for RG&E and Dynegy.
4. Clean Air Interstate Rules (CAIR): On March 10, 2005, EPA finalized new cap-and- trade programs for reducing emissions of SO2 and NOx by approximately 70 percent in 28 eastern states. Implementation of the rules will be in two phases. Phase I for NOx begins in 2009 and Phase II begins in 2015. Phase I for SO2 begins in 2010 and Phase II begins in 2015.
5. Clean Air Mercury Rule: On March 15, 2005, EPA finalized a rule for controlling mercury emissions from power plants through a new cap-and-trade program for mercury emissions. Although, EPA implements the cap by setting a mercury budget for each state, it is left up to each state to determine how they will meet that budget. NYSDEC has promulgated Part 246 with accelerated compliance dates and restrictions on trading. Phase I covers 2010 through 2014 with limits comparable to the Federal Rule. Phase II begins in 2015 and calls for the development of unit specific limits which will result in reductions of approximately 90%.
6. Regional Greenhouse Gas Initiative (RGGI): RGGI is a cooperative effort by seven Northeastern and Mid-Atlantic states which is designed to reduce carbon dioxide emissions through a regional cap-and-trade program. NYSDEC has issued a preproposal for public comment. The preproposal proposes to generally apply the regional model rule that calls for a cap of 64.3 million tons for New York State beginning in 2009. Under the preproposal, beginning in 2015, the cap would be reduced 2.5% annually for four years for a total reduction of 10%. NYSDEC has sought comment on a proposal to apply a

100% auction structure with all proceeds dedicated to energy efficiency and related initiatives. As proposed, generators would need to procure allowances equal to their annual emissions of CO2. Offsets are proposed to be allowed but in a very limited fashion. Auction rules remain to be developed beginning in 2007.

7. Regional Haze Rule: To reduce haze in national parks and wilderness areas, EPA issued a regional haze rule requiring Best Available Retrofit Technology (BART) on certain facilities built between 1962 and 1977 that have the potential to emit more than 250 tons a year of visibility-impairing pollution (i.e., SO2, NOx and fine particulate matter). Those facilities fall into 26 categories, including fossil fuel-fired power plants. This rule could affect 13 New York power plants and could result in the addition of BART controls by 2013. The Regional Haze Rule will be implemented through a New York State implementation plan, which will not be submitted until 2007. Potential BART controls include SO2 scrubbers, selective catalytic reduction of NOx, and fabric filter particulate controls.

8. Part 222 Distributed Generation Sources. NYSDEC is drafting regulations that will limit the amount of distributed generation can that can be used in the NYISO's Special Case Resource (SCR) program and Emergency Demand Response Program (EDRP). This air emission program is a necessary component of New York's federally-approved State Implementation Plan (SIP) to achieve compliance with National Ambient Air Quality Standards (NAAQS) for ozone. The program will limit the amount of distributed generation that is not otherwise regulated, to 271.9 MW in the New York City Metropolitan Area (NYCMA) and 111.4 MW in the rest of New York State in 2007. The limits will be reduced over time to 50 MW in NYCMA and 50 MW in the rest of the State. The use of this resource will be limited to 30 hours/year and emission limits will be imposed.

9. Ozone Transport Commission OTC is evaluating what additional measures are needed to bring the region into attainment with National Ambient Air Quality Standards. If promulgated, such additional reductions would likely be required as early as the 2009 ozone season. Existing regulations and regulations that are scheduled to be implemented (e.g., CAIR) may not be deemed to be sufficient to achieve standards, especially for ozone. The following two OTC initiatives are under consideration with decisions anticipated at a March 2, 2007 OTC meeting:

   - CAIR Plus: OTC is evaluating additional NOx and SO2 reductions from existing generators beyond the CAIR requirements. While there have been a number of stakeholders meetings on this topic, none have been held for quite a few months. There is currently no communication as to what, if any, additional reductions will be required or how reductions that are determined to be needed will be implemented.

   - High Electric Demand Day (HEDD): A focus of the OTC has been NOx emissions from uncontrolled peaking units during ozone episodes. There is a potential for a change to require approximately 25% reductions of NOx emissions from these units during ozone episodes.

Although there are a significant number of initiatives underway, the ultimate disposition and impact of which have yet to be determined, the NYISO's primary concern at this point is that impacts on electric system supply resources be determined with sufficient lead time that any adverse impact on system reliability can be mitigated within the NYISO's Comprehensive Reliability Planning Process. The NYISO will continue to monitor these issues for consideration in future cycles of the CRPP.

Generation Expansion

Approximately 9,500 MW of new generation has been proposed in New York State. The current economic climate across the country has caused a significant number of projects to be canceled or delayed. The same phenomena could occur in New York State. Cancellations or delays in load pockets, such as New York City, would require generation from other areas to help meet demand. This would cause heavier loading on the existing transmission system interfaces to New York City.

Retirement of Existing Generation

Competition from new, more efficient combined cycle plants, environmental regulations, and potential revenue shortfalls caused by the expiration of existing Power Purchase Agreements potentially could lead to the retirement of additional generating units . The loss of generation due to retirements in transmission-constrained areas would require the addition of transmission facilities or new generation within the area. Such additions would avoid more loading on the existing transmission system to meet demand in areas that experience retirements.

Regulatory issues could also lead to potential retirements. For example, the Indian Point Nuclear Power Plant's proximity to population centers has created pressure for the plant to be shut down. This plant is essential to New York City and the Lower Hudson Valley to meet electricity needs. Additional generation could be needed to replace this generation capacity to fill a potential void if the retirement occurred. Depending on its location, the replacement generation could change the loading on the existing transmission system, and could give rise to the need for transmission system upgrades.

Transmission Owner Plans

Transmission Owners in New York State could build new interconnections with neighboring systems. This would increase the import capability into New York State and allow more power to flow, and hence increase loading on the existing transmission system within New York. For example, the New York Power Authority recently announced plans to interconnect a new cable beneath the Hudson River between Northern New Jersey and the West 49th Street substation to deliver an additional 500 MW of capacity into New York City.

Fuel Availability/Diversity

There is a potential for a natural gas shortage in New York State. If this occurs, it could result in natural gas fired units having to burn other fuels or to curtail operation. If generator curtailments due to fuel unavailability occur in load pockets, generation from other areas would be needed to help meet demand, causing heavier loading on the existing transmission system. Many of the dual-fuel fired units are larger, older steam units located in load pockets and their retirement could impact reliability needs. The NYSRC'sMinimum Oil Burn requirements in New York City and on Long Island should not be misconstrued as preventing natural gas shortages. Instead, the requirements are a mechanism to guard against the adverse effects to bulk power system reliability resulting from significant generation loss caused by a major gas transmission infrastructure failure on high electric load days. Assuming the continued availability of dual-fuel capability, the rules have the effect of lowering demands on the gas transmission system on days when local generation is particularly needed. Another challenge in the future will be to maintain the benefits that fuel diversity, in particular dual fuel capability, provides today. This will be more important in New York City and Long Island which are more dependent on oil and gas fired units, many of which have interruptible gas supply contracts.

An analysis of gas consumption for electric generation was conducted and reported in conjunction with the development of the RGGI. The analysis compares projections for gas consumption for electric generation under a reference case, without RGGI, and a case with RGGI. The analysis did not examine gas deliverability issues. Rather it, made the assumption that additional pipeline capacity would be added when economically warranted, and further that gas supply would be available in sufficient quantities throughout the planning horizon. The analysis examined the additional gas requirements and compared them to the historical maximum delivered gas quantities for the RGGI States. The study determined that significant increases in gas deliverability are required with and without RGGI. Questions of gas deliverability, its impact on electric system reliability, and the feasibility of environmental strategies need to be examined on an ongoing basis.

Recent events in the gas transmission capacity market indicate that new resources may be built when the market needs them. Examples of this phenomenon include: (1) the new Iroquois pipeline that connected to Con Edison's Bronx gate station and was placed in service in 2004, bringing additional supplies of natural gas to New York City; (2) the Millennium Pipeline, which will add new supplies to New York State and more specifically the New York City metropolitan area, received its FERC certificate to build in January 2007, has a projected in service date of Winter 2008-2009; and has firm customer commitments, and, (3) Transco's "Leidy-to-Long Island" project, which received its FERC approval to build in May 2006, and will bring additional supplies to Long Island when it is placed in service in Winter 2007-2008.

Impact of New Technologies

Many new technologies that are applicable to electricity generation and transmission are under research and development. Some examples are Carbon Filament Transmission Lines, distributed generation and new energy management systems. Carbon filament lines would allow transmission lines to operate with higher temperatures thus, increasing their loading capacity. Distributed generation would allow electricity generation at the location of growing loads. Finally, new energy management systems could reduce on-peak demand. New technologies such as these could help to alleviate loading on the existing transmission system.

Load Forecast Uncertainty

There is considerable uncertainty associated with any load forecast. Many events can cause actual loads to deviate from forecasted values. The existing transmission system may or may not benefit from a load forecast swing. Lower than forecasted load would cause less loading on the transmission system and reduce or delay identified needs. Higher than forecasted loads would likely result in more severe thermal and voltage criteria violations occurring earlier.

Neighboring System Plans

Neighboring systems could upgrade current transmission interconnections or build new interconnections into New York. These changes would cause more power to flow into New York. This additional power flow from neighboring regions could change the loading patterns on the existing transmission system within New York.

9 Scenario Definition

Following analysis of the RNA study case, test cases which combined variations in installed generation, load forecasts, transmission system transfer capabilities, and available assistance from neighboring systems were simulated to determine their impact on the reliability of the NYCA system, and hence the adequacy of the bulk power system.

Scenarios for consideration in this study include:

1. High load growth forecast.
2. Retirement of Older Coal Plants.
    a. All coal units in NY retire except Cayuga and Somerset remain in service. This results in a reduction of 1545 MW of summer capacity.
    b. 490 MW of coal units in Southeast NY retire in 2009.
    c. 681 MW of coal units in Upstate NY retire in 2009.
3. Changing Resource Mix.
    a. Poletti 1 Retirement Deferred to 2010.
    b. NUG retirement based upon contract termination dates.
    c. NYPA transmission project together with 500 MWs of capacity at West 49th Street.
    d. NYPA 680 MW Clean Coal Project.

Issues not specifically covered by the above scenarios include:

1. Wind/Renewable Additions – this issue has been covered in separate studies.
2. Infrastructure Aging – assumed to have no effect over the study period.
3. New Technologies – insufficiently defined to include as any different identifiable impact.
4. Neighboring System Plans – not assumed to change, but may merit additional investigation if dependence on external support is shown to increase significantly under any of the scenarios.
5. Demand response systems – effectively decreases load and would likely be accompanied by some form of generation reduction. Such changes could result in a variation in either upstate or downstate, generation reduction scenarios.

10 Transmission System Assessment

A key element underlying the determination of reliability needs is an assessment to determine if the transmission system meets reliability criteria, and to establish the transfer limits to be used in the Multi-Area Reliability Simulation (MARS) model. This assessment is conducted through a series of power flow, stability and short circuit studies.

In general, the RNA analyses indicated that the bulk power transmission system can be secured, but that transfer limits for certain key interfaces must be reduced in order to respect voltage collapse criteria. However, a reduction in transfer limits or a limiting interface can result in higher LOLE findings and/or needs occurring earlier than they otherwise would. As a result, LOLE analysis was conducted for the RNA study case, a case with thermal limits, and finally a case with no internal NYCA transmission limits. These cases were conducted to demonstrate the impact that transmission limits have on the LOLE results.

10.1 Development of RNA study case System Cases

Table 10.1.1 below summarizes the Area load plus losses.

Table 10.1.1: Area Load plus Losses (MW)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
LOAD+LOSS MW										
WEST	2909	2966	2982	2983	2990	2952	2928	2921	2929	2927
GENESSEE	2031	2078	2097	2110	2122	2104	2096	2103	2118	2125
CENTRAL	2959	3017	3054	3087	3128	3153	3171	3200	3208	3213
NORTH	806	809	810	811	830	822	819	820	819	815
MOHAWK	1286	1316	1333	1336	1314	1341	1338	1339	1336	1330
CAPITAL	2278	2320	2327	2330	2361	2313	2297	2294	2293	2288
HUDSON	2389	2450	2482	2504	2509	2513	2514	2526	2549	2562
MILLWOOD	733	749	757	761	765	761	763	768	771	777
DUNWOODIE	1537	1518	1544	1567	1587	1590	1603	1615	1623	1637
NYC	11801	11811	11972	12136	12274	12422	12557	12665	12770	12889
LISLAND	5425	5539	5641	5741	5870	5922	6028	6134	6258	6397
	34154	34575	35000	35364	35751	35894	36113	36384	36675	36959

Table 10.1.2 below summarizes the Area generation dispatched for the RNA study case system.

Table 10.1.2: Generation Dispatched (MW)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
GEN DISP MW										
WEST	4659	4900	5287	5296	5274	5236	5212	5204	5212	5210
GENESSEE	836	665	659	662	664	646	638	675	660	667
CENTRAL	5292	5542	5618	5650	5841	5866	5884	5913	5921	5927
NORTH	1208	1214	1180	1181	1200	1192	1189	1190	1189	1185
MOHAWK	459	600	603	620	605	622	629	630	627	621
CAPITAL	2848	2753	2838	2891	2973	2946	2929	2906	2947	2954
HUDSON	2940	2779	2926	2898	2903	2909	2908	2921	2942	2957
MILLWOOD	2212	2202	2159	2164	2167	2165	2166	2170	2176	2179
DUNWOODIE	3	3	3	3	3	3	3	3	3	3
NYC	7594	7684	7395	7560	7550	7694	7830	7937	8044	8164
LISLAND	3725	3524	3626	3726	3855	3907	4013	4120	4243	4383
	31776	31865	32294	32650	33036	33186	33400	33668	33964	34249

Appendix 5.3.1 contains the summary of significant system performance results of each of the RNA study cases.

10.1.1 Emergency Thermal Transfer Limit Analysis

RNA study case emergency thermal transfer limits analysis was performed according to the methodology described in Section 8.1.2. The definitions of the transmission interfaces are described in Appendix 5.1.

Table 10.1.3 illustrates the emergency thermal transfer limits for the RNA study case system conditions:

Table 10.1.3: Emergency Thermal Transfer Limits[10]

	2008		2009		2010		2011	
Dysinger East	3200	1	3200	1	3200	1	3200	1
West Central	1700	1	1700	1	1700	1	1700	1
Moses South	2550	2	2575	2	2575	2	2575	2
Volney East	4975	3	4950	3	4950	3	4950	3
Total East	6775	4	6625	4	6625	4	6625	4
Central East	3350	4	3325	4	3300	4	3275	4
Central East+Fras-gilb	4000	4	4000	4	3925	4	3900	5
CE Group	6025	4	6000	4	5950	4	5925	4
F to G	3450	6	3450	6	3475	6	3450	6
UPNY-SENY Open	6050	6	6050	6	6050	6	6050	6
UPNY-ConEd Open	6675	7	6550	7	6625	7	6600	7
Millwood South Closed	8600	7	8450	7	8450	7	8450	7
Dunwoodie-South Plan	5025	9	5425	9	5600	9	5600	9
I to J	3864	9	4200	9	4400	9	4400	9
LI Import	2110	8	2110	8	2110	8	2110	8

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[10] 2007 RNA MARS limits derived from IRM base case

Table 10.1.3 Continued

	Limiting Facility	Limiting Rating	Contingency
1	Niagara-Rochester 345	1685	L/O Somerset-Rochester 345
2	Moses - Adirondack- 230	440	L/O Massena-Marcy 765, Generation Reject Chataeuguay
3	Fraser - Coopers Corners-345	1792	Pre-disturbance
4	New Scotland-Leeds 345	1724	L/O New Scotland-Leeds 345
5	Fraser - Coopers Corners-345	1207	Pre-disturbance
6	Leeds - Pleasant Valley-345	1724	L/O Athens-Pleasant Valley 345
7	Roseton-Fishkill 345	1963	Pre-disturbance
8	Dunwoodie-Shore Rd 345	599	Pre-disturbance
9	S. Bronx-Rainey 345	1201	L/O Mott Haven Rainey 345

The reduction in West Central transfer capability between 2007 and 2008 results from the retirement of the Russell plant in 2008. The variations in through-time transfer limits are due to the differences in generation dispatch and other factors.

Appendix 5.3.2 contains the TLTG output reports for each interface through time.

10.1.2 Emergency Voltage Transfer Limit Analysis

RNA study case system voltage analysis was performed using Power-Voltage (PV) analysis for the Dysinger East to the CE Group transmission interfaces. The voltage contingency analysis program, or VCAP analysis, was used for the F to G to I to J transmission interfaces in order to more accurately represent generation contingencies and perform more detailed analysis of specific transfer cases.

Table 10.1.4 illustrates the initial RNA study case system voltage analysis. Appendix 5.3.3 illustrates the pre-disturbance and post-contingency voltage as a function of transfers.

Table 10.1.4: Emergency Voltage Transfer Limits[11]

	2008		2009		2010		2011	
Dysinger East	2600	1	2600	1	2600	1	2600	1
West Cent	1300	1	1300	1	1300	1	1300	1
Moses South	2050	2	2000	2	2000	2	2000	2
Volney East	3500	3	3500	3	3750	3	3750	3
Total East	6175	4	6100	4	6175	4	5925	4
Central East	2850	4	2600	4	2825	4	2800	4
Cent East+Fras-gilb	3400	4	3075	4	3325	4	3325	4
CE Group	4825	4	4450	4	4750	4	4725	4
F to G	3750	5	3525	5	3650	5	3800	5
UPNY-SENY Open	6150	5	6150	5	6150	5	6150	5
UPNY-ConEd Open	5000	7	5000	7	5000	7	5000	7
Millwood South Closed	8450	8	8450	7	8450	7	8450	7
Dunwoodie-South Plan	5154	8	5081	7	5031	7	4938	7
I to J	>3864 T	T	3791	9	3741	9	3648	9

	Limiting Facility	Limiting Voltage (kV)	Contingency
1	Rochester 345	328	L/O Somerset-Rochester 345
2	Porter 230	218	L/O Marcy-New Scotland 345
3	Edic 345	328	L/O 9 Mile Point #2
4	New Scotland 345	328	New Scotland 77 Bus Fault
5	Pleasant Valley 345	328	L/O Leeds-Pleasant Valley 345
6	Pleasant Valley 345	328	L/O Millstone #3
7	Sprain Brook 345	328	L/O Tower 67/68 at Ladentown
8	Sprain Brook 345	328	L/O W89/W90 Tower at Pleasantville
9	Voltage Collapse Limit		L/O Ravenswood 3

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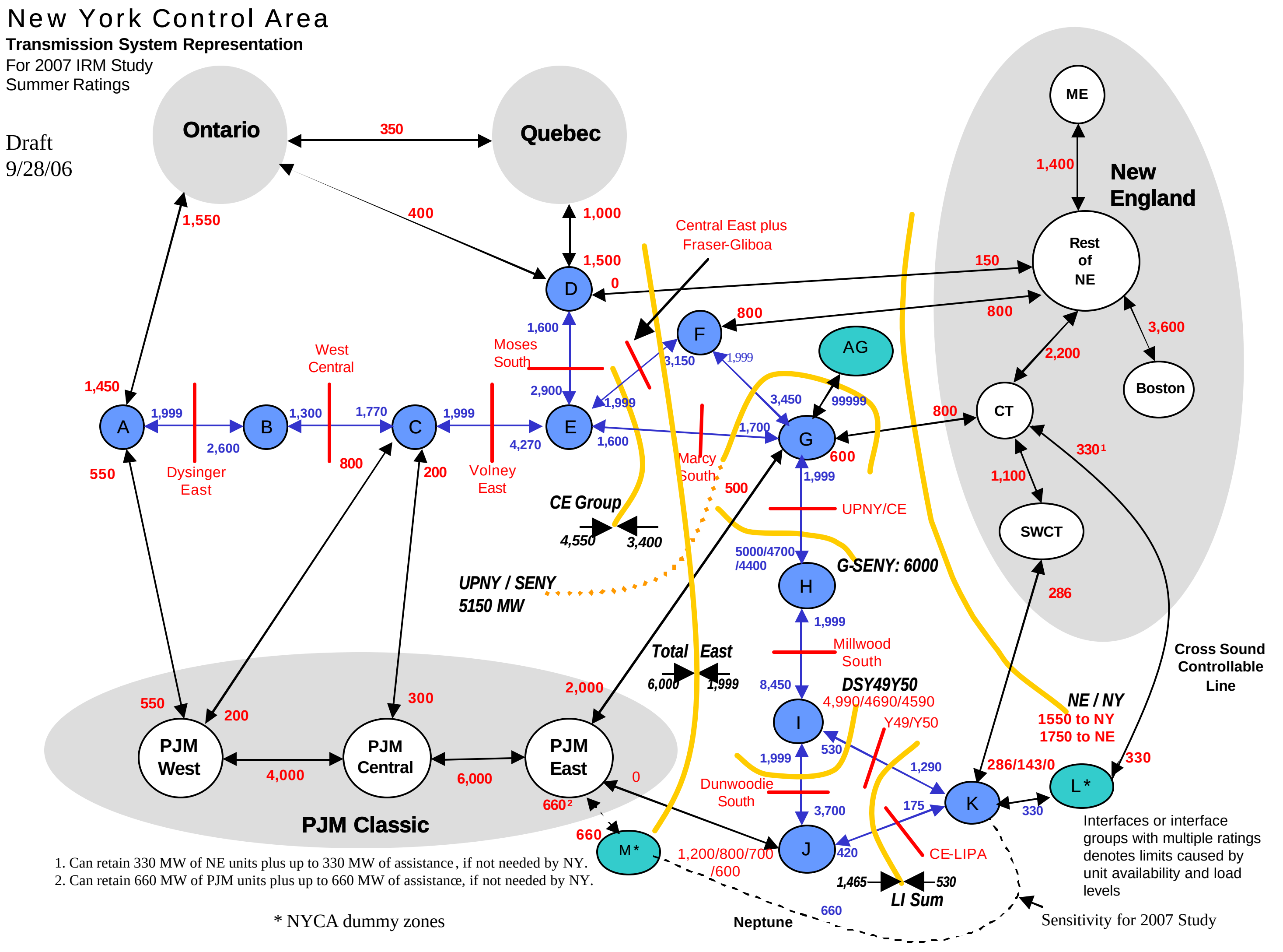
[11] Ibid

10.2 Development of the MARS Topology

As described in Section 7.2, the MARS model was used to measure the NYCA LOLE. A key input into the MARS modeling process is the transmission network topology. The starting point for the CRPP is the most recently approved New York State Reliability Council installed reserve margin study topology. Figure 1 below is the most recently approved topology, which is the one that was used for the study entitled: “NEW YORK CONTROL AREA INSTALLED CAPACITY REQUIREMENTS FOR THE PERIOD MAY 2007 THROUGH APRIL 2008”. This topology was the starting point for the RNA but was modified as dictated by assessment of future transmission system conditions, as discussed herein.



1. Can retain 330 MW of NE units plus up to 330 MW of assistance, if not needed by NY.
2. Can retain 660 MW of PJM units plus up to 660 MW of assistance, if not needed by NY.

* NYCA dummy zones

Figure 1: 2007 IRM Study MARS Topology

The following presents the impact on LOLE of alternative transmission transfer limits.

10.2.1 Free Flow Transmission Model

Table 10.1.5 illustrates the NYCA LOLE for an unconstrained free-flowing transmission model. Initially, in 2007 the RNA study case System NYCA Capacity Reserve Margin initially is well above the 18% IRM and the Locational Requirements of 80% percent In City and 99% for Long Island. The continued growth in load in South East New York, generation retirements, and the limited number of new generating units that are presently under construction would reduce the NYCA Reserve Margin to below 114% and increase the NYCA LOLE to .12 by 2012.

Table 10.1.5 LOLE for the RNA study case System Based on Free Flowing Conditions

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
AREA-A										
AREA-B		0.01	0.03	0.04	0.06	0.10	0.12	0.17	0.24	0.29
AREA-C										
AREA-D										
AREA-E				0.02	0.02	0.04	0.04	0.07	0.10	0.13
AREA-F										
AREA-G					0.01	0.01	0.01	0.01	0.02	0.03
AREA-H										
AREA-I		0.01	0.03	0.05	0.07	0.11	0.13	0.19	0.26	0.32
AREA-J		0.01	0.03	0.05	0.07	0.12	0.14	0.21	0.29	0.36
AREA-K					0.01	0.01	0.02	0.03	0.05	0.09
NYCA		0.01	0.03	0.05	0.08	0.12	0.15	0.21	0.30	0.37

10.2.2 CRPP Transmission Constraint Model With Thermal Limits Only

Table 10.1.6 below illustrates the through-time thermal transfer limits used for the CRPP Transmission Constraint Model. These transfer limits were the basis of the thermal sensitivity case conducted for the RNA study case, which assumed that voltage constraints were eliminated.

Table 10.1.6 Through-Time Thermal Transfer For CRPP Transmission Constraint Model

```
&INF-TRLM-00     ITL
 *                           INTERFACE-TRANSFER-LIMITS
 *------------------------------------------------------------------------------------------
*                     INTERFACE     POSITIVE      NEGATIVE                           ZERO TIE
*                        OR         DIRECTION     DIRECTION     ZERO TIE LIMITS        FOR
*   EFFECTIVE        INTF. GROUP    TIE LIMIT     TIE LIMIT     BEFORE NON-FIRM      NON-FIRM
*     DATE              NAME          (MW)          (MW)          ASSISTANCE ?
*-------------------------------------------------------------------------------------------
*    MMMYYYY          AAAAAAAA         #             #                Y/N              Y/N
*    -------          --------      -------       -------             ---              ---
 @  01JAN2000**         'DYSINGER'     3200          1999              N                N
 @  01JAN2000**         'W.CENTRL'     1770          1300              N                N
 @  01JAN2000**         'VOLNEY-E'     4270          1999              N                N
 @  01JAN2000**         'MOSES SO'     2900          1600              N                N
 @  01JAN2000**         'CEN EAST'     3800          1999              N                N
 @  01JAN2000**         'MARCY-SO'     1700          1600              N                N
 @  01JAN2000**         'F TO G  '     3450          1999              N                N
 @  01JAN2000**         'UP-CONED'     6600          1999              N                N
 @  01JAN2000**         'MILLWOOD'     8450          1999              N                N
 @  01JAN2000**         'DUNWOOD.'     4400          1999              N                N
 @  01JAN2000**         'CN-LILCO'      175           420              N                N
 @  01JAN2000**         'Y49Y50  '     1290           530              N                N
 @  01JAN2000**         'F - NE  '      800           600              N                Y
 @  01JAN2000**         'G - NE  '      800           400              N                Y
 @  01JAN2000**         'D - NE  '      150             0              N                Y
 @  01JAN2000**         'K - NE  '      286           286              N                Y
 @  01JAN2000**         'ME-ROP  '     1400          1400              N                N
 @  01JAN2000**         'ROP-BSTN'     3600          3600              N                N
 @  01JAN2000**         'ROP-ROCT'     2200          2200              N                N
 @  01JAN2000**         'ROCTSWCT'     1100          1100              N                N
 @  01JAN2000**           'A - PJMW'    550            89              N                Y
 @  01JAN2000**           'C - PJMW'    200           129              N                Y
 @  01JAN2000**           'C - PJMC'    300            32              N                Y
 @  01JAN2000**           'G - PJME'   2000            30              N                Y
 @  01JAN2000**           'J - PJME'      1          1200              N                Y
 @  01JAN2000**          "C_TO_E"      6000          6000              N                N
 @  01JAN2000**          "W_TO_C"      4000          4000              N                N
 @  01JAN2000**           'D - HQ  '   1000           500              N                Y
 @  01JAN2000**           'A - OH  '   1550          1395              N                Y
 @  01JAN2000**           'D - OH  '    400           400              N                Y
 @  01JAN2000**           'OH - HQ '    350           350              N                N
 @  01JAN2000**           'NYD - NE'    660           330              N                Y
 @  01JAN2000**           'NYD - K '    330           330              N                N
 @  01JAN2000**           'AG - G '   99999         99999              N                N
 @  01JAN2007**         'K - NY2 '      660           660              N                N
 @  01JAN2007**         'NY2-EAST'     1320           660              N                N
*****GROUPS
 @  01JAN2000**           'TOTAL-ES'   7200          1999              N                N
 @  01JAN2000**           'UPNYSENY'   5150          1999              N                N
 @  01JAN2000**           'UPSEBYPA'   5150          1999              N                N
 @  01JAN2000**           'CE GRP  '   6000          3400              N                N
 @  01JAN2000**           'NY-IMPTS'  99999         99999              N                N
 @  01JAN2000**           'LI SUM  '   1465           530              N                N
 @  01JAN2000**           'DSY49Y50'  99999          9999              N                N
 @  01JAN2000**           'G-SENY  '   7600          2499              N                N
 @  01JAN2000**           'NE-IMPTS'   1550          1750              N                N
 @  01JAN2000**           'NE_F&F_G'  99999         99999              N                N
 @  01JAN2000**           'HUDVALLY'  99999         99999              N                N
;;;; END OF &INF-TRLM-00 ;;;;
```

Table 10.1.7 below illustrates the LOLE results utilizing the through-time thermal transfer limits for the CRPP Transmission Constraint Model.

Table 10.1.7 LOLE Results for the RNA study case System Based on Thermal Transfer Limits

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
AREA-A										
AREA-B		0.01	0.03	0.04	0.06	0.09	0.10	0.13	0.17	0.19
AREA-C										
AREA-D										
AREA-E			0.01	0.02	0.02	0.04	0.04	0.06	0.08	0.10
AREA-F										
AREA-G					0.01	0.01	0.01	0.02	0.02	0.03
AREA-H										

10.2.3 CRPP Transmission Constraint Model with Thermal and Voltage Limits Invoked

Table 10.1.8 below illustrates the through-time transfer limits utilizing both thermal and voltage transfer limits:

Table 10.1.8: Thru-Time Thermal And Voltage Transfer Limits For CRPP Transmission Constraint Model

```
&INF-TRLM-00     ITL
*                              INTERFACE-TRANSFER-LIMITS
 *-------------------------------------------------------------------------------------*
INTERFACE     POSITIVE      NEGATIVE                            ZERO TIE
*                          OR        DIRECTION     DIRECTION     ZERO TIE LIMITS       FOR
*   EFFECTIVE         INTF. GROUP    TIE LIMIT     TIE LIMIT     BEFORE NON-FIRM      NON-FIRM
*     DATE               NAME          (MW)          (MW)          ASSISTANCE ?
*-------------------------------------------------------------------------------------
*-------------------------------------------------------------------------------------
*    MMMYYYY           AAAAAAAA         #             #               Y/N             Y/N
 *    -------          --------      -------       -------            ---                  ---
 @  01JAN2000**          'DYSINGER'     2600          1999            N               N
 @  01JAN2000**          'W.CENTRL'     1770          1300            N               N
 @  01JAN2000**          'VOLNEY-E'     4270          1999            N               N
 @  01JAN2000**          'MOSES SO'     2900          1600            N               N
 @  01JAN2000**          'CEN EAST'     3150          1999            N               N
 @  01JAN2000**          'MARCY-SO'     1700          1600            N               N
 @  01JAN2000**          'F TO G  '     3450          1999            N               N
 @  01JAN2000**          'UP-CONED'     5000          1999            N               N
 @  01JAN2000**          'MILLWOOD'     8450          1999            N               N
 @  01JAN2007**          'DUNWOOD.'     3700          1999            N               N
 @  01JAN2008**          'DUNWOOD.'     3864          1999            N               N
 @  01JAN2009**          'DUNWOOD.'     3791          1999            N               N
 @  01JAN2010**          'DUNWOOD.'     3741          1999            N               N
 @  01JAN2011**          'DUNWOOD.'     3648          1999            N               N
 @  01JAN2000**          'CN-LILCO'      175           420            N               N
 @  01JAN2000**          'Y49Y50  '     1290           530            N               N
 @  01JAN2000**          'F - NE  '      800           600            N               Y
 @  01JAN2000**          'G - NE  '      800           400            N               Y
 @  01JAN2000**          'D - NE  '      150             0            N               Y
 @  01JAN2000**          'K - NE  '      286           286            N               Y
 @  01JAN2000**          'ME-ROP  '     1400          1400            N               N
 @  01JAN2000**          'ROP-BSTN'     3600          3600            N               N
 @  01JAN2000**          'ROP-ROCT'     2200          2200            N               N
 @  01JAN2000**          'ROCTSWCT'     1100          1100            N               N
 @  01JAN2000**            'A - PJMW'    550            89            N               Y
 @  01JAN2000**            'C - PJMW'    200           129            N               Y
 @  01JAN2000**            'C - PJMC'    300            32            N               Y
 @  01JAN2000**            'G - PJME'   2000            30            N               Y
 @  01JAN2000**            'J - PJME'      1          1200            N               Y
 @  01JAN2000**            "C_TO_E"     6000          6000            N               N
 @  01JAN2000**            "W_TO_C"     4000          4000            N               N
 @  01JAN2000**            'D - HQ  '   1000           500            N               Y
 @  01JAN2000**            'A - OH  '   1550          1395            N               Y
 @  01JAN2000**            'D - OH  '    400           400            N               Y
 @  01JAN2000**            'OH - HQ '    350           350            N               N
 @  01JAN2000**            'NYD - NE'    660           330            N               Y
 @  01JAN2000**            'NYD - K '    330           330            N               N
 @  01JAN2000**            'AG - G '   99999         99999            N               N
 @  01JAN2007**          'K - NY2 '      660           660            N               N
 @  01JAN2007**          'NY2-EAST'     1320           660            N               N
*****GROUPS
 @  01JAN2000**            'TOTAL-ES'   6000          1999            N               N
 @  01JAN2000**            'UPNYSENY'   5150          1999            N               N
 @  01JAN2000**            'UPSEBYPA'   5150          1999            N               N
 @  01JAN2000**            'CE GRP  '   4550          3400            N               N
 @  01JAN2000**            'NY-IMPTS'  99999         99999            N               N
 @  01JAN2000**            'LI SUM  '   1465           530            N               N
 @  01JAN2007**            'DSY49Y50'  13680          2529            N               N
 @  01JAN2008**            'DSY49Y50'  14172          2529            N               N
 @  01JAN2009**            'DSY49Y50'  13953          2529            N               N
 @  01JAN2010**            'DSY49Y50'  13803          2529            N               N
 @  01JAN2011**            'DSY49Y50'  13524          2529            N               N
 @  01JAN2000**            'G-SENY  '   6000          2499            N               N
 @  01JAN2000**            'NE-IMPTS'   1550          1750            N               N
 @  01JAN2000**            'NE_F&F_G'  99999         99999            N               N
 @  01JAN2000**            'HUDVALLY'  99999         99999            N               N
;;;; END OF &INF-TRLM-00 ;;;;
```

Table 10.1.9 below illustrates the LOLE results utilizing the through-time thermal and voltage transfer limits for the CRPP Transmission Constraint Model.

Table 10.1.9 LOLE for the RNA study case Transfer Limits[12]Year

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
AREA-A										
AREA-B		0.01	0.03	0.04	0.06	0.09	0.10	0.13	0.17	0.19
AREA-C										
AREA-D										
AREA-E				0.02	0.02	0.04	0.04	0.06	0.08	0.10
AREA-F										
AREA-G							0.01	0.01	0.01	0.01
AREA-H										
AREA-I		0.01	0.04	0.06	0.08	0.14	0.18	0.27	0.37	0.46
AREA-J		0.01	0.05	0.010	0.14	0.25	0.32	0.44	0.59	0.74
AREA-K					0.01	0.02	0.02	0.05	0.08	0.12
NYCA		0.01	0.06	0.10	0.15	0.25	0.33	0.46	0.60	0.76

10.3 Short Circuit Assessment

As noted previously, a short circuit assessment was performed for this cycle of the Comprehensive Reliability Planning Process. The methodology employed was that described in the “NYSIO Guideline for Fault Current Assessment,” contained in Appendix B. The ratings and bus monitored list was the same as that being used for the 2006 ATRA fault current assessment. The RNA study case included projects according to the CRPP project list. The 2011 Fault Levels were compared against the Class Year 2006 fault levels, and this comparison indicated no significant differences.

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[12] The 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.

11 Appendices

1 Initial Planning Process Document

2 Short Circuit Methodology

2.1 Short Circuit Results

3 Load and Capacity Tables by Zone

3.1 Capacity (by type) and Load by Year for NYCA

3.2 Generation by Zone, by Year, by Type

4 Resource Adequacy Assessment

4.2 LOLE Results

5 Transmission Adequacy Assessment

5.1 Interface Definitions

5.2 Power Flow Contingency Lists

5.3 Assessment Results