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

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

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1 Introduction

In general, electricity restructuring has led to the unbundling of generation and transmission development. Largely gone are the days of planning in which 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 objectives of the CRPP, are stated in Section 1.1 of NYISO's Open Access Transmission Tariff (OATT) Attachment Y.

~~The purpose of the Comprehensive Reliability Planning Process (CRPP) is to determine whether the electric system resources provided by a combination of market forces and regulated entities is providing sufficient resources to maintain the reliability of the New York State bulk power system.~~

The first step in the CRPP is the development of the draft Reliability Needs Assessment (RNA) In addition to the base case, sensitivity and scenario analysis has been conducted to identify any opportunities or risk that should be monitored or included for consideration by the CRPP process 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 base case, sensitivity, and scenario analysis that have been conducted, and to provide input into the development of the final RNA.

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

This ~~report begins with~~supporting documentation contains: (i) an overview of the CRPP; ~~followed by~~(ii) a recitation of the finding of reliability needs, scenarios ~~and observations of~~ set forth in the draft RNA and; (iii) ~~presents~~ the methodology and analysis that supports those findings.

2 The Comprehensive Planning Process

The following presents an overview and summary of the CRPP, the CRPP stakeholder process and the reliability policies and criteria which 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 existing reliability criteria of the NERC, NPCC, and NYSRC as they may change from time to time. This process is anchored in the NYISO's market-based philosophy in which market 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 request the appropriate Transmission Owner to proceed with a regulated backstop solution in order to maintain reliability. Under the CRPP, the NYISO has an affirmative obligation to investigate whether market failure is the reason for the lack of a market-based solution and to explore 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 with respect to either resource adequacy or transmission reliability. Following the review of the RNA by the NYISO committees and final approval by the NYISO Board, the NYISO will request solutions to its 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, which will serve as the benchmark to establish the time for a market-based solution to appear. Both market-based and regulated solutions are open to all resources: transmission, generation, and demand response. Non-transmission owner developers also have the ability to submit proposals for regulated solutions. The NYISO has the responsibility to evaluate all proposed solutions to determine whether they will meet the identified reliability needs in a timely manner. The NYISO does not conduct an economic evaluation of the proposed solutions.

Following its evaluation of all proposed solutions, the NYISO prepares its Comprehensive Reliability Plan. The CRP will identify all proposed solutions that have been found ~~will~~ to be able to meet the identified reliability needs. If there is a viable market-based project that will meet the identified need in a timely manner, the CRP will so state. If there is no viable market-based proposal and the NYISO determines that a regulated backstop solution must be implemented the CRP will so state and the NYISO will request the appropriate Transmission Owner to proceed with the development of its backstop solution. The NYISO also has the obligation to monitor the continued viability of proposed projects to meet identified needs and to report on its findings in subsequent Plans.

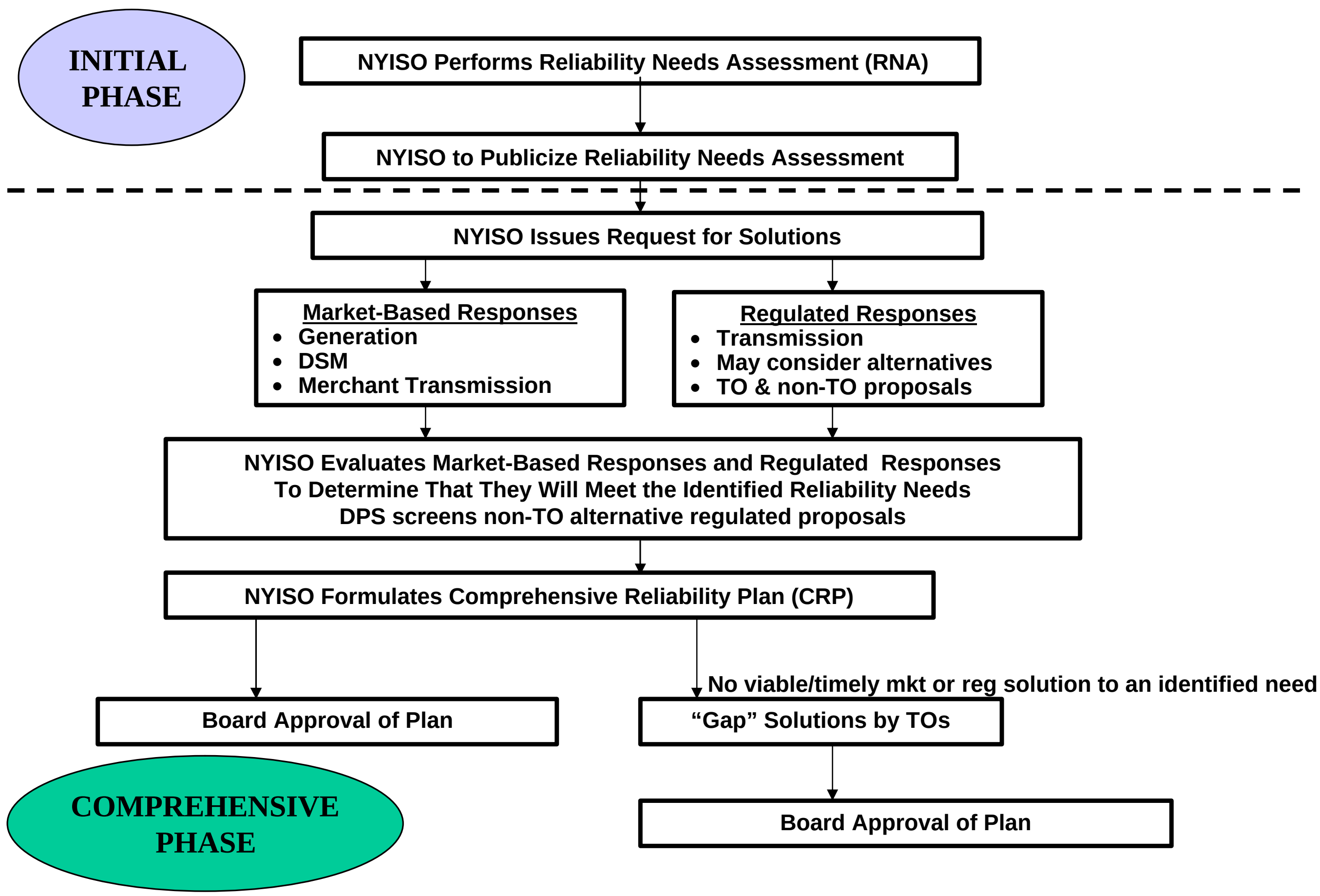
There is also a provision which will allow the NYISO Board to deal with the sudden appearance of a reliability need on an emergency basis whether during or in-between the normal CRPP cycle. In the event that there is an immediate threat to reliability, the NYISO will request the appropriate Transmission Owner to develop a "gap solution" and to pursue its completion in conjunction with the New York State Public Service Commission (NYSPSC). Such a gap solution is intended to be temporary ~~in nature so as~~and not to interfere with any pending market-based project.

The CRPP also address the issues of cost allocation and cost recovery. The approved Tariff contains a set of principles for cost allocation based upon the principle that beneficiaries should pay. The NYISO is presently engaged in a stakeholder process to develop the implementation procedures for cost allocation. Cost recovery for regulated transmission solutions will be through a separate rate schedule in the NYISO 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 either the RNA or the final CRP that cannot be resolved by 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 as a result of the CRPP, the NYISO is required to report this to 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.

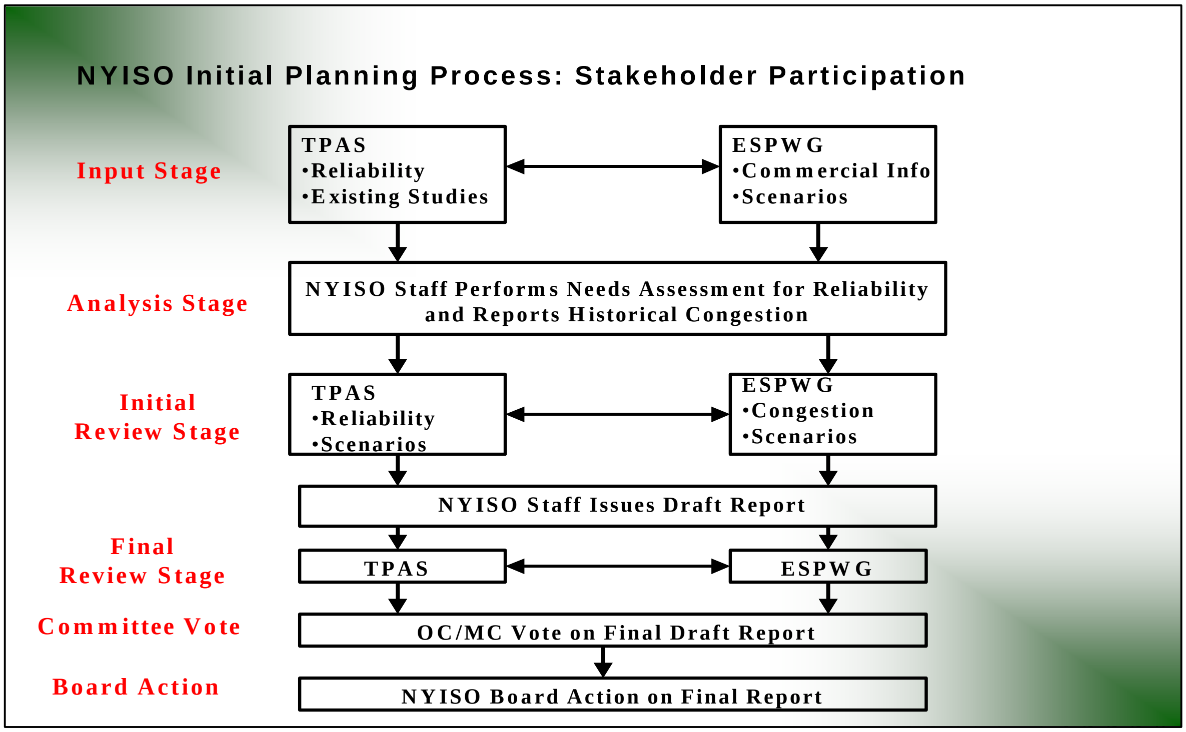
NYISO Reliability Planning Process



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 diagram below summarizes the CRRP.

2.2 Stakeholder Process

In light of the fact that the CRRP contains both reliability and business issues, it has been agreed that both the Transmission Planning Advisory Subcommittee ("TPAS") and the Electric Systems Planning Working Group (ESPWG) participates 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 will be established between these two groups and with NYISO Staff was conducted during each stage of the initial planning process.

The intention 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 will be provided in the absence of a consensus.

Following TPAS and ESPWG review, the Draft Report will be forwarded to the Operating Committee for discussion and action and subsequently to the Management Committee for discussion and action.

2.3 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 term 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.

2.3.1 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 is the ability of the bulk power system to withstand disturbances such as electric short circuits or unanticipated loss of system components.

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

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

2.3.2 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 is a voluntary, not-for-profit organization formed 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; compliance by member councils and the industry is voluntary.

Ten Regional Reliability Councils currently comprise NERC'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.

The next level is the New York State Reliability Council (NYSRC). It 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 industry govern the NYSRC. New York-specific reliability rules may be more detailed or stringent than NERC's 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.

2.3.3 Reliability Policies and Criteria

Similar to the levels of reliability organizations, there are levels of documents comprising reliability policies and criteria. 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.

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, Scenarios, Observations

This reliability needs assessment for the New York State bulk-power[1] baseline system for the first Five Year period indicates that the forecasted system does not meet reliability criteria. Therefore, because of continued load growth and no resource additions, the second Five Year period does not meet reliability criteria. Load growth in excess of two percent per year which totals almost 5,000 MW in Southeast New York State (SENY), defined as load zones G-K, with the minimal addition of approximately 1250 MW of net new generating capacity in that area over the last ten years, has led to increasing dependence on the transmission system to meet capacity and energy needs in SENY. 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 1, neighboring system changes, and load growth have and will continue to result in voltage criteria violations at much lower transfer levels than had been previously observed. The result is that transfers into SENY will be limited by voltage constraints rather than thermal constraints. This reduced capability to make power transfers to SENY due to these voltage constraints, coupled with continuing load growth in SENY results in a resource adequacy criterion violation as early as 2008. Below are the major findings of the Reliability Needs Assessment:

1. **Base Case:** Employing the calculated base case transfer limits[2] from the analysis with the updated transmission topology[3] to determine resource adequacy needs (defined as a loss-of-load-expectation or LOLE that exceeds .1 days per year), the first year of need for the New York Control Area (NYCA) is determined to be 2008, with an LOLE of .395 days per year. The LOLE for the NYCA increases to 2.429 days per year by 2010. Although the transfer limits calculated were based on voltage limitations, the initial reliability needs were defined in terms of MW of load that is at risk of not being served. The compensatory MW needed to meet the .1 days per year reliability criterion for the NYCA through 2010 would be 1,750 MW. The exact locations of the MW additions, whether in Zones G through K or a combination, along with any transmission upgrades and demand-side resources impacts the level of compensatory MW required. Also, to the extent voltage limitations are eliminated or reduced, the compensatory MW would be reduced accordingly.

   Utilizing the Base Case voltage constraint limits[4] to determine Base Case resource adequacy needs and the updated transmission topology, resulted in the following LOLE results

AREA OR POOL	2006	2007	2008	2009	2010
AREA-A thru AREA-F	0.000	0.000	0.000	0.000	0.000
AREA-G	0.000	0.000	0.000	0.000	0.003

[1] Reliability needs for the non-bulk system were not assessed.
[2] See Supporting Document Section 11 Table 11.1.4 page 53
[3] See Supporting Document Section 11 Table 11.1.9 page 50
[4] See Supporting Document Section 11 Table 11.1.4 page 53

AREA-H	0.000	0.000	0.001	0.007	0.010
AREA-I	0.001	0.001	0.029	0.079	0.148
AREA-J	0.001	0.002	0.383	0.764	2.400
AREA-K	0.021	0.001	0.031	0.071	0.179
NYCA	0.022	0.004	0.395	0.786	2.429

The compensatory MW were added as described to meet the .1 days per year LOLE criterion. An alternate set of compensatory MW for 2010 was developed by adding MW only to the zone with the highest starting LOLE. The following tables present the results for the compensatory MW additions and resulting LOLE.

Base Case Compensatory MW (MW are cumulative)

AREA OR POOL	2008	2009[5]	2009	2010	Alt. 2010
AREA-A Thru AREA-F	0	0	0	0	0
AREA-G	0	0	0	0	0
AREA-H	0	0	0	0	0
AREA-I	0	0	0	250	0
AREA-J	500	750	1000	1250	1500
AREA-K	0	0	0	250	0
NYCA	500	750	1000	1750	1500

LOLE Results after the Addition of the Compensatory MW

AREA OR POOL	2008	2009	2009	2010	Alt. 2010
AREA-A Thru AREA-F	0.000	0.000	0.000	0.000	.001
AREA-G	0.000	0.000	0.000	0.001	.001
AREA-H	0.001	0.001	0.001	0.002	.002
AREA-I	0.015	0.026	0.018	0.014	.028
AREA-J	0.096	0.121	0.051	0.091	.072
AREA-K	0.018	0.030	0.027	0.019	.043
NYCA	0.105	0.137	0.069	0.100	.099

2. The ability to transfer power into SENY will be significantly limited by voltage constraints in the Lower Hudson Valley (LHV) unless corrective actions are taken. The ability to transfer power into SENY significantly impacts the compensatory MW required to bring the NYCA into compliance with LOLE criterion. An investigation into the need for compensatory MVARS versus compensatory MWs was conducted. The transfer limits through the LHV were reduced by as much as 1000-1500 MW as early as 2008 to meet voltage criteria. The need for this reduction in transfer limits is the result of expected plant retirements, continued load growth in SENY, changes in neighboring systems, and changes in the transmission system network such as the addition of the series reactors in the New York City cable system. The voltage criteria violations exist both pre- and post- contingency. Also impacting the voltage limits are

[5] Two results are shown for 2009 to demonstrate the difference between the impacts of adding one additional 250 MW units to bring the NYCA below criterion.

severe tower contingencies that include generation, shunt capacitor, and /or transformer loss. Depending on the amount of supply, transmission and demand-side resources that are added to the system, the degree to which it will be necessary to correct the identified voltage constraints will vary.

3. Assuming that voltage constraints are resolved, the NYISO Staff conducted a sensitivity analysis of LOLE based on thermal transfer limits. Utilizing thermally constrained transfer limits to determine resource adequacy needs and the updated transmission topology, resulted in the following LOLE results:

AREA OR POOL	2006	2007	2008	2009	2010
AREA-A Thru AREA-E	0.000	0.000	0.000	0.000	0.000
AREA-F	0.000	0.000	0.000	0.000	0.000
AREA-G	0.000	0.000	0.000	0.001	0.017
AREA-H	0.000	0.000	0.001	0.001	0.007
AREA-I	0.000	0.001	0.038	0.088	0.505
AREA-J	0.000	0.001	0.055	0.124	0.583
AREA-K	0.021	0.002	0.029	0.070	0.309
NYCA	0.021	0.003	0.073	0.160	0.752

Compensatory MW were added to the following Areas to meet the LOLE criterion of .1 days per year for NYCA. In order to demonstrate that an alternative set of compensatory MW in different locations can meet the LOLE criterion as well, an alternative combination of compensatory MW was developed for 2010. Also, a second alternate was developed with all the compensatory MW placed in the zone with highest starting LOLE. The results are presented in the following tables.

Compensatory MW Thermal Sensitivity Case

AREA OR POOL	2009	2010	Alt. 2010	Alt 2010
AREA-A Thru AREA-F	0	0	0	0
AREA-G	0	0	250	0
AREA-H	0	0	250	0
AREA-I	0	250	250	0
AREA-J	250	750	250	1250
AREA-K	0	250	250	0
NYCA	250	1250	1250	1250

LOLE Thermal Sensitivity Case

AREA OR POOL	2009	2010	Alt. 2010	Alt. 2010
AREA-A Thru AREA-F	0	0	0	0
AREA-G	0.001	0.000	0.000	.002
AREA-H	0.001	0.001	0.002	.002
AREA-I	0.062	0.018	0.039	.049
AREA-J	0.082	0.040	0.070	.023
AREA-K	0.069	0.027	0.025	.049
NYCA	0.100	0.069	0.087	.068

The 2010 compensatory MW solution for which the 250 MW generic units were distributed according to the iterative rule adopted for this analysis resulted in a LOLE of approximately 0.07 days per year (note: The addition of a 1000 MW of compensatory MW in 2010 resulted in an LOLE of 0.12). The alternative 2010 resulted in a LOLE of approximately 0.09 days per year. This sensitivity analysis was conducted with an I-J transfer limit of 3425 MW. To the extent that the full capability of the phase angle regulators were utilized, the thermal transfer limit could be potentially be increased to 3700 MW and the compensatory MWs reduced accordingly.

4. In light of the voltage constraints and alternative thermal limits determined herein, and the resource adequacy deficiencies identified herein, SENY Transmission Owners will need to develop regulated backstop solutions to correct the unacceptable statewide or NYCA LOLE results determined in this RNA. They are Central Hudson Gas and Electric Corporation, Consolidated Edison Company, Long Island Power Authority, and Orange and Rockland Utilities, Inc.

Scenarios

Scenarios are variations on key assumptions in the base 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.

1. Retirement of Older Coal Plants

The scenario in which all coal units in western NY are retired except for the Somerset and Cayuga units results in a reduction in transfer limits in western NY of approximately 500 MW. However, the impact on LOLE was minimal.

2. The Retirement of the Indian Point Units 2 and 3

A preliminary MARS analysis for the 2008 and 2010 system was performed to evaluate the retirement of the Indian Point 2 and 3 nuclear plants. The Baseline system capacity was reduced to 37039 for 2008 and 2010 and the following transfer limits for the LHV, which were based on thermal analysis were utilized in the MARS transmission topology:

'F to G'	3425
'UP-ConEd'	5000
'I to J'	3400
'UPNYSENY'	4900

The NYCA LOLE increases significantly with the retirement of the Indian Point units to well in excess of 3.5 days per year. Accordingly, loss of capacity resulting from the retirement of the Indian Point units would need to be replaced in a manner that provides equivalent real and reactive capability. Also, compensatory actions would be required to provide reactive support and maintain transfer levels through the Hudson Valley.

3. M29 Transmission Project

A sensitivity analysis of the impact of the M29 Transmission Project was performed on the 2007 and 2010 system conditions. The emergency thermal transfer limit analysis indicated that the project would increase the I to J transfer limit by approximately 350 MW. The reactive charging available with the project would increase the I to J voltage limit by approximately 300 MW. The following table illustrates the impact of M29 transmission project on the Area and NYCA LOLE

Impact of M29 Transmission Project on LOLE Based on Thermal Transfer Limits

AREA OR POOL	Without M29		With M29	
	2007	2010	2007	2010
AREA-A				
AREA-B				
AREA-C				
AREA-D				
AREA-E				
AREA-F				
AREA-G		.017		.019
AREA-H		.007	.002	.007
AREA-I	.001	.505	.001	.516
AREA-J	.001	.583	.001	.404
AREA-K	.002	.309	.003	.337
NYCA	.003	.752	.003	.628

4. Load Forecast Uncertainty

a. High Load Forecast

If actual load is higher than the levels forecast in this RNA, the LOLE criterion violation identified in this RNA may occur sooner. The following table illustrates the impact of the high load forecast on the Area and NYCA LOLE for the thermal transfer limit case. The table indicates that the year of need for the thermal transfer limit case occurs one year earlier for the high load forecast. Because the analyses conducted by the NYISO for the five-year base case were non-convergent (i.e., the power flow analyses would not solve) for the base case load forecast, the system is likely to become non-convergent at even lower transfer limits due to voltage constraints at an earlier date under the high-load forecast. The NYISO, however, has not calculated the voltage transfer limits associated with the high-load forecast sensitivity case to determine such date.

Impact of High Load Forecast on LOLE

AREA OR POOL	2006	2007	2008	2009	2010	2011
AREA-A	0.000	0.000	0.000	0.000	0.000	0.000
AREA-B	0.000	0.000	0.000	0.000	0.000	0.001
AREA-C	0.000	0.000	0.000	0.000	0.000	0.000
AREA-D	0.000	0.000	0.000	0.000	0.000	0.000
AREA-E	0.000	0.000	0.000	0.000	0.000	0.001
AREA-F	0.000	0.000	0.000	0.000	0.000	0.001
AREA-G	0.000	0.000	0.001	0.000	0.024	0.035
AREA-H	0.000	0.000	0.001	0.002	0.007	0.011
AREA-I	0.001	0.0003	0.059	0.141	0.751	1.215
AREA-J	0.001	0.003	0.082	0.177	0.820	1.255
AREA-K	0.043	0.005	0.053	0.130	0.541	0.888
NYCA	0.044	0.008	0.111	0.241	1.079	1.641

~~This reliability needs assessment for the New York State bulk power[6] baseline system for the first Five Year period indicates that the forecasted system does not meet reliability criteria. Therefore, because of continued load growth and no resource additions, the second Five Year period does not meet reliability criteria. Load growth in excess of two percent per year which totals almost 5,000 MW in Southeast New York State (SENY), defined as load zones G-K, with the minimal addition of approximately 1250 MW of net new generating capacity in that area over the last ten years, has led to increasing dependence on the transmission system to meet capacity and energy needs in SENY. 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 1, neighboring system changes, and load growth have and will continue to result in voltage criteria violations at much lower transfer levels than had been previously observed. The result is that transfers into SENY will be limited by voltage constraints rather than thermal constraints. This reduced capability to make power transfers to SENY due to these voltage constraints, coupled with continuing load growth in SENY results in resource~~

[6] Reliability needs for the non-bulk system were not assessed.

~~adequacy criteria violations as early as 2008. Below are the major findings of the Reliability Needs Assessment:~~

1. ~~**Base Case:** Employing the calculated base case transfer limits[7] from the analysis with the updated transmission topology to determine resource adequacy needs (defined as a loss-of-load expectation or LOLE that exceeds .1 days per year), the first year of need for the New York Control Area (NYCA) is determined to be 2008, with an LOLE of. .395 days per year. The LOLE for the NYCA increases to 2.429 days per year by 2010. Although the transfer limits calculated were based on voltage limitations, the initial reliability needs were defined in terms of MW of load that is at risk of not being served. The compensatory MW needed to meet the .1 days per year reliability criteria for the NYCA through 2010 would be 1,750 MW. The exact locations of the MW additions, whether in Zones G through K or a combination, impacts the level of compensatory MW required. Also, to the extent voltage limitations are eliminated or reduced, the compensatory MW would be reduced accordingly.~~

~~Utilizing the Base Case voltage constraint limits[8] to determine Base Case resource adequacy needs and the updated transmission topology, resulted in the following LOLE results~~

~~**Table 3.1: The Base Case Results**~~

~~AREA OR POOL~~	~~2006~~	~~2007~~	~~2008~~	~~2009~~	~~2010~~
~~AREA-A thru AREA-F~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.000~~
~~AREA-G~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.003~~
~~AREA-H~~	~~0.000~~	~~0.000~~	~~0.001~~	~~0.007~~	~~0.010~~
~~AREA-I~~	~~0.001~~	~~0.001~~	~~0.029~~	~~0.079~~	~~0.148~~
~~AREA-J~~	~~0.001~~	~~0.002~~	~~0.383~~	~~0.764~~	~~2.400~~
~~AREA-K~~	~~0.021~~	~~0.001~~	~~0.031~~	~~0.071~~	~~0.179~~
~~NYCA~~	~~0.022~~	~~0.004~~	~~0.395~~	~~0.786~~	~~2.429~~

~~The compensatory MW were added as described to meet the .1 days per year LOLE criteria. An alternate set of compensatory MW for 2010 was developed by adding~~

[7] See Supporting Document section 11 table 11.1.4 page 53
[8] Ibid

~~MW only to the zone with the highest starting LOLE. The following tables present the results for the compensatory MW additions and resulting LOLE.~~

~~Table 3.2: Base Case Compensatory MW (MW are cumulative)~~

~~AREA OR POOL~~	~~2008~~	~~2009~~[9]	~~2009~~	~~2010~~	~~Alt. 2010~~
~~AREA-A Thru AREA-F~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~
~~AREA-G~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~
~~AREA-H~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~
~~AREA-I~~	~~0~~	~~0~~	~~0~~	~~250~~	~~0~~
~~AREA-J~~	~~500~~	~~750~~	~~1000~~	~~1250~~	~~1500~~
~~AREA-K~~	~~0~~	~~0~~	~~0~~	~~250~~	~~0~~
~~_NYCA_~~	~~500~~	~~750~~	~~1000~~	~~1750~~	~~1500~~

~~Table 3.3: LOLE Results after the Addition of the Compensatory MW~~

~~AREA OR POOL~~	~~2008~~	~~2009~~	~~2009~~	~~2010~~	~~Alt. 2010~~
~~AREA-A Thru AREA-F~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.000~~	~~.001~~
~~AREA-G~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.001~~	~~.001~~
~~AREA-H~~	~~0.001~~	~~0.001~~	~~0.001~~	~~0.002~~	~~.002~~
~~AREA-I~~	~~0.015~~	~~0.026~~	~~0.018~~	~~0.014~~	~~.028~~
~~AREA-J~~	~~0.096~~	~~0.121~~	~~0.051~~	~~0.091~~	~~.072~~
~~AREA-K~~	~~0.018~~	~~0.030~~	~~0.027~~	~~0.019~~	~~.043~~
~~_NYCA_~~	~~0.105~~	~~0.137~~	~~0.069~~	~~0.100~~	~~.099~~

~~2.The ability to transfer power into SENY will be significantly limited by voltage constraints in the Lower Hudson Valley (LHV) unless corrective actions are taken. The ability to transfer power into SENY significantly impacts the compensatory MW required to bring the NYCA into compliance with LOLE criteria. An investigation into the need for compensatory MVARS versus compensatory MWs was conducted. The transfer limits through the LHV were reduced by as much as 1000-1500 MW as~~

[9] Two results are shown for 2009 to demonstrate the difference between the impacts of adding one additional 250 MW units to bring the NYCA below criteria.

~~early as 2008 to meet voltage criteria. The need for this reduction in transfer limits is the result of expected plant retirements, continued load growth in SENY, changes in neighboring systems, and changes in the transmission system network such as the addition of the series reactors in the New York City cable system. The voltage criteria violations exist both pre- and post- contingency. Also impacting the voltage limits are severe tower contingencies that include generation, shunt capacitor, and /or transformer loss. Depending on the amount of supply and demand-side resources that are added to the system, the degree to which it will be necessary to correct the identified voltage constraints will vary.~~

~~3.Assuming that voltage constraints are resolved, the NYISO Staff conducted a sensitivity analysis of LOLE based on thermal transfer limits. Utilizing thermally constrained transfer limits to determine resource adequacy needs and the updated transmission topology, resulted in the following LOLE results:~~

~~Table 3.4: Base Case Sensitivity~~

~~AREA OR POOL~~	~~2006~~	~~2007~~	~~2008~~	~~2009~~	~~2010~~
~~AREA-A Thru AREA-E~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.000~~
~~AREA-F~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.000~~
~~AREA-G~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.001~~	~~0.017~~
~~AREA-H~~	~~0.000~~	~~0.000~~	~~0.001~~	~~0.001~~	~~0.007~~
~~AREA-I~~	~~0.000~~	~~0.001~~	~~0.038~~	~~0.088~~	~~0.505~~
~~AREA-J~~	~~0.000~~	~~0.001~~	~~0.055~~	~~0.124~~	~~0.583~~
~~AREA-K~~	~~0.021~~	~~0.002~~	~~0.029~~	~~0.070~~	~~0.309~~
~~NYCA~~	~~0.021~~	~~0.003~~	~~0.073~~	~~0.160~~	~~0.752~~

~~Compensatory MW were added to the following Areas to meet the LOLE criteria of .1 days per year for NYCA. In order to demonstrate that an alternative set of compensatory MW in different locations can meet the LOLE criteria as well, an alternative combination of compensatory MW was developed for 2010. Also, a second alternate was developed with all the compensatory MW placed in the zone with highest starting LOLE. The results are presented in the following tables.~~

~~Table 3.5: Compensatory MW Thermal Sensitivity Case~~

~~AREA OR POOL~~	~~2009~~	~~2010~~	~~Alt. 2010~~	~~Alt 2010~~
~~AREA-A Thru AREA-F~~	~~0~~	~~0~~	~~0~~	~~0~~
~~AREA-G~~	~~0~~	~~0~~	~~250~~	~~0~~
~~AREA-H~~	~~0~~	~~0~~	~~250~~	~~0~~
~~AREA-I~~	~~0~~	~~250~~	~~250~~	~~0~~
~~AREA-J~~	~~250~~	~~750~~	~~250~~	~~1250~~
~~AREA-K~~	~~0~~	~~250~~	~~250~~	~~0~~
~~NYCA~~	~~250~~	~~1250~~	~~1250~~	~~1250~~

~~Table 3.6: LOLE Thermal Sensitivity Case~~

~~AREA OR POOL~~	~~2009~~	~~2010~~	~~Alt. 2010~~	~~Alt. 2010~~

~~AREA-A Thru AREA-F~~	~~0~~	~~0~~	~~0~~	~~0~~
~~AREA-G~~	~~0.001~~	~~0.000~~	~~0.000~~	~~.002~~
~~AREA-H~~	~~0.001~~	~~0.001~~	~~0.002~~	~~.002~~
~~AREA-I~~	~~0.062~~	~~0.018~~	~~0.039~~	~~.049~~
~~AREA-J~~	~~0.082~~	~~0.040~~	~~0.070~~	~~.023~~
~~AREA-K~~	~~0.069~~	~~0.027~~	~~0.025~~	~~.049~~
~~_NYCA_~~	~~0.100~~	~~0.069~~	~~0.087~~	~~.068~~

~~The 2010 compensatory MW solution for which the 250 MW generic units were distributed according to the iterative rule adopted for this analysis resulted in a LOLE of approximately 0.07 days per year (note: The addition of a 1000 MW of compensatory MW in 2010 resulted in an LOLE of 0.12). The alternative 2010 resulted in a LOLE of approximately 0.09 days per year. This sensitivity analysis was conducted with an I-J transfer limit of 3425 MW. To the extent that the full capability of the phase angle regulators were utilized, the thermal transfer limit could be potentially be increased to 3700 MW and the compensatory MWs reduced accordingly.~~

~~4.In light of the voltage constraints and alternative thermal limits determined herein, and the resource adequacy deficiencies identified herein, SENY Transmission Owners will need to develop regulated backstop solutions to correct the unacceptable statewide or NYCA LOLE results determined in this RNA. They are Central Hudson Gas and Electric Corporation, Consolidated Edison Company, Long Island Power Authority, and Orange and Rockland Utilities, Inc.~~

~~Scenarios~~

~~Scenarios are variations on key assumptions in the base 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.~~

~~1.Retirement of Older Coal Plants~~

~~The scenario in which all coal units in western NY are retired except for the Somerset and Cayuga units results in a reduction in transfer limits in western NY of approximately 500 MW. However, the impact on LOLE was minimal.~~

~~2.The Retirement of the Indian Point Units 2 and 3~~

~~A preliminary MARS analysis for the 2008 and 2010 system was performed to evaluate the retirement of the Indian Point 2 and 3 nuclear plants. The Baseline system capacity was reduced to 37039 for 2008 and 2010 and the following transfer limits for the LHV, which were based on thermal analysis, were utilized in the MARS transmission topology:~~

~~'F to G' 3425~~

~~'UP-ConEd' 5000~~
~~'I to J' 3400~~
~~'UPNYSENY' 4900~~

~~The NYCA LOLE increases significantly with the retirement of the Indian Point units to well in excess of 3.5 days per year. Accordingly, loss of capacity resulting from the retirement of the Indian Point units would need to be replaced in a manner that provides equivalent real and reactive capability. Also, compensatory actions would be required to provide reactive support and maintain transfer levels through the Hudson Valley.~~

~~3.M29 Transmission Project~~

~~A sensitivity analysis of the impact of the M29 Transmission Project was performed on the 2007 and 2010 system conditions. The emergency thermal transfer limit analysis indicated that the project would increase the I to J transfer limit by approximately 350 MW. The reactive charging available with the project would increase the I to J voltage limit by approximately 300 MW. The following table illustrates the impact of M29 transmission project on the Area and NYCA LOLE~~

~~Table 3.7 Impact of M29 Transmission Project on LOLE Based on Thermal Transfer Limits~~

~~AREA OR POOL~~	~~Without M29~~		~~With M29~~	
	~~2007~~	~~2010~~	~~2007~~	~~2010~~
~~AREA-A~~				
~~AREA-B~~				
~~AREA-C~~				
~~AREA-D~~				
~~AREA-E~~				
~~AREA-F~~				
~~AREA-G~~		~~.017~~		~~.019~~
~~AREA-H~~		~~.007~~	~~.002~~	~~.007~~

~~AREA-I~~	~~.001~~	~~.505~~	~~.001~~	~~.516~~
~~AREA-J~~	~~.001~~	~~.583~~	~~.001~~	~~.404~~
~~AREA-K~~	~~.002~~	~~.309~~	~~.003~~	~~.337~~
~~NYCA~~	~~.003~~	~~.752~~	~~.003~~	~~.628~~

~~4.Load Forecast Uncertainty~~

~~a.High Load Forecast~~

~~If actual load is higher than the levels forecast in this RNA, the LOLE criteria violation identified in this RNA may occur sooner. The following table illustrates the impact of the high load forecast on the Area and NYCA LOLE for the thermal transfer limit case. The table indicates that the year of need for the thermal transfer limit case occurs one year earlier for the high load forecast. Because the analyses conducted by the NYISO for the five-year base case were non-convergent, under existing transfer levels beginning in 2008 at lower load levels due to voltage constraints, the system is likely to become non-convergent at even lower transfer limits due to voltage constraints at an earlier date under the high-load forecast case. The NYISO, however, has not calculated the voltage transfer limits associated with the high-load forecast sensitivity case to determine such date.~~

~~Table 3.8 Impact of High Load Forecast on LOLE~~

~~AREA OR POOL~~	~~2006~~	~~2007~~	~~2008~~	~~2009~~	~~2010~~	~~2011~~
~~AREA-A~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.000~~
~~AREA-B~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.001~~
~~AREA-C~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.000~~
~~AREA-D~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.000~~
~~AREA-E~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.001~~
~~AREA-F~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.001~~
~~AREA-G~~	~~0.000~~	~~0.000~~	~~0.001~~	~~0.000~~	~~0.024~~	~~0.035~~
~~AREA-H~~	~~0.000~~	~~0.000~~	~~0.001~~	~~0.002~~	~~0.007~~	~~0.011~~
~~AREA-I~~	~~0.001~~	~~0.0003~~	~~0.059~~	~~0.141~~	~~0.751~~	~~1.215~~
~~AREA-J~~	~~0.001~~	~~0.003~~	~~0.082~~	~~0.177~~	~~0.820~~	~~1.255~~
~~AREA-K~~	~~0.043~~	~~0.005~~	~~0.053~~	~~0.130~~	~~0.541~~	~~0.888~~
~~NYCA~~	~~0.044~~	~~0.008~~	~~0.111~~	~~0.241~~	~~1.079~~	~~1.641~~

Observations

1. The NYCA resource needs required to meet resource adequacy reliability criteria are very dependent on the amount of both internal and external resources that can be delivered to the NYC and Long Island load zones.
2. The addition of a new HVDC tie line increases the NYCA dependence on external resources in meeting resource adequacy criteria. This increasing dependence will place more emphasis on the importance and criticality of regional planning.
3. The voltage performance of the transmission system needs to be thoroughly investigated and plans developed to mitigate any adverse impacts.
4. This report contains a brief description of several environmental initiatives that could significantly impact the availability of existing generating units. These initiatives will need to be investigated more thoroughly as part of the ongoing CRPP.

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 summary statistics. 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. Figure 4.1 also displays the nominal transfer capabilities between the major markets in the Northeast. *The key point is 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. The transfer capability as a percent of the regional load has been steadily declining.*

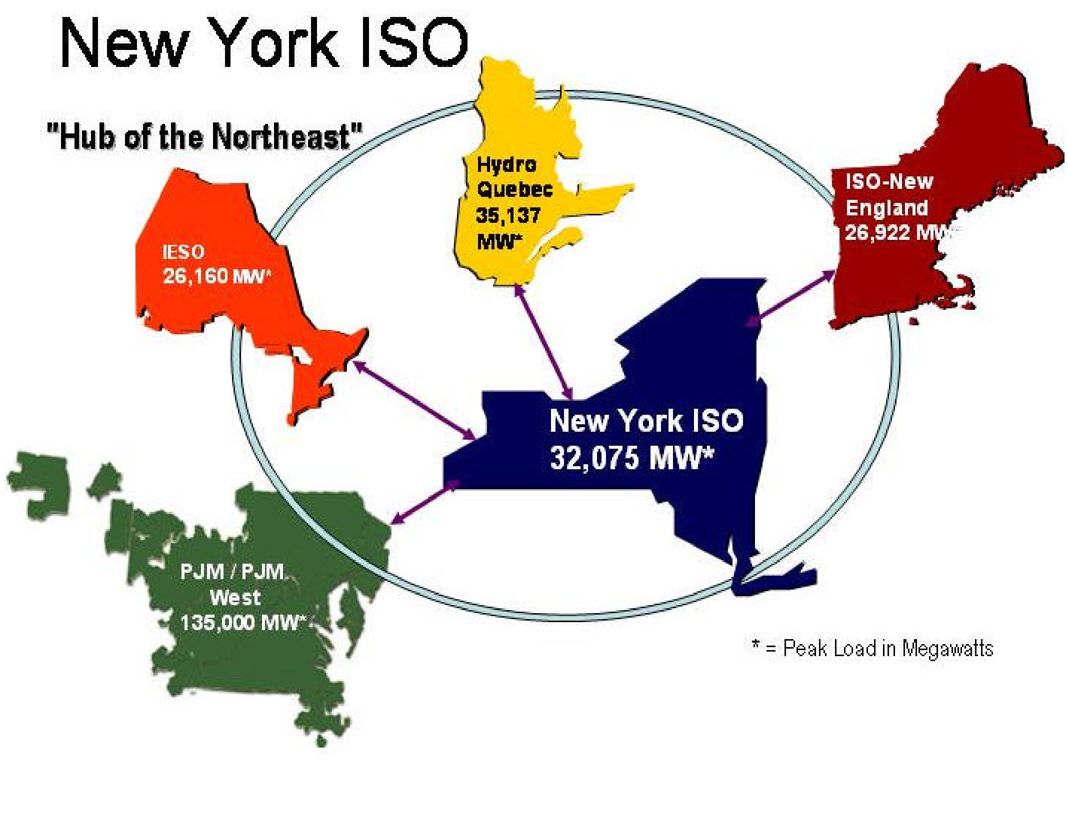


Figure 4.1: Northeast Grid In Context

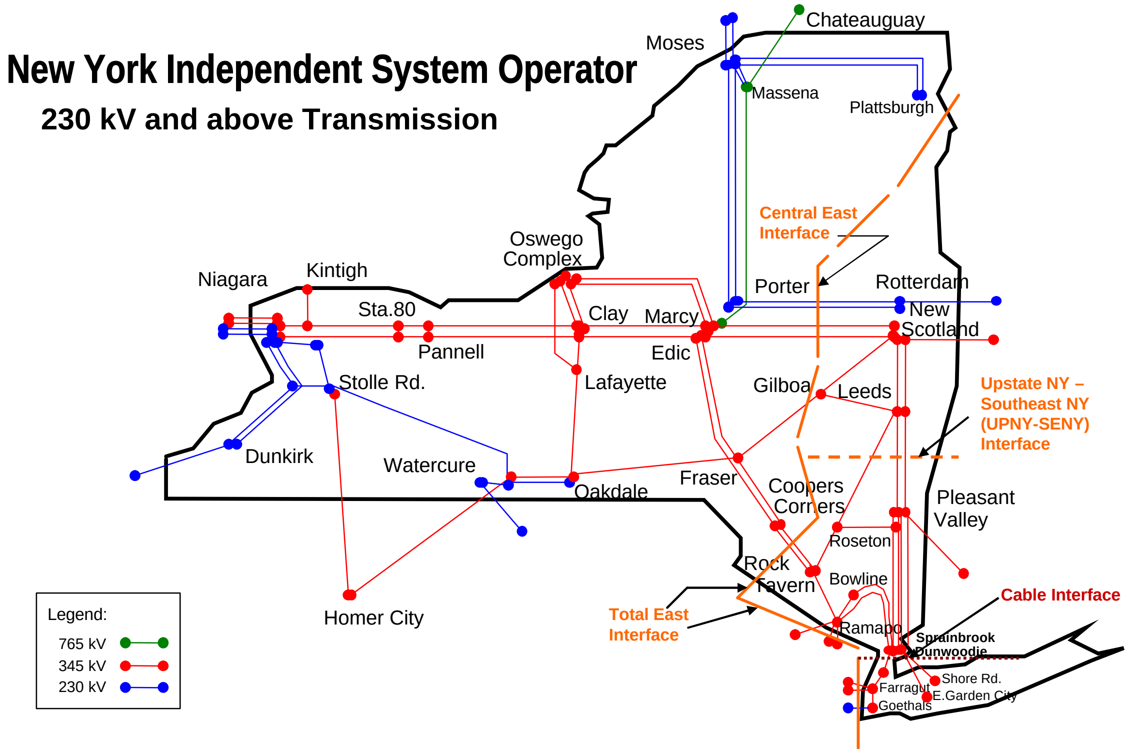


Figure 4.2: NYCA Bulk Transmission System

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 such as the transfer capability between the Northeastern control areas presented in Figure 4.1.

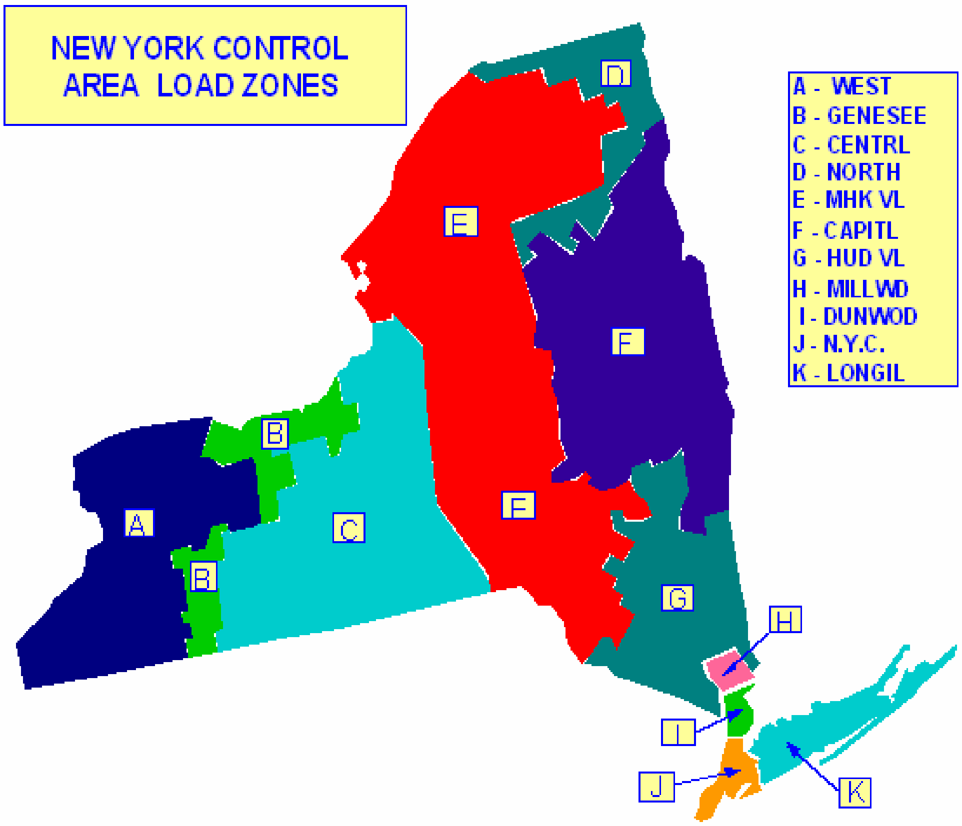


Figure 4.3: NYCA Load Zones

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 which leaves Zone J (New York City) and Zone K (Long Island) as two additional areas defined in east NY. 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 you have the *cable interface* which includes the red dotted line on the transmission map and also the lower end of the total east interface. This 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 2004. 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)	8,900	14,430
Upper Hudson Valley (F)	2,180	3,470
Lower Hudson Valley (G-I)	4,490	5,490
New York City (J)	11,150	8,940
Long Island (K)	5,050	5,180

Note: Numbers are approximate and based on the summer of 2004

Table 4.2: Nominal Transfer Capability

Transmission Interface	Transfer Capability (MW)
Total East	6,100
Central East	2,850
UPNY – SENY	5,100
Cable Interface	
• New York City	4,700
• Long Island	1,270

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 highly congested 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. Historical trends in load growth and capacity additions have only increased the importance of the transmission system in maintaining system reliability.

In addition to being highly dependent on the transmission system, the New York City and Long Island zones' electricity generating infrastructure has the highest average age of generating units in the state and, recent plant additions notwithstanding, is still highly dependent on an aging fleet of combustion and gas turbine capacity. Also, the generation mix in Western NY has much larger proportions of hydro, nuclear and coal.

This creates a high potential for economic transfer from West NY to New York City and Long Island (Economic transfer is the transmission of power from a lower cost region to a higher cost region).

5 Historical Trends

This initial comprehensive reliability plan is a ten-year look ahead to 2015. Therefore, to provide background and context, this section presents the historical trends and overview regarding load growth, generating capability and transmission system additions, and fuel diversity for the New York Control Area (NYCA) for the last ten years.

Load Growth

The NYCA peak load has grown from approximately 27,300 MW in 1994 on a weather adjusted basis to 31,400 MW in 2004, which totals approximately 4,100 MW. This represents a ten-year compound growth rate of approximately 1.21%. However, a regional analysis presents a much different picture. ~~Load growth in~~ West NY (Zones A through E) and Upper Hudson Valley (Zone F) or Capital has experienced negative load growth. The Lower Hudson Valley (Zones G-H-I) or LHV has experienced a growth rate in excess of 2.4% annually (corrected for Rockland Electric Company joining PJM) with total load growth of approximately 915 MW. New York City (Zone J) or NYC has grown at a rate of 2.6% annually with total load growth of approximately 2570 MW. Long Island (zone K) or LI has grown at a rate of 3.5% annually with total load growth of approximately 1,500 MW over the last ten years. Together, the area defined as LHV, NYC and LI or Southeast NY (SENY) has experienced total load growth of almost 5,000 MW over the last ten years versus a net load growth of 4,100 MW for the NYCA as a whole.

Generating Capability

Table 5.1 below is a tabulation of installed generating capability or "iron-in-the-ground" for the NYCA to the nearest 10 MW and the regions as defined above for the years 1994, 1999 and 2004. These numbers are based on summer ratings and were derived from the annual "Load and Capacity Data Report" which represents generating capability as of year end of the reporting year. The capacity data from the data report ~~has~~ have been adjusted for capacity sold out of State, such as the NYPA hydro allotment and non-qualifying capacity such as the Indian Point gas turbines. These adjustments total approximately 360 MW for year 1994 and 400 MW for both years 1999 and 2004. Also, the year end 2004 data includes the Waterside units in NYC and the Albany steam units which are scheduled to be retired in 2005 in conjunction with new capacity additions which are scheduled to commence commercial operations in 2005. The net impact of the retirements and the new capacity is projected to be a net increase in capacity slightly in excess of 500 MW.

Table 5.1: New York Installed Generating Capability (MW)

For Select Years (as of 12/31)

Region	1994	1999	2004
West NY	13,660	14,480	14,430
Upper Hudson Valley	2,400	2,440	3,470
Lower Hudson Valley	5,700	5,530	5,490
New York City	8,550	7,870	8,940
Long Island	4,320	4,370	5,180

Total	34,630	34,690	37,510

The purpose of the above table is to present information on trends in NYCA capacity and an approximate estimate of the amount of capacity that would be available to meet installed capacity requirements during the summer capability period of each year. The first observation that can be made is that, while the NYCA load has increased by 4,100 MW, generating capability has increased by almost 2,900 MW, not including demand response. Also, it should be noted that almost all of the capacity additions that have been installed over the last ten years have been realized since the NYISO began operations of the NYCA wholesale electricity market on December 1, 1999.

In the summer of 2005, the load growth increased by approximately 560 MW to a total 31,960 MW. ~~capacity~~ Capacity increased by approximately 700 MW as the result of new capacity coming into service. Including demand response which is listed in the data book at 975 MW, the approximately 4,660 MW of load growth that is estimated to have occurred between 1994 and the summer of 2005 will have been offset by a combination of demand response totaling 975 MW and capacity additions totaling approximately 3,600 MW.

However, just as the load growth story over the last ten years embodies regional overtones, the expansion of NYCA generating capability also embodies regional overtones. While all the load growth has occurred in SENY, the generation expansion has been more uniformly distributed between SENY and Upstate NY (UPNY) – i.e., West NY and Capital. The peak load share for UPNY of the NYCA peak load has declined from 42.8% to 36.8% while SENY's share has increased from 57.2% to 63.2%. At the same time, UPNY's share of NYCA installed capacity has increased slightly from 46.4% to 47.7% while SENY's share has declined slightly from 53.6% to 52.3%. Including the capacity additions that are scheduled for 2005, UPNY's share increases to 47.9% while SENY's share declines to 52.1%.

The conclusion that can be drawn from these trends is that is that the NYCA has become more dependent on the transmission system in meeting its resource adequacy and energy requirements. In fact, on a regional basis, it is estimated that the load in SENY will have increased by over 5,400 MW between 1994 and the summer of 2005 while capacity has only increased by approximately 1,550 MW not including demand response which totals approximately 270 MW.

Transmission System

While the NYCA has ~~becoming~~ become more dependent on the transmission system, expansion of the transmission system has been has minimal. The "1994 Load and Capacity Data" book reported approximately 10,795 miles of transmission lines in service operating at 115 kV or higher while the "2005 Load and Capacity Data" book reported approximately 10,790 miles of transmission lines in service operating at 115 kV or higher. These numbers should not be interpreted to mean that the NYCA transmission system has not expanded. The transmission and sub-transmission (i.e., 69 kV and 34.5 kV) system has been expanded to accommodate local load growth requirements.

Fuel Diversity

Fuel diversity is not only important from economic perspective but also from a reliability perspective. Fuel diversity, in particular dual fuel capability, provides operational flexibility and a hedge against the disruption of anyone particular fuel source. Figure 5.1 presents the fuel mix of NYCA generating capability as of 1994, while Figure 5.2 presents the fuel mix as it existed as of year end 2004.

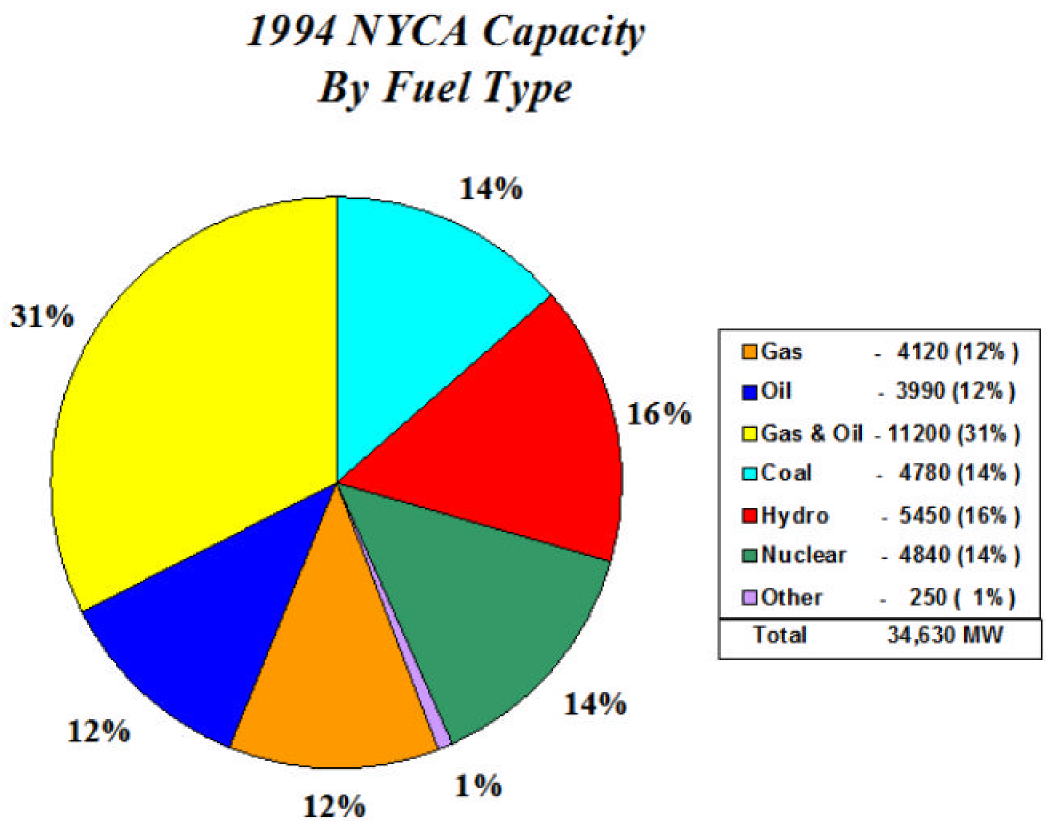


Figure 5.1: 1994 NYCA Capacity by Fuel Type

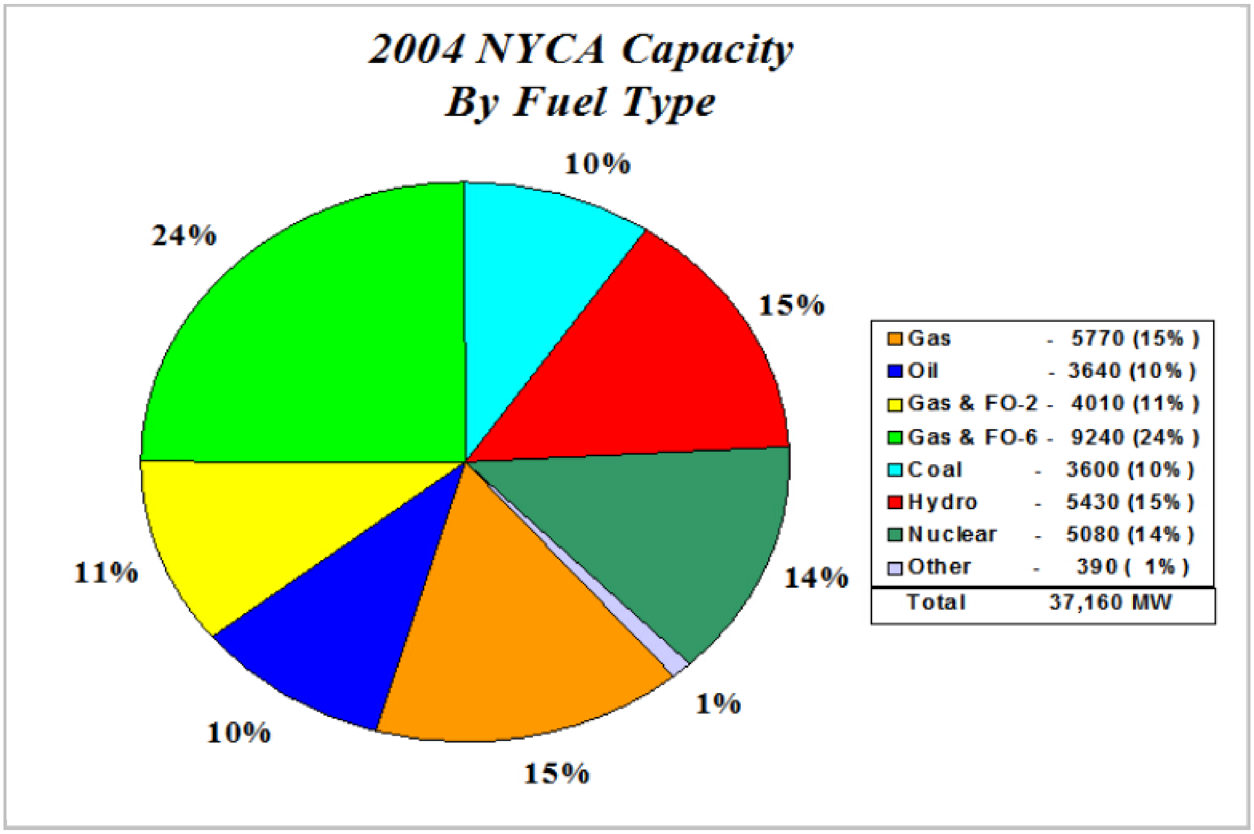


Figure 5.2: 2004 NYCA Capacity by Fuel Type

In 1994, 55 percent of the NYCA generating capacity was fueled by oil or natural gas. This has increased to 60 percent by 2004 while capacity fuel by natural gas only has grown from 12 percent of capacity to 15 percent. Although a significant portion of NYCA generating capacity is fueled by oil and natural gas, the NYCA fuel mix is well diversified. The fuel mix is diversified in the sense that more than half of the oil and natural fired capacity is dual fueled (35 percent of total capacity in 2004) and is dispatched primarily to meet peaking and intermediate energy requirements. As a result, oil and natural gas fired generation accounted for less than 40 percent of the electric energy produced in 2004. Also, another point to note is that the 2004 chart splits dual fired natural gas and oil capacity between units that burn #2 oil or distillate and #6 oil as an alternate fuel. The new base load capacity being installed currently are primarily combined cycle type generating units that burn natural gas as their primary fuel and burn #2 oil or distillate as an alternate fuel on a limited basis. This will have economic as well as potential reliability impacts on a going forward basis.

The diversified fuel mix that NY enjoys today is the result of the actions taken by NY investor owned utilities as a result of the oil embargo and fuel price shocks of the mid and late 1970s. New coal and nuclear capacity was constructed and existing capacity was either converted back to coal or dual fuel capability (the ability to burn natural gas as well as #6 oil).

6 NYCA Load and Energy Forecast: 2006 – 2015

6.1 Introduction

Overview

This section describes the demand forecast for the eleven year period beginning with 2005 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 forecast of summer and winter peak demands and annual energy requirements.

Executive Summary

The NYISO has initiated the ~~Electric System Planning Process (ESPP)~~CRPP to assess the adequacy of New York's electricity infrastructure for meeting reliability and market needs over the 2005 – 2015 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 autumn of 2004. 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:

	Average Annual Rates of Change		
	84-94	**94-04**	**04-15**
Employment	0.32%	0.79%	0.75%
Population	0.40%	0.41%	0.10%
Households	0.41%	0.59%	0.33%
Total Income	2.04%	2.55%	1.56%
Average Electric Price	-0.82%	0.05%	-1.64%
Summer Peak	2.20%	1.41%	1.17%
Winter Peak	1.35%	0.79%	0.80%
Annual Energy Requirements	1.56%	1.01%	1.15%
	Shares of Total Employment		
	1984	**2005**	**2015**
Business Service Employment Share	22.8%	24.1%	24.4%
Public Service Employment Share	28.8%	35.6%	36.8%
Manufacturing Employment Share	15.5%	7.1%	6.3%

~~***6.2Caution and Disclaimer***~~

~~6.2The contents of these materials are for discussion and information purposes and are provided "as is" without representation or warranty of any kind, including without limitation, accuracy, completeness or fitness for any particular purposes. The New York Independent System Operator assumes no responsibility to you or any other party for the consequences of any errors or omissions. The NYISO may revise these materials at any time in its sole discretion without notice to you.~~

6.2 Historical Overview

NYCA System

Table 6.2.1 shows the New York Control Area's (NYCA) historic peak and energy growth since 1984.

Table 6.2.1: 21-Year Historic Peak and Energy Data and Growth Rates

21 Year Historic Peak and Energy Data and Growth Rates

Calendar Year	Annual Energy (GWH)	Annual Energy Growth (%)	Summer Peak (MW)	Summer Peak Growth (%)	Winter	Winter Peak (MW)	Winter Peak Growth (%)
1984	124,637		21,870		84 - 85	20,291	
1985	126,290	1.33%	22,926	4.83%	85 - 86	20,664	1.84%
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 - 01	23,774	-1.11%
2001	156,787	0.10%	30,982	10.11%	01 - 02	23,713	-0.26%
2002	158,745	1.25%	30,664	-1.03%	02 - 03	24,454	3.12%
2003	158,014	-0.46%	30,333	-1.08%	03 - 04	25,262	3.30%
2004	160,211	1.39%	28,433	-6.26%	04 - 05	25,541	1.10%
Annual Average Growth Rates		1.26%		1.32%			1.16%

NYCA is a summer peaking system and its summer peak has grown faster than sendout and winter peak over this period. Both summer and winter peaks show considerable year-to-year variability in growth as each responds to essentially the weather conditions on an extreme day each year. Annual energy is influenced by weather conditions over an entire year, which is much less variable.

Table 6.2.2 shows trends in weather-normalized sendout and peaks for the NYCA system.

Table 6.2.2: Weather Normalized Annual Sendout and Seasonal Peak Loads

Calendar Year	Annual Energy (GWH)	Annual Energy Growth (%)	Summer Peak (MW)	Summer Peak Growth (%)	Winter	Winter Peak (MW)	Winter Peak Growth (%)
1993	144,471		27,000		93 - 94	24,132	
1994	145,779	0.91%	27,300	1.11%	94 - 95	23,311	-3.40%
1995	146,087	0.21%	27,500	0.73%	95 - 96	23,072	-1.03%
1996	147,000	0.62%	27,800	1.09%	96 - 97	22,771	-1.31%
1997	148,008	0.69%	28,400	2.16%	97 - 98	21,211	-6.85%
1998	150,849	1.92%	29,100	2.46%	98 - 99	23,878	12.58%
1999	153,925	2.04%	29,700	2.06%	99 - 00	24,114	0.99%
2000	156,177	1.46%	30,300	2.02%	00 - 01	23,026	-4.51%
2001	155,223	-0.61%	30,780	1.58%	01 - 02	21,954	-4.66%
2002	156,582	0.88%	31,000	0.71%	02 - 03	24,564	11.89%
2003	157,588	0.64%	31,410	1.32%	03 - 04	25,794	5.01%
2004	161,257	2.33%	31,400	-0.03%	04 - 05	25,781	-0.05%
Annual Average Growth Rates		1.00%		1.38%			0.60%

The same pattern is shown in Table 6.2.2 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.

Regional Sendout and Peaks

Table 6.2.3 shows how sendout has grown and is projected for the different regions in New York (Actual sendout by region is provided in the 2005 Load & Capacity Data Report.) The West region is NYCA Zones A – E. Upper Hudson Valley is F, Lower Hudson Valley is G – 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. UHV is the location of Albany, the State capitol. Its economy is strongly influenced by state government employment. LHV's economy has its own endogenous industries among which IBM is the best known company. 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 UHV and LHV by the Central East interface. UHV and LHV are separated by the UPNY/SENY interface, LHV and J by Dunwoodie South. J and K are separated by the Con Ed – LIPA interface.

Table 6.2.3: Weather-normalized Zonal Sendout and Forecast

Weather-normalized Zonal Sendout and Forecast	West	UHV	LHV	J	K	NYCA
1993	56,489	12,076	16,411	41,828	17,667	144,471
1994	55,446	12,478	16,560	43,290	18,005	145,779
1995	54,966	13,256	16,493	43,407	17,965	146,087
1996	55,942	12,771	16,321	44,024	17,941	147,000
1997	57,120	11,820	16,206	44,676	18,185	148,008
1998	57,170	11,918	16,830	46,043	18,888	150,849
1999	57,521	11,908	17,096	47,914	19,486	153,925
2000	57,707	11,441	17,241	49,605	20,183	156,177
2001	55,930	11,446	17,207	49,912	20,728	155,223
2002	55,772	11,182	17,902	50,348	21,378	156,582
2003	55,395	11,025	18,641	50,706	21,821	157,588
2004	55,984	11,200	19,166	52,409	22,497	161,257
2005	57,085	11,326	19,625	52,836	23,178	164,050
2006	58,622	11,341	19,851	53,263	23,713	166,790
2007	59,291	11,356	20,190	54,319	24,244	169,400
2008	60,024	11,371	20,492	55,427	24,784	172,100
2009	60,525	11,387	20,775	56,345	25,258	174,290
2010	60,910	11,402	21,142	57,185	25,702	176,340
2011	61,125	11,417	21,558	57,917	26,043	178,060
2012	61,207	11,432	21,988	58,539	26,354	179,520
2013	61,105	11,447	22,610	58,949	26,598	180,710
2014	61,010	11,463	23,129	59,296	26,842	181,740
2015	61,116	11,478	23,608	59,717	26,961	182,880
Average Annual Growth						
1993 - 2004	-0.082%	-0.683%	1.421%	2.071%	2.222%	1.004%
2004 - 2015	0.801%	0.223%	1.913%	1.194%	1.659%	1.151%

Since 2001, LHV has been New York's fastest growing region. This is expected to persist in the forecast. Long Island (K) and New York City (J), while still exhibiting solid energy growth, have more limited opportunities for residential and commercial expansion than does LHV. Upstate regions should see their sendout declines abate. However, their economies are not expected to be strong enough to lift sendout growth very far into positive territory.

Table 6.2.4: Weather Normalized Zonal Summer Peaks and Forecast

	Weather-normalized Zonal Summer Peaks and Forecast						
		West	UHV	LHV	J	K	NYCA
	1993	9,068	2,313	3,337	8,365	3,596	27,000
	1994	9,257	2,349	3,401	8,538	3,628	27,300
	1995	8,992	2,298	3,345	8,902	3,837	27,500
	1996	9,256	2,349	3,580	8,776	3,579	27,800
	1997	9,315	2,131	3,650	9,609	4,273	28,400
	1998	9,213	2,267	3,755	9,689	4,396	29,100
	1999	9,101	2,182	3,933	10,057	4,782	29,700
	2000	9,072	1,984	3,864	9,801	4,386	30,300
	2001	9,183	2,063	4,271	10,424	4,901	30,780
	2002	9,264	2,086	4,013	10,457	5,082	31,000
	2003	9,044	2,104	3,978	10,240	4,993	31,410
	2004	8,684	2,021	4,316	11,105	5,123	31,400
	2005	8,905	2,100	4,410	11,315	5,230	31,960
	2006	8,930	2,129	4,516	11,505	5,320	32,400
	2007	8,987	2,158	4,624	11,660	5,410	32,840
	2008	9,102	2,188	4,735	11,805	5,500	33,330
	2009	9,158	2,218	4,849	11,965	5,580	33,770
	2010	9,216	2,249	4,965	12,090	5,680	34,200
	2011	9,220	2,280	5,084	12,217	5,779	34,580
	2012	9,209	2,311	5,206	12,294	5,879	34,900
	2013	9,098	2,343	5,331	12,426	5,981	35,180
	2014	8,941	2,376	5,459	12,559	6,085	35,420
	2015	8,911	2,408	5,590	12,648	6,112	35,670
Average Annual Growth							
1993 - 2004		-0.392%	-1.220%	2.365%	2.610%	3.270%	1.382%
2004 - 2015		0.235%	1.607%	2.380%	1.190%	1.618%	1.166%

Weather-normalized peaks for the West and UHV were lower in 2004 than they were in 1993. However, West peaks are volatile even on a weather-normalized basis as its load, heavily influenced by manufacturing, is very responsive to economic cycles. UHV peaks have declined over the same period as well.

Table 6.2.4 shows that all the load growth in New York over the past eleven years has occurred south of the UPNY/SENY Interface.

6.3 Trends Effecting Electricity in New York

6.3.1 Employment

A factor which has had considerable impact on the nature of electricity use is the changing structure of New York's economy. In earlier times, New York was a manufacturing center. However, the relative importance of manufacturing to the State economy has been declining for at least forty years.

For much of the latter half of the twentieth century New York was home to much of the US financial industry. New York City was considered, along with London, one of the financial capitals of the world. Virtually all US investment banking, securities trading, and major bank headquarters were located there. Since at least the 1970's, however, the role of finance in New York's economy has receded.

Today, New York's economy is dominated by public services. These include all levels of government employment, education and health care. These industries share the common feature that most~~, at least,~~ of their revenue is provided by governments or taxing authorities of one kind or another.

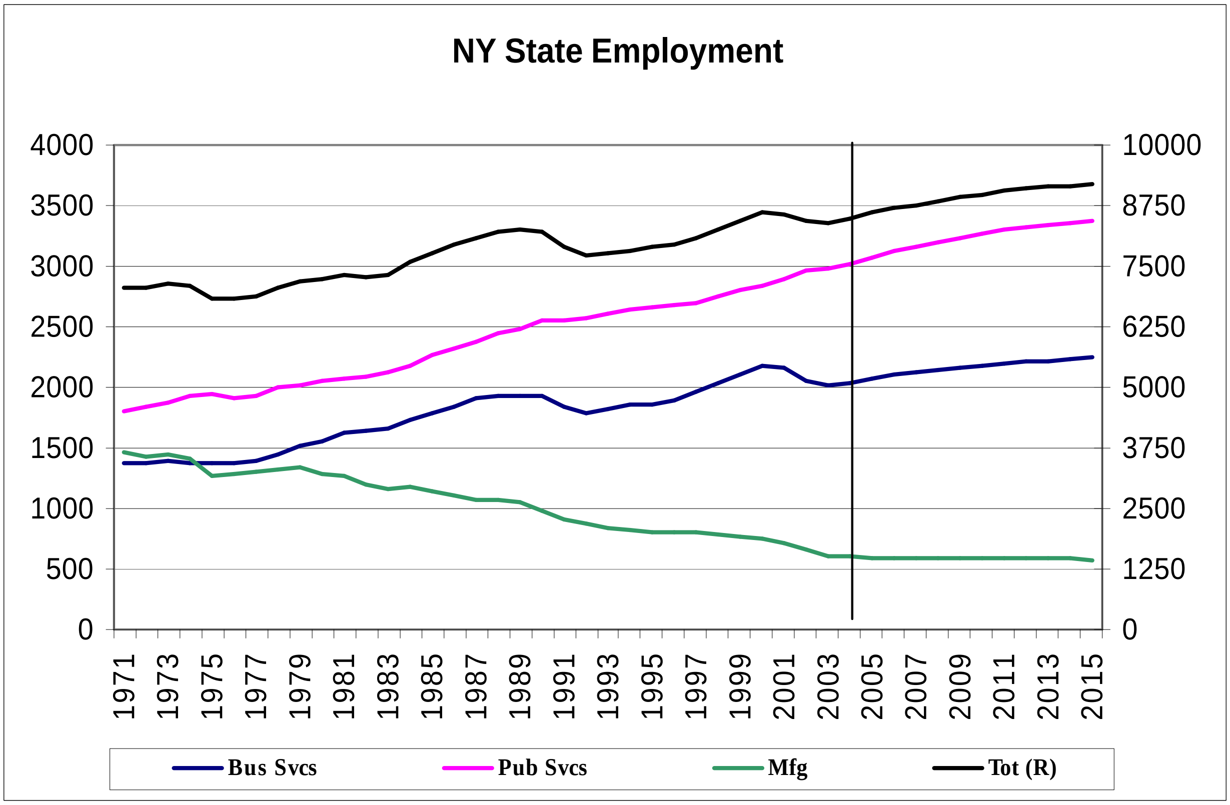


Figure 6.1: New York State Employment

Public service employment began the 1970s roughly comparable to business service (finance, professional, managerial and administrative services) and manufacturing. Since then it has almost doubled, while business services have grown by about one-third and manufacturing has declined by about two-thirds. Business services and manufacturing employment have reflected the impact of national recessions, declining in bad economic times and growing (or declining less rapidly) when the economy recovered. Public service employment, however, has grown without interruption since the mid-1970s.

These trends have held in all New York regions, as is shown in Figure 6.2

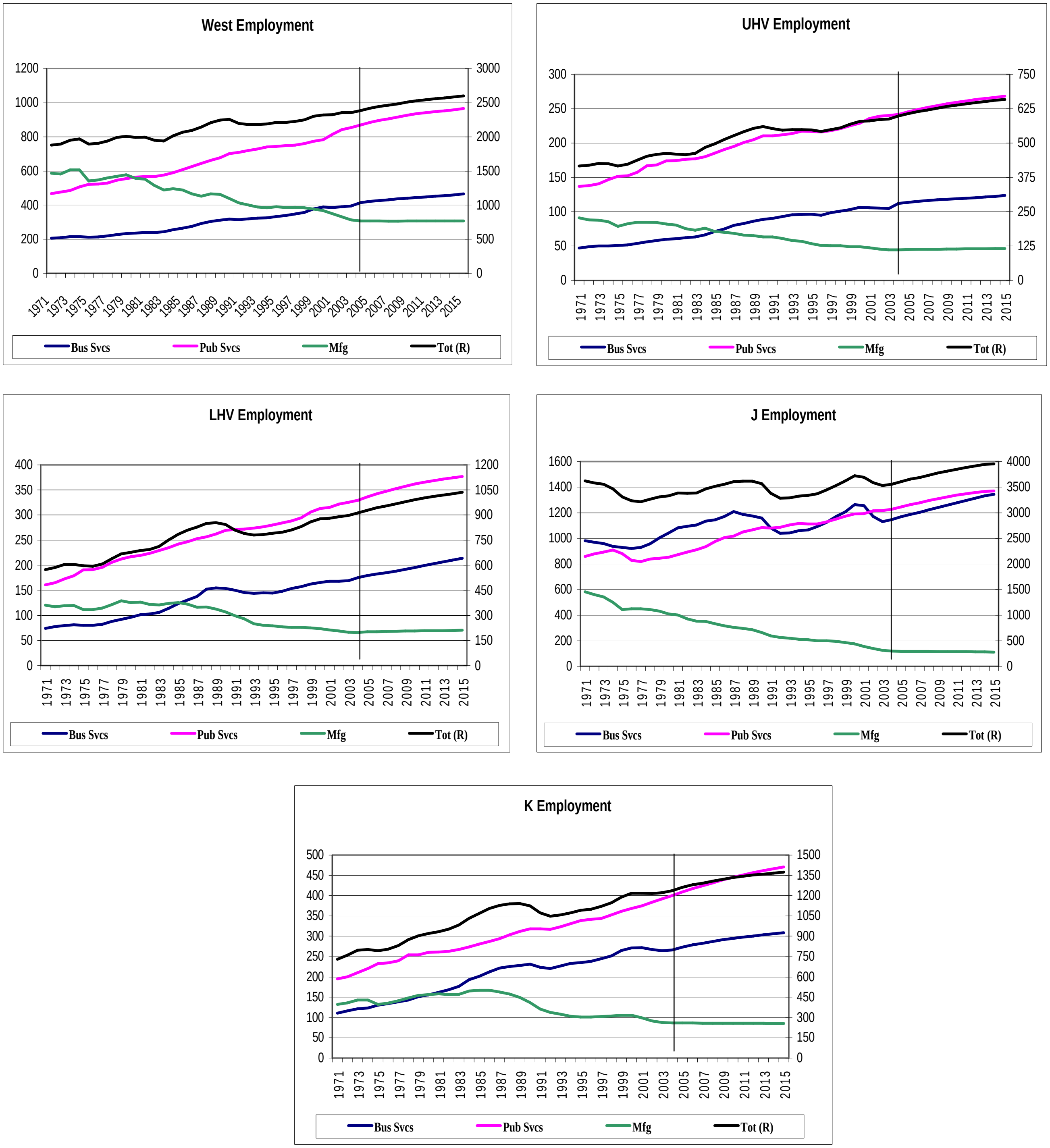


Figure 6.2: Employment Trends

In every region, manufacturing employment has receded. The region this has had the greatest effect on is the West, where it used to be the largest source of employment. It is now the smallest. The decline of manufacturing has carried over to this region's demographic trends.

In other regions except for New York City, manufacturing at one time was the second leading employer. It is now the smallest, and is projected to remain there. Similarly, public services are now and are projected to be the largest employer.

6.3.2 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 is was in 1975. The Lower Hudson Valley has seen the most population growth, adding 20% to its 1975 starting point. Other regions fall in between. New York State has added over 8% to its 1975 population base.

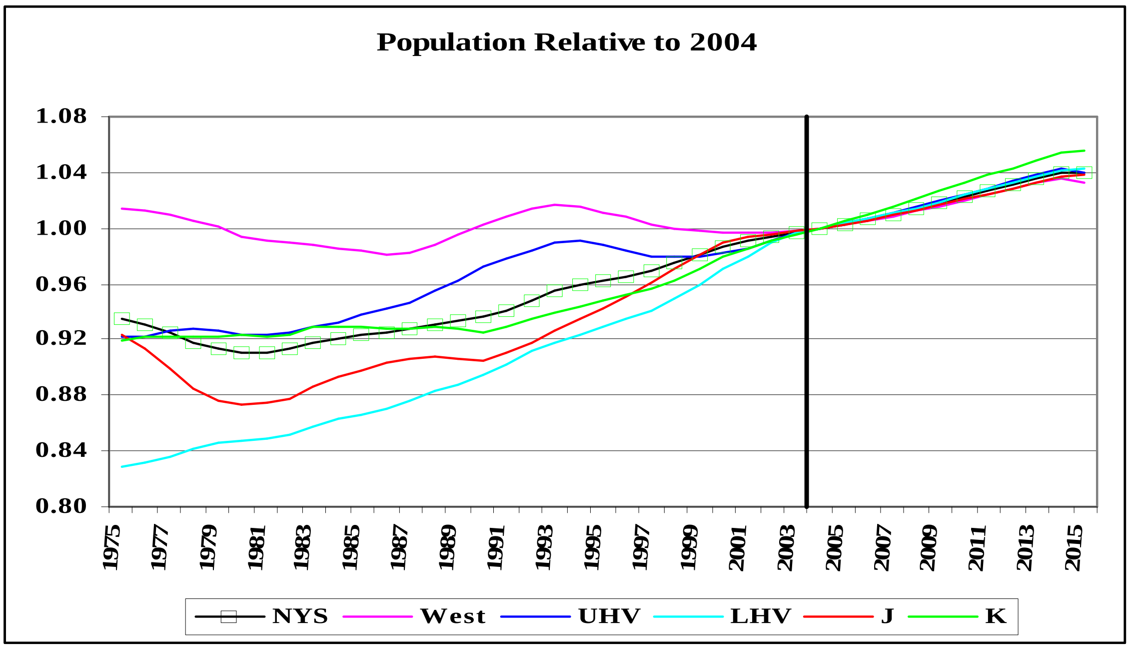


Figure 6.3: Population Relative to 2004

In the forecast, the regional variations in population growth are expected to smooth out. Long Island (K) and the Lower Hudson Valley will grow slightly faster than the other regions, with New York City (J) population actually expected to see the smallest increase.

6.3.3 Income

Employment and population trends carry over into total income. The West is again shown to have the slowest growth historically, by a considerable margin. As its employment base has declined, population has left and taken its income with it.

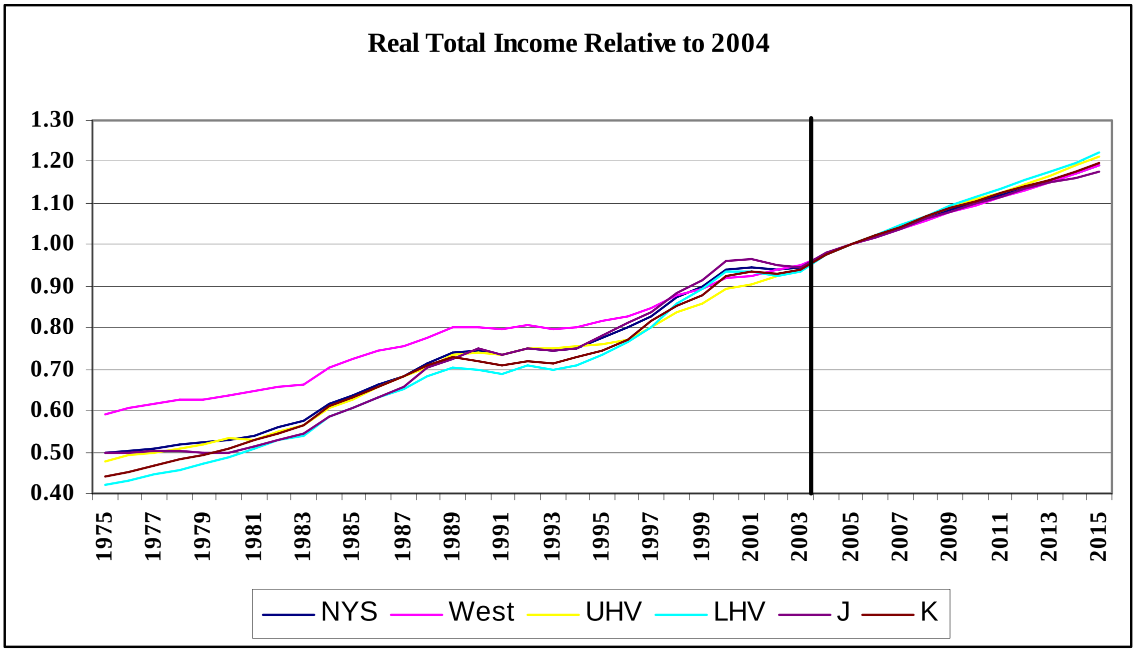


Figure 6.4: Real Total Income Relative to 2004

Forecasted income growth is expected to be more even, reflecting trend employment and population growth.

6.3.4 Electric Prices

Electric prices in New York are expected to follow the trend predicted by the Energy Information Agency in its "Annual Energy Outlook – 2005, Mid-Atlantic Region" , modified to line up with New York actual data for 1990 – 2001. Prices for individual regions are not available.

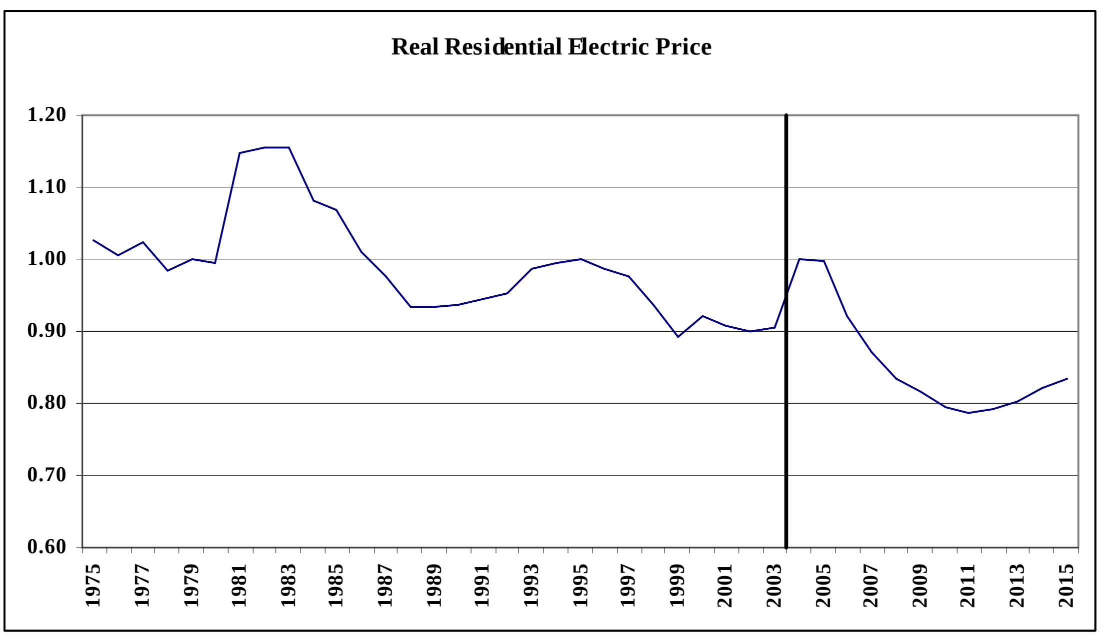


Figure 6.5: Real Residential Electric Price

Electricity prices, historical and forecast, are closely linked to movements in oil and natural gas prices, since these are the major component of variable costs and determine marginal prices in the short-term.

Historical and forecasted average annual growth rates for key economic indicators are shown in Table 6.3.1.

Table 6.3.1: Regional Economic Growth Rates of Key Economic Indicators

Regional Economic Growth Rates of Key Economic Indicators	84-94	94-04	04 - 15
West			
Total Non-ag Employment	0.83%	0.85%	0.80%
Population	0.30%	-0.15%	0.29%
Total Income	1.30%	2.01%	1.80%
Upper Hudson Valley			
Total Non-ag Employment	1.27%	0.87%	0.88%
Population	0.61%	0.09%	0.36%
Total Income	2.21%	2.62%	1.97%
Lower Hudson Valley			
Total Non-ag Employment	0.43%	1.53%	1.17%
Population	0.67%	0.81%	0.38%
Total Income	1.94%	3.27%	2.07%
New York City			
Total Non-ag Employment	-0.41%	0.68%	0.97%
Population	0.46%	0.68%	0.34%
Total Income	2.49%	2.71%	1.70%
Long Island			
Total Non-ag Employment	0.38%	1.43%	0.96%
Population	0.15%	0.58%	0.49%
Total Income	1.77%	2.96%	1.88%

6.4 Forecast Methodology

The starting point for the NYCA forecast is the 2004 fall forecast of the New York State Economy produced by Economy.com. The Economy.com forecast is a detailed projection of employment, output, income, population, and other concepts. Series are projected for New York State and for each of twenty-three regions in the State. These are aggregated into the five regions for which energy and peak forecasts are made.

NYCA GWH and summer and winter peak models are presented below:

Table 6.4.1: NYCA Annual GWH Model

Lag	Coefficient	Standard Error	t Value
1	0.409182	0.194536	-2.10

Yule Walker Estimates

SSE	0.00270796	**DFE**	22
MSE	0.0001231	**Root MSE**	0.01109
SBC	-166.85356	**AIC**	-178.06314
Regress R Square	0.9853	**Total R-Square**	0.9940
Durbin-Watson	1.4539		

Variable	DF	Standard Estimate	Error	Approx t value	Variable Pr > |t|
Intercept	1	5.9465	1.4415	4.13	0.0004
ShrEdHl	1	0.3398	0.0838	4.06	0.0005
ShrManuf	1	0.1798	0.0734	2.45	0.0227
IncTot_R	1	0.4547	0.0837	5.43	<.0001
PrElecRes_R	1	-0.0864	0.0578	-1.50	0.1489
CDD	1	0.0570	0.0133	4.28	0.0003
HDD	1	0.1153	0.0373	3.09	0.0053

ShrEdHl:	Share of Total Non-ag employment in Public Services
ShrManuf:	Share of Total Non-ag employment in Manufacturing
IncTot_R:	Total Income in real dollars
PrElecRes_R:	Residential electric price in real dollars
CDD:	Cooling degree days
HDD:	Heating degree days

Table 6.4.2: NYCA Summer Peak Model

Lag	Coefficient	Standard Error	T Value
1	0.437153	0.179877	2.43

Yule Walker Estimates

SSE	0.01500619	**DFE**	25
MSE	0.0006002	**Root MSE**	0.02450
SBC	-125.66031	**AIC**	-132.6663
Regress R Square	0.9870	**Total R-Square**	0.9748
Durbin-Watson	2.0437		

Variable	DF	Standard Estimate	Error	Approx t value	Variable Pr > |t| Label
Intercept	1	-10.3123	1.7333	-5.95	<.0001
AnnGWh	1	0.586	0.1254	4.68	<.0001
HH	1	1.43520	0.3503	4.10	0.0004
CDD	1	0.1280	0.0344	3.72	0.0010

AnnGWh	Annual Energy, as modeled in NYCA Annual GWh Model
HH	Households
CDD	Cooling Degree Days

Table 6.4.3: NYCA Winter Peak Model

SSE	0.0157554	**DFE**	28
MSE	0.0005627	**Root MSE**	0.02372
SBC	-134.61439	**AIC**	-137.41678
Regress R Square	0.9440	**Total R-Square**	0.9440
Durbin-Watson	1.3637		

Variable	DF	Estimate	Standard Error	t value	Approx Pr > |t|
Intercept	1	0.9520	0.4161	2.29	0.0299
AnnGWh	1	0.7652	0.0352	21.72	<.0001

Regional energy forecasts, from either econometric or time series models, were developed for each region. Each region's forecast was adjusted so that the sum of the regions equaled the forecast produced by the NYCA Annual GWh Model.

Summer peaks for West, UHV and LHV were calculated for each region based on the trend of its summer load factor for 1993 – 2003. J and K summer peak forecasts were developed using growth rates provided by Consolidated Edison and LIPA.

Regional peaks were not constrained to match the NYCA system peak, or to achieve a constant level of peak diversity. Rather, they reflect energy and load factor trends observed over the past eleven years and projected to reflect anticipated economic growth.

Since the initial regional peak forecasts were developed in the spring of 2005, very high load have been observed in the West, and somewhat lower load in LHV. It has not been determined as of yet if these are entirely attributable to the unusually warm weather experienced in the western part of New York in June and July, or if they are caused by load growth over the last several years that may have been masked by cool summers in 2003 and 2004.

As a result, of the 2005 experience, however, the load forecasts for West, UHV and LHV have been modified slightly. The forecast in Tables 6.2.3 and 6.2.4, therefore, differs from that presented previously in the “2005 Load & Capacity Report.”

EDRP was estimated at 1.9% of total peak and apportioned to the regions based on a breakdown of enrolled customers as of March 2005.

7 Description of Baseline 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 were reviewed both at TPAS and ESPWG. 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 screening procedure is attached as referenced in section 1.1 below.

The NYISO developed the system representation for the second five years of the Study Period 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 BPTFs; and (4) ~~and~~ Market Participant input. ~~Based on this process, t~~The network model for the second five year period was identical to the network model for the year 2010 of the ~~in~~ first five~~the Five Year~~ years ~~Base Case~~ except for the ~~MW and MVAR~~ load model. The load model reflected the load forecast from the Gold Book.

7.1 Project Screening

NYISO RNA Base 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 ~~Comprehensive Planning Process~~CRPP.

The following three categories of projects were considered for inclusion in the Base 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 Base Case as follows:

~~a.~~A. TO projects on non-bulk power facilities were included. ~~Projects that are in service or under construction were included.~~

~~b.~~B. ~~TO projects on non-bulk power facilities were included.~~ Projects that are in service or under construction were included.

~~c.~~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:

4. The project is a Backstop Regulated Solution triggered in a prior year's Comprehensive Reliability Plan; or
5. The project is related to any projects and plans that are included in the Base Case; or
6. 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.

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

Table 7.2.1 summarizes the capacity type for the New York Control Area through the ten- year study period. Similar summary tables are available for the eleven LBMP zones in New York State in Appendix B.

Table 7.2.1: Load and Capacity Table

Category	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Steam Turbine (Oil)	1649	1649	1649	1649	1649	1649	1649	1649	1649	1649	1649
Steam Turbine (Oil & Gas)	9074	9074	9074	8120	8120	8120	8120	8120	8120	8120	8120
Steam Turbine (Gas)	1067	1067	1067	1067	1067	1067	1067	1067	1067	1067	1067
Steam Turbine (Coal)	3597	3597	3242	2830	2830	2830	2830	2830	2830	2830	2830
Steam Turbine (Wood)	39	39	39	39	39	39	39	39	39	39	39
Steam Turbine (Refuse)	264	264	264	264	264	264	264	264	264	264	264
Steam (PWR Nuclear)	2544	2544	2639	2639	2639	2639	2639	2639	2639	2639	2639
Steam (BWR Nuclear)	2610	2610	2610	2610	2610	2610	2610	2610	2610	2610	2610
Pumped Storage Hydro	1409	1409	1409	1409	1409	1409	1409	1409	1409	1409	1409
Internal Combustion	119	119	119	119	119	119	119	119	119	119	119
Conventional Hydro	4488	4488	4488	4488	4488	4488	4488	4488	4488	4488	4488
Combined Cycle	7041	8041	8041	8041	8041	8041	8041	8041	8041	8041	8041
Jet Engine (Oil)	527	527	527	527	527	527	527	527	527	527	527
Jet Engine (Gas & Oil)	173	173	173	173	173	173	173	173	173	173	173
Combustion Turbine (Oil)	1414	1414	1414	1414	1414	1414	1414	1414	1414	1414	1414
Combustion Turbine (Oil & Gas)	1428	1428	1428	1428	1428	1428	1428	1428	1428	1428	1428
Combustion Turbine (Gas)	1284	1284	1284	1284	1284	1284	1284	1284	1284	1284	1284
Wind	47	47	47	47	47	47	47	47	47	47	47
Other	1	1	1	1	1	1	1	1	1	1	1
UDR	330	330	990	990	990	990	990	990	990	990	990
Non UDR	2755	2755	2755	2755	2755	2755	2755	2755	2755	2755	2755
Special Case Resources	975	975	975	975	975	975	975	975	975	975	975
Demand Response Programs	269	269	269	269	269	269	269	269	269	269	269
NYCA Demand	31960	32400	32840	33330	33770	34200	34580	34900	35180	35420	35670
Required Capability	37395	37915	38434	39012	39531	40039	40487	40865	41195	41478	41773
Total NYCA Capability	38772	39772	39512	38146	38146	38146	38146	38146	38146	38146	38146
Reserve Margin	21%	23%	20%	14%	13%	12%	10%	9%	8%	8%	7%

*Capacity based on Summer Capability

It should be noted that the reserve margin calculation in the above table does not include special cases resources (SCR). Inclusion of SCR would increase these reserve calculations by about 3 percentage points.

Project Additions and Retirements

The Base Case model of the New York system for the 2005 RNA includes the following new and proposed facilities:

~~a.~~A. TO projects on non-bulk power facilities.
~~b.~~B. The Neptune project.
~~c.~~C. Facilities that have accepted their Attachment S cost allocations and are in service or under construction as of March 31, 2005. The SCS Astoria project is modeled at its contracted-for capacity of 500 MW.
~~d.~~D. Transmission upgrades related to any projects and facilities that are included in the Base Case, as defined above.

The NYISO's scenario analyses address, among other things, all other TO plans and projects on the bulk power system and merchant projects that as of March 31, 2005 had accepted their cost allocation but had not yet commenced construction.

The Base Case model of the New York system for the 2005 RNA includes the following retirements:

A. Waterside units 6, 8 and 9 – NYC (Zone J)
B. Poletti 1 – NYC (Zone J)
C. Albany units 1, 2, 3 and 4 – Capital (Zone F)
D. Huntley units 63, 64, 65 and 66 – Frontier (Zone A)
E. Russell station – Rochester (Zone B)
F. Lovett units 3, 5 and 5 – Lower Hudson valley (Zone G)

7.3 Base Case Load & Capacity Summary

The table 7.3.1 below presents a load and resource summary for the base case for the years 2006 through 2015. The summary is consistent with load and capacity table contained in the "2005 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 UDR which are counted as resources in determining reserve margins and resource to zonal load ratios. For the purposes of the resource adequacy assessments the HVDC ties were modeled as free flowing ties.

Table 7.3.1: Base Case Load and Capacity Summary for the NYCA, Zones J and K

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Peak Load										
NYCA	32,400	32,840	33,330	33,770	34,200	34,580	34,900	35,180	35,420	35,670
Zone J	11,505	11,660	11,805	11,965	12,090	12,217	12,294	12,426	12,559	12,648
Zone k	5,320	5,410	5,500	5,580	5,680	5,779	5,879	5,981	6,085	6,112
Resources										
NYCA										
"-Capacity"	39,420	39,160	37,794	37,794	37,801	37,801	37,801	37,801	37,801	37,801
"-SCR"	975	975	975	975	975	975	975	975	975	975
"-UDR"	330	990	990	990	990	990	990	990	990	990
Total	40,725	41,125	40,111	39,759	39,766	39,766	39,766	39,766	39,766	39,766
Zone J										
"-Capacity"	10,102	10,102	9,217	9,217	9,217	9,217	9,217	9,217	9,217	9,217
"-SCR"	172	172	172	172	172	172	172	172	172	172
"-UDR"	0	0	0	0	0	0	0	0	0	0
Total	10,274	10,274	9,389	9,389	9,389	9,389	9,389	9,389	9,389	9,389
Zone K										
"-Capacity"	5,340	5,340	5,340	5,340	5,340	5,340	5,340	5,340	5,340	5,340
"-SCR"	98	98	98	98	98	98	98	98	98	98
"-UDR"	330	990	990	990	990	990	990	990	990	990
Total	5,768	6,428	6,428	6,428	6,428	6,428	6,428	6,428	6,428	6,428
NYCA Res. Margin %	125.7%	125.2%	120.3%	117.7%	116.3%	115.0%	113.9%	113.0%	112.3%	111.5%
Zons J Res/Load/ Ratio	89.3%	88.1%	79.5%	78.5%	77.7%	76.9%	76.4%	75.6%	74.8%	74.2%
Zons K Res/Load Ratio	108.4%	118.8%	116.9%	115.2%	113.2%	111.2%	109.3%	107.5%	105.6%	105.2%

The table shows a steady decline in the NYCA reserve margin from 125.7% in 2006 to 111.5% by the end of the planning period. Likewise, the Zone J resource to load ratio declines throughout the planning horizon from 89.3% to 74.2%, while Zone K peaks at 118.8% with the addition of the Neptune project in 2007 but declines to 105.2% by the end of the planning horizon.

Proposed Projects for Inclusion in Study Base Cases - Load Flow									
	In-service	**MW Capacity**		**Status**	**CRPS**	**ATBA**	**ATRA**	**CATR**	**CRPS-15**
	Dates	Summer	Winter (**)		2010	2010	2010	2010	2015
I. Generation									
A. Additions									
ConEd-East River Repowering	I/S	298		I/S	X	X	X	X	X
NYPA-Poletti Expansion	2006/01	500		UC	X	X	X	X	X
SCS Energy-Astoria Energy	2006/04	500		UC	X	X	X	X	X
PSEG-Bethlehem	2005/07	770	828	UC	X	X	X	X	X
Calpine-Bethpage 3	2005/05	79.9		UC	X	X	X	X	X
Pinelawn-Pinelawn Power 1	2005/05	79.9		UC	X	X	X	X	X
ANP-Brookhaven Enery Center	2009/Q2	560				X	X	X	
SCS Energy-Astoria Energy	2007/Q2	500				X	X	X	
NYC Energy-Kent Ave	2007/06	79.9				X	X	X	
LMA-Lockport II	2007/Q2	79.9				X	X	X	
Calpine-JFK Expansion	2006/06	45				X	X	X	
Reliant-Repowering Phases 1	2010/Q2	535.8	593.7				X	X	
Reliant-Repowering Phases 2	2011/Q3	535.8	593.7				X	X	
SEI-Bowline Point 3 (Mirant)	2008/Q2	750					X	X	
Bay Energy	2007/06	79.9					X	X	
Entergy-Indian Point 2 Uprate	I/S	1078		I/S	X	X	X	X	X
Entergy-Indian Point 3 Uprate	I/S	1080		I/S	X	X	X	X	X
Fortistar-VP	2007/Q2	79.9					X	X	
Fortistar-VAN	2007/Q2	79.9					X	X	
KeySpan-Spagnoli Rd CC	2008-09	250					X	X	
Chautauqua Windpower	2006/11	50					X	X	
Besicorp-Empire State Newsprint	2007/Q2	603	660				X	X	
Flat Rock Windpower	2005/12	198					X	X	
Flat Rock Windpower	2006/12	123.75					X	X	
Calpine-Wawayanda	2008/Q2	500					X	X	
Global Winds-Prattsburgh	2006/10	75					X	X	
ECOGEN-Prattsburgh Wind Farm	2006/07	79					X	X	
Constellation-Ginna Plant Uprate	2006/11	610					X	X	
PSEG Cross Hudson Project	2008	550					X	X	
Liberty Radial Interconnection to NYC	2007/05	400					X	X	
B. Retirements									
NYPA-Poletti 1	2008/02	885.3	885.7		X	X	X	X	X
RG&E-Russell	2007/12	238	245		X	X	X	X	X
ConEd-Waterside 6,8,9	2005/07	167.2	167.8		X	X	X	X	X
PSEG-Albany	2005/02	312.3	364.6		X	X	X	X	X
NRG-Huntley 63,64	2005/11	60.6	96.8		X	X	X	X	X
NRG-Huntley 65,66	2006/11	166.8	170		X	X	X	X	X
Mirant-Lovett 5	2007/06	188.5	189.7		X	X	X	X	X
Mirant-Lovett 3,4	2008/06	242.5	244		X	X	X	X	X
Astoria 2	2010/Q2	175.3	181.3				X	X	
Astoria 3	2011/Q3	361	372.4				X	X	
Hudson Ave. 10	2004/10	65			X	X	X	X	X
II. Transmission		**Miles**							
A. Additions									
PSEG-Bergen (new)-W. 49th St.345kV Cable	2008	7.50					X	X	
AE Neptune PJM –LI DC Line (600 MW)	2007	65.00		UC	X		X	X	X
LIPA-Duffy Convrtr Sta-Newbridge Rd. 345kV	2007/S	1.70		UC	X		X	X	X
LIPA-Newbridge Rd. 345kV-138kV (2-Xfmrs)	2007/S	N/A		UC	X		X	X	X
LIPA-E. Garden City-Newbridge Rd. 138kV	2007/S	4.00		UC	X		X	X	X
LIPA-Ruland Rd.-Newbridge Rd. 138kV	2007/S	9.10		UC	X		X	X	X
Rochester Transmission-Sta. 80 & various	2008/F	N/A		UC	X	X	X	X	X
Liberty Radial Interconnection to NYC-230kV	2007	0.62					X	X	
ConEd-Dunwoodie-Sherman Crk 138kV	2005/W	7.80			X	X	X	X	X
LIPA-Riverhead-Canal(new) 138kV Operation	2005/S	16.40		UC	X	X	X	X	X
LIPA-E. Garden City-Supr.Condr. Sub. 138kV	2006/S	0.38		UC	X	X	X	X	X
LIPA-Northprt-Norwalk Hrbr. 138kV Replcmnt(2)	2006/S	11.00		UC	X	X	X	X	X
ConEd-Mott Havn-Dunwoodie 345kV Rec.(2)	2007/S	9.99			X	X	X	X	X
ConEd-Mott Havn-Rainey 345kV Rec. (2)	2007/S	4.08			X	X	X	X	X
ConEd-Sherman Crk 345kV-138kV (2-Xfmrs)	2007/S	N/A				X	X	X	
ConEd-Sprin Brk-Sherman Crk 345kV	2007/S	10.00				X	X	X	
LIPA- Holtsville GT-Brentwood 138kV (2)	2007/S	12.40		UC	X	X	X	X	X
LIPA-Brentwood-Pilgram 138kV Operation	2007/S	4.60		UC	X	X	X	X	X
LIPA-Sterling-Off Shore Wind Farm 138kV	2008/S	8.00							
O&R-Ramapo-Tallman 138kV Rec.	2007/S	3.24			X	X	X	X	X
O&R-Tallman-Burns 138kV	2007/S	6.08			X	X	X	X	X
LIPA-Riverhead-Canal 138kV	2010/S	16.40				X	X	X	
CHG&E-Hurley Ave-Saugerties 115kV	2011/W	11.11							
CHG&E-Pleasant Valley-Knapps Corners 115kV	2011/W	17.70							
CHG&E-Saugerties-North Catskill 115kV	2012/W	12.25							
Besicorp-Reynolds Rd. 345kV	2007/S	9.00					X	X	
Spagnoli Rd.-Ruland Rd. 138kV	2008/S	1.00					X	X	
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CRPS: Comprehensive Reliability Planning Study

ATBA: Annual Transmission Baseline Assessment

ATRA: Annual Transmission Reliability Assessment

CATR: Comprehensive Area Transmission Review

UC: Under construction

I/S: In-Service

Notes

(**) If Winter ratings are not available, the NYISO will use the summer ratings by default.

8 Analysis Methodology

The Comprehensive Reliability Planning Process (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 existing NYISO publications and reports. Results from the Input Stage regarding methodology, identification of scenario drivers, and initial identification of scenarios was 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. This is to reflect that based on intermediate results in the Analysis Stage, modifications to the Input Stage were done as appropriate.

For the Baseline System, reliability simulations were performed for each year from 2006 to 2015. Load and generation projections were determined from NYISO 2005 Load & Capacity Report. The ~~R~~reliability simulation ~~used the MARS set up~~started from the latest IRM study and was updated as described in Section 11.1.4.2. NYISO Voltage and thermal emergency transfer limits analysis was performed to determined transfer limits used in the MARS transmission constraints model.

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

8.1 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 only be performed 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 long construction time, and cross multiple administrative districts with each requiring appropriate 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 baseline systems. These transfer limits were used in the General Electric Multi-Area Reliability Simulation program to identify the reliability Needs of the proposed Baseline Systems.

8.1.1 Baseline System Case Development

The power flow cases were developed to represent the Baseline System assumptions for transmission system upgrades, generation additions and/or retirements, and load levels for each year from 2006 to 2015. 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.

8.1.2 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.

8.1.3 Voltage Transfer Limit Analysis

Emergency voltage and voltage collapse analysis was performed using the PV and VCAP analysis software for the transmission interfaces identified in 8.1.2.

In order to determine transfer limits, it was necessary to vary the power flow across the interface(s) under study by adjusting generation at one or more locations on the other side of the interface. The assumed location for adjusting generation for evaluating transfer limits of the various interfaces was similar to the study assumptions for the 2005 ATR.

8.1.4 Evaluation of Analytical_Results

The results of the analysis described in 8.1.2 and 8.1.3 were evaluated to develop the transmission constraint model used in the MARS analysis.

8.1.5 Scenario Database Development

The Baseline 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.

8.2 Resource Adequacy Analysis

Introduction

This task focused on evaluating the adequacy of the NYCA transmission system as it ~~impacts~~ 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 reserve requirements will be such 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 a daily loss-off-load expectation (LOLE) of 0.1 days per year.

MARS

The primary tool used for the performance of the reliability analysis was GE's Multi-Area Reliability Simulation program (MARS). 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 Baseline System Case was developed that included the existing system in combination with 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 latest Load & Capacity Data report issued by NYISO. 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 ~~Reference~~ Base Case assuming no transmission system transfer limitations within the NYCA system. This will indicate 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 is 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 capacity were added until the LOLE criterion was satisfied.

8.3 Short Circuit Analysis

A fault duty study was performed using ASPEN to determine the impact of the 2013 maximum generation scenario on local circuit breakers. Additional analyses of other generation scenarios was not necessary to be performed as excessive short circuit currents were only analyzed for the maximum generation scenario. The NYISO methodology was used.

Three-phase, single-phase and line-line-ground short-circuit currents were determined for the same substations as in the 2002 ATRA. These bus level currents were compared to the breaker ratings. Any bus fault current that exceeded the breaker fault interrupting capability was noted, and an individual breaker assessment was performed to identify if a reliability need existed. The individual breaker analyses were performed to determine whether the fault current occurring at a specific breaker exceeded that breaker's rating.

9 System Planning Issues

9.1 Introduction

There are many issues that could impact the base 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 base case assumptions. These issues reviewed are 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.

9.2 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 hydro resources, is 19.5%.

It is expected the majority of the additional requirement will be supplied by wind generators. The NYISO interconnection queue for wind generation now totals in excess of 5,000 MW. Wind generators, which are intermittent resources and have other unique electrical characteristics which 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 immediate 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 US EPA has promulgated this rule, but it will be implemented by NYSDEC through their own rules and permitting actions, with EPA's rule as a baseline. The EPA rule requires existing power plants to demonstrate

compliance with performance standards requiring an 80-95 percent reduction in the impingement mortality of aquatic organisms and a 60-90 percent reduction in fish egg and larvae entrainment in cooling water intakes, both from uncontrolled levels. These performance standards are based on the impacts that would be achieved with closed loop cooling systems (i.e., cooling towers).

A "comprehensive demonstration study" of the existing impacts and proposed BTA, considering technical and economic viability, must be submitted as part of the water discharge permit renewal application (most will be due in the 2007-2009 timeframe). Though allowed by the EPA rule, NYSDEC has indicated that they will not consider economic viability in the determination of BTA. This policy could force most, if not all, existing power plants to install cooling towers.

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 EPA and New York State Department of Environmental Conservation (NYSDEC) began enforcement action 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. The rule limits mercury emissions from new and existing coal-fired power plants, and creates a market-based cap-and-trade program that will permanently cap utility mercury emissions in two phases: the first phase cap is 38 tons beginning in 2010, with a final cap set at 15 tons beginning in 2018. 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 – either by participating in EPA's trading program or some other mechanism (e.g., emission standards forcing all units to add emission controls). New York and other states have challenged EPA's rule in court arguing that a cap-and-trade program is unlawful in mitigating a toxic air pollutant. Accordingly, strict mercury emission requirements for coal-burning power plants could result

6. Regional Greenhouse Gas Initiative (RGGI): RGGI is a cooperative effort by 9 Northeastern and Mid-Atlantic states to reduce carbon dioxide emissions through a regional cap-and-trade program. A model rule for the program, which will require

fossil fuel-fired electric power generators greater than 25 MW to reduce carbon dioxide emissions below 1990 levels, is expected by to be issued sometime in 2005. An implementation date has not been established, but is likely to be 2008 or 2009. Staff from participating states' environmental and public service agencies are currently in the process of evaluating various cap level scenarios and the resulting energy and economic impacts.

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.

Although there are a significant number of initiatives whose ultimate disposition and impact have not yet been determined, the NYISO 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 Comprehensive Reliability Planning Process. There will be a need to monitor these issues on an ongoing basis for consideration in future cycles of the CRPP.

Generation Expansion

There is currently approximately 9500 MW of proposed new generation 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 very likely 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 NYC.

Retirement of Existing Generation

Revenue shortfalls for steam oil and gas plants, caused by the expiration of existing Power Purchase Agreements and competition from new, more efficient combined cycle plants and potential new environmental regulations, if enacted, could lead to potential retirements. The loss of generation due to retirements in transmission-constrained areas would cause more loading on the existing transmission system as it tries to meet demand requirements in those areas.

Regulatory issues could also lead to potential retirements. For example, the Indian Point nuclear plant's proximity to population centers has created pressure for the plant to be shut down. This plant is essential to New York City to meet load obligations. Upstate generation would be needed to help fill this potential void and cause more loading on the existing transmission system.

Transmission Owner Plans

Transmission owners in NY State could possibly 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.

Fuel Availability/Diversity

There is a potential for a natural gas shortage in the New York State. This could cause natural gas fired units to burn other fuels or curtail operation. If unit operation curtailment due to fuel unavailability occurs in load pockets, generation from other areas would need to help meet demand, causing heavier loading on the existing transmission system. Many of the dual fired units are the larger older steam units located in load pockets and would impact reliability needs in a multiple ways if retired. The real challenge on a going forward basis will be to maintain the benefits that fuel diversity, in particular dual fuel capability, provides today. This will be especially critical in New York City and Long Island which are entirely dependent on oil and gas fired units, many at which have interruptible gas supply contracts

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. The carbon filament lines will allow transmission lines to operate with higher temperatures thus, increasing their loading capacity, distributed generation will allow electricity generation at the location of the load and the new energy management system can reduce on-peak demand. New technologies such as these will 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 lines. ~~vice versa~~Higher than foecasted loads are likely to result in thermal and voltage criteria violations occurring at an earlier time..

Neighboring System Plans

Neighboring systems could possibly 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 would increase loading on the existing transmission system within NY.

10 Scenario Definition

Following analysis of the Base Case, test cases which combine variations in installed generation, load forecasts, transmission system transfer capabilities, and available assistance from neighboring systems will be simulated to determine their impact on the reliability of the NYCA system and hence the adequacy of the transmission system.

Scenarios for consideration in this study include:

1. Retirement of Older Coal Plants

   ~~a.~~All~~,~~ western coal units retire except Cayuga and Somerset remain
   ~~b.~~a. ~~Scenario a plus retirement of Cayuga and Somerset~~ in service

2. TO Projects

   a. M29 Transmission Project

3. Additional Resources

   a. Large remote units
   b. RPS Impacts and Demand Side Programs

4. Neighboring System Delivery Schedules

   a. PAR Schedules (ABC Lines) initially at 400/400/200. Retest at 1/3 each in power flow
   b. Tie Assistance and External ICAP – Up to the 2755 External ICAP

5. Load Forecast Uncertainty

   a. As described in impact 2.10, or using the high load forecast from the LFWG
   b. Load growth distributed as an equal percentage increase in all regions

Issues not specifically covered by the above scenarios include:

5. Wind/Renewable Additions – this issue has been covered in a separate study sponsored by NYSERDA and NYISO.
6. Infrastructure Aging – assumed to have no effect over the study period.
7. New Technologies – insufficiently defined to include as any different identifiable impact.
8. 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.
9. Demand response systems – effectively decreases load and would likely be accompanied by some form of generation reduction. Such changes could result in a minor variation on either upstate or downstate, generation reduction scenarios.

11 Reliability Needs Assessment

11.1 First Five Year Base Case Analysis

11.1.1 Baseline System Case Development

Table 11.1.1 below summarizes the power flow Area load plus losses for the first five years.

Table 11.1.1: Area Load Plus Losses (MW)

	2006	2007	2008	2009	2010
LOAD+LOSS MW					
WEST	2530	2539	2563	2581	2605
GENESEE	1754	1765	1788	1800	1814
CENTRAL	2666	2690	2715	2744	2766
NORTH	688	697	702	700	695
MOHAWK	1225	1255	1258	1274	1297
CAPITAL	2112	2153	2183	2215	2254
HUDSON	2296	2372	2428	2490	2564
MILLWOOD	684	697	718	733	754
DUNWOODI	1447	1473	1501	1542	1588
NYC	11461	11620	11758	11937	12067
LISLAND	5310	5403	5500	5578	5682
	32173	32665	33114	33594	34086

Table 11.1.2 below summarizes the Area generation dispatched for the Baseline system.

Table 11.1.2: Generation Dispatched (MW)

	2006	2007	2008	2009	2010
GEN DISP MW					
WEST	4992	4760	4685	4802	4967
GENESEE	489	600	522	634	649
CENTRAL	4838	5397	5288	5393	5354
NORTH	1121	1200	1205	1183	1208
MOHAWK	671	671	664	671	668
CAPITAL	2032	2032	2394	2255	2429
HUDSON	3079	3193	3027	2995	3019
MILLWOOD	2097	2013	2093	2120	2197
DUNWOODI	3	3	3	3	3
NYC	7672	7831	8269	8398	8448
LISLAND	3910	3502	3500	3678	3682

Appendix 5.3.1 contains the summary of significant system performance results of each of the base cases. For the 2006 and 2007 base cases, the phase angle regulators at Farragut and Goethals exceed their angle limits by less than 8 degrees while holding the power flow across the A,B,C lines at 1000 MW. If the

angle limits were invoked, then the A,B,C power flow would spillover[10] their desired power flow setting. For 2006 the spillover would be 144 MW and for 2007 it would be 100 MW.

11.1.2 Emergency Thermal Transfer Limit Analysis

Baseline emergency thermal transfer limits analysis was performed according to the methodology described in Section 8.1.2. The definition of the transmission interfaces are described in Appendix 5.1.

Table 11.1.3 illustrates the Emergency thermal transfer limits for the base case system conditions:

Table 11.1.3: Emergency Thermal Transfer Limits

	2006		2007		2008		2009		2010	
Dys East	3200	1	3200	1	3200	1	3200	1	3200	1
West Cent	1925	1	1925	1	2050	1	2050	1	2050	1
Moses South	2550	2	2550	2	2575	2	2575	2	2575	2
Vol East	4950	3	4975	3	4950	3	4950	3	4950	3
Total East	6175	4	6775	4	6625	4	6625	4	6625	4
Central East	3375	4	3400	4	3375	4	3375	4	3375	4
Cent E+Fgilb	4125	4	4150	4	4075	4	4075	4	4075	4
CE Group	6050	4	6075	4	5975	4	5975	4	5975	4
F to G	3425	6	3425	6	3425	6	3425	6	3425	6
UPNY-S Open	5325	6	5325	6	5325	6	5325	6	5325	6
UPNY-C Open	5900	7	5950	7	5700	7	5700	7	5725	7
Millwd South Closed	8675	7	8600	7	8450	7	8450	7	8450	7
Dunw-South Plan	5000	9	4925	9	4825	9	4825	9	4825	9
Dunw-South Oper	3975	9	3950	9	3775	9	3775	9	3775	9
I to J	3700	9	3650	9	3475	9	3475	9	3475	9
LI Import	1450	8	2050	8	2050	8	2050	8	2050	8

	Limiting Facility	Limiting Rating	Contingency
1	Niagara-Rochester 345	1685	L/O Kintingh-Rochester 345
2	Adirondack-Moses 230	440	L/O Massena-Marcy 765, Generation Reject Chataeuguay
3	Coopers Corners-Fraser 345	1792	Predisturbance
4	New Scotland-Leeds 345	1724	L/O New Scotland-Leeds 345
5	Coopers Corners-Fraser 345	1404	L/O Porter-Rotterdam 230, Marcy-Coopers Corners 345
6	Pleasant Valley-Leeds 345	1724	L/O Athens-Pleasant Valley 345
7	N.M. Tap-Coopers Corners 345	1793	L/O Coopers Corners-Rock Tavern 345
8	Dunwoodie-Shore Rd 345	599	Predisturbance
9	Dunwoodie-Rainey 345	715	Predisturbance

The increase in transfer capability between 2006 and 2007 for the Total East, Dunwoodie South Plan, and LI Import transmission interfaces is due to the

[10] Spillover is the inability of the phase angle regulators to control the power flow to the desired level at its rated angular capability.

addition of the Neptune PJM to LIPA HVDC interconnection. The variations in thru-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 thru time.

11.1.3 Emergency Voltage Transfer Limit Analysis

Baseline system voltage analysis was performed using PV analysis for the Dysinger East to CE Group transmission interfaces. 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 11.1.4 illustrates the initial Baseline system voltage analysis. Appendix 5.3.3 illustrates the pre-disturbance and post-contingency voltage as a function of transfers.

Table 11.1.4: Emergency Voltage Transfer Limits

	2006		2007		2008		2009		2010	
Dys East	2825	1	2825	1	2900	1	2825	1	2825	1
West Cent	1500	1	1600	1	1700	1	1600	1	1600	1
Moses South	2000	2	2050	2	2000	2	2000	2	2000	2
Vol East	3750	3	3500	3	3500	3	3750	3	3750	3
Total East	5925	4	6175	4	6100	4	6175	4	5925	4
Central East	2900	4	2850	4	2600	4	2825	4	2800	4
Cent E+Fgilb	3450	4	3400	4	3075	4	3325	4	3325	4
CE Group	4875	4	4825	4	4450	4	4750	4	4725	4
F to G	3850	5	3750	5	3525	5	3650	5	3800	5
UPNY-S Open	5200	5	5225	5	5200	5	5250	5	5250	5
UPNY-C Open	4600	7	4700	7	4600	7	4300	7	4000	7
Millwd South Closed	7375	8	7375	8	7375	7	7375	7	7375	7
Dunw-South Plan	4525	8	4475	8	4570	7	4370	7	4170	7
Dunw-South Oper	3575	8	3575	8	2850	7	2650	7	2450	7
I to J	3300	8	3300	8	2600	7	2500	7	2200	7

	Limiting Facility	Limiting Voltage (kV)	Contingency
1	Rochester 345	328	L/O Kintingh-Rochester 345
2	Porter 230	218	L/O Marcy-New Scotland 345
3	Edic 345	328	L/O 9Mile 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	SprainBrook 345	328	L/O Tower 67/68 at Ladentown
8	SprainBrook 345	328	L/O W89/W90 Tower at Pleasantville

With the retirement of the Lovett 3, 4, and 5 and Polletti units in 2008, the loss W89/W90 tower contingency resulted in non-convergent cases due to the reduction of dynamic reactive capability and generation in Southeast New York to reduce the transfers across the transmission interfaces south of Pleasant Valley.

Additional analysis was performed to quantify the extent of the reliability requirement. Initially, Static VAR Compensation (SVC) was added at Pleasant Valley, SprainBrook and Ramapo with 0 to 900 MVAR limits. The voltage of the SVC was set at 328 kV in order to meet the post contingency voltage limits at these 345 kV substations. This analysis resulting in acceptable voltage performance at the following levels:

Table 11.1.5: SVC Compensation and Associated Voltage Transfer Limits

SVC (MVARS) at Ramapo 345 kV Station	Voltage Transfer Limit (MW)				
	UPNY-SENY	UPNY-Con Ed	Millwood South	I-J	I-JK
473	5193	4200		2750	4020
335	5125	4125		2650	3925

To achieve the equivalent level of voltage performance to the 335 MVARs of SVC at Ramapo is 500 MVARs of switched shunt capacitors. However, without the dynamic reactive power regulating capability of the SVC, the system is susceptible to voltage collapse so that a 5% margin must be applied to the last solved case. The following table illustrates potential switched shunt capacitor requirements to achieve acceptable levels of voltage transfer limits:

Table 11.1.6: Switched Shunt Capacitor Additions and Associated Voltage Transfer Limits

Year	Switched Shunt Capacitors	Voltage Transfer Limit (MW)				
		UPNY-SENY	UPNY-Con ED	Millwood South	I-J	I-JK
2008	335 MVAR Cap at Ramapo	4700	3725	6325	2475	3550
2008	500 MVAR Cap at Ramapo + 135 MVAR Cap at SprainBrook	4950	4000	6600	2625	3825
2009	500 MVAR Cap at Ramapo + 135 MVAR Cap at SprainBrook	4625	4050	6650	2575	3825
2010	500 MVAR Cap at Ramap + 500 MVAR Cap at SprainBrook	4975	4075	6675	2625	3825

Voltage analysis was also performed to quantify the benefits of additional generation capacity to improve voltage transfer capability. For the 2008 system, the addition of one 250 MW unit in Area H and J, acceptable voltage response was achieved at the following transfer levels: UPNY-SENY 5050, UPNY-Con Ed 4275, Dunwoodie South P 4075, I to J 2825.

The results of the transfer limit analysis indicated a large sensitivity to dispatch conditions, MVAR load demand on the Bulk Power System, unit availability and base case power flows. The following table demonstrates some of the sensitivities of the voltage constrained transfer limits. The limits were observed to decrease over ~~the five years of~~ the first ~~Five~~ five ~~Years~~ years of the planning period. Since these limits became low near the end of the planning period, it was decided that for the resource adequacy analysis, a conservative transfer limit reflecting some level of MVAR compensation would be used. These limits are summarized in the Resource Adequacy section of this report.

Sum06	SENY	UPNYCONED	DS	Facility	Contingency
Shift Ontario/Oswego -> NYC & LI					
Scenario 1 - Ramapo @ 240 MW					
	4632	3929	3838	Sprainbrook	Pre-fault
XL	4651	3981	3886		TWR 34/42
NL/EL	4805	4099	4003	Dunwoodie	L/O Rav#3
Scenario 2 - Ramapo @ 1000 MW					
XL	4931	4139	4052		TWR 34/42
	4963[e]	4140[e]	4050[e]	Sprainbrook	Pre-fault
NL/EL	5124	4296	4203	Dunwoodie	L/O Rav#3
Scenario 3 - Ramapo @ 1000 MW, Lovett off					
XL	4524	3520	3444		TWR 67/68
NL	4841[e]	3781[e]	3701[e]	Ramapo 345	TWR 67/68
	5009	3941	3857	Dunwoodie	Pre-fault
EL	5131	4060	3973	Sprainbrook	L/O Rav#3
Scenario 4 - Ramapo @ 1000 MW, Lovett off, O&R mitigation added					
	4994	3928	3842	Sprainbrook	Pre-fault
XL	5159	4133	4042		TWR 67/68
NL/EL	5265	4185	4091	Dunwoodie	L/O Rav#3
Scenario 5 - Ramapo @ 1000 MW, Lovett off, approx 600 MVAR reactive compensation in SENY					
XL	5481	4446	4351		TWR 67/68
NL	5757	4669	4569	Pleasant Valley	TWR 34/42
EL	5761	4672	4572	Dunwoodie	L/O Rav#3
Scenario 6 - Ramapo @ 1000 MW, Bowline #2 off					
XL	4988	3740	3660		TWR 34/42
	5121	3823	3737	Sprainbrook	Pre-fault
NL/EL	5171	3870	3784	Sprainbrook	L/O Rav#3
Scenario 7 - Ramapo @ 1000 MW, Indian Point #2 off					
XL	4776	4257	3261		TWR 67/68
	4856	4280	3237	Sprainbrook	Pre-fault
NL/EL	5032	4487	3439	Sprainbrook	L/O Rav#3
Shift Zone G -> NYC, Y49/Y50 @ 1240 MW					
Scenario 1 - UPNY-SENY @ 4800 MW, PV-Long Mtn. @ 100 MW					
		4356	4259	Sprainbrook	Pre-fault
XL		4829*	4723*		TWR 34/42
NL/EL		4902	4797	Sprainbrook	L/O Rav#3
Scenario 2 - UPNY-SENY @ 5300 MW, PV-Long Mtn. @ 70 MW					
		4258	4161	Sprainbrook	Pre-fault
NL/EL		4603	4500	Dunwoodie	L/O Rav#3
XL		4684	4580		TWR 34/42
Scenario 3 - UPNY-SENY @ 5300 MW, PV-Long Mtn. @ 300 MW, Gilboa #2 & #4 on					
		4269	4173	Sprainbrook	Pre-fault
NL/EL		4548	4448	Dunwoodie	L/O Rav#3
XL		4553	4454		TWR 67/68
Scenario 4 - UPNY-SENY @ 5300 MW, PV-Long Mtn. @ 70 MW, Y49/Y50 @ 630 MW					
		4333	4232	Sprainbrook	Pre-fault
XL		4400	4298		L/O Rav#3
NL/EL		4442	4338	Dunwoodie	L/O Rav#3

Sum10

Shift Ontario/Oswego -> NYC & LI					
Scenario 1 - Ramapo @ 440 MW					
XL	4470	3362	3171		TWR 67/68
NL	4940	3768	3564	Pleasant Valley	TWR 34/42
	5123	3941	3734	Dunwoodie	Pre-fault
EL	5180	3999	3788	Dunwoodie	L/O Rav#3
Shift Zone G -> NYC, Y49/Y50 @ 1000 MW					
Scenario 1 - Ramapo @ 1000 MW					
XL		3455	3265		TWR 67/68
NL		3592	3392	Ramapo 345	TWR 67/68
		4063	3854	Dunwoodie	Pre-fault
EL		4297	4083	Dunwoodie	L/O Rav#3

Note: Ignore Ramapo 500

NL – Normal Criteria Voltage Limit
EL – Emergency Criteria Voltage Limit
XL – 95% Voltage Collapse Criteria Limit
* – 95% of highest transfer tested. Actual voltage collapse limit is likely to be highe
e – Extrapolated limit

Sum10	UPNY-SENY open	UPNY-SENY close	UPNY-CONED open	UPNY-CONED close	Sprain Brook DS open	Sprain Brook DS close	Facility	Contingency
Scenario 2 - Ramapo @ 1000 MW into NY, Y49/Y50 @ 1200 MW, Lovetts & Poletti Retired, and Lovetts Line & Cap upgrade								
NL/EL	2950^{e}	3579^{e}	1902^{e}	3957^{e}			Ramapo 500	L/O IND PT#2
XL	**5059**	**5612**	**3938**	**5922**	**3737**	**5721**		TWR 34/42
NL	5209	5780	4033	6121	3824	5912	Ramapo 345	TWR 67/68
PL	5364	5940	4148	6265	3967	6053	Dunw 345	Pre-fault
NL	5437	6004	4247	6326	4033	6112	Millwood 345	TWR 67/68
EL	5700	6271	4505	6585	4286	6365	Dunw 345	L/O Rav#3
Scenario 3 = Scenario 2 plus M29								
NL	2128^{e}	2686^{e}	995^{e}	3082^{e}			Ramapo 500	TWR 67/68
EL	3683^{e}	4257^{e}	2535^{e}	4622^{e}			Ramapo 500	L/O Rav#3
XL	**5260**	**5813**	**4133**	**6117**	**3931**	**5914**		TWR 34/42
NL	5449	6039	4270	6362	4058	6150	Ramapo 345	TWR 67/68
NL	5618	6174	4428	6511			Rock Tavern	TWR 67/68
NL					4222^{e}	6306^{e}	PV	TWR 34/42
PL	5880^{e}	6465^{e}	4682^{e}	6773^{e}			Ramapo 500	Pre-fault
PL	5886^{e}	6471^{e}	4688^{e}	6779^{e}	4467^{e}	6558^{e}	Dunw 345	Pre-fault
EL	5997^{e}	6589^{e}	4796^{e}	6893^{e}	4572^{e}	6668^{e}	Dunw 345	L/O Rav#3
Scenario 4 = Scenario 3 plus Lovetts I/S minus Lovetts Line & Cap upgrade								
NL	2708^{e}	3326^{e}		2035^{e}			Ramapo 500	TWR 67/68
EL	3860^{e}	4453^{e}	2433^{e}	4510^{e}			Ramapo 500	L/O Rav#3
XL	**5335**	**5888**	**4606**	**6591**	**4397**	**6381**		TWR 34/42
PL	5548	6131	4784	6873	4566	6654	Dunw 345	Pre-fault
NL	5578	6160	4812	6901	4594	6682	PV	TWR 34/42
EL	5706	6288	4937	7024	4717	6804	Dunw	L/O Rav#3
Scenario 5 = Scenario 4 plus Poletti I/S								
NL	4448	5028	3734	5820			Ramapo 500	TWR 34/42
XL	**5510**	**6074**	**4792**	**6788**	**4579**	**6575**		TWR 67/68 or 34/42
PL	5548	6116	4796	6876	4577	6658	Dunw 345	Pre-fault
NL	5606	6179	4853	6937	4632	6718	PV	TWR 34/42
EL	5835	6449	5080	7200	4857	6976	Dunw 345	L/O Rav#3
Scenario 6 = Scenario 3 plus Poletti I/S								
NL	2056^{e}	2686^{e}	947^{e}	3082^{e}			Ramapo 500	TWR 67/68
XL	**5432**	**5973**	**4295**	**6270**	**4091**	**6067**		TWR 67/68 or 34/42
NL	5592	6170	4404	6488	4192	6275	Ramapo 345	TWR 67/68
NL	5740^{e}	6309^{e}	4543^{e}	6621^{e}			Rock Tavern	TWR 67/68
NL					4342^{e}	6421^{e}	PV	TWR 34/42
PL	5855	6432	4657	6740	4439	6522	Dunw 345	Pre-fault
EL	5989	6594	4786	6896	4566	6676	Millwood 345	L/O Rav#3
Scenario 7 - Ramapo @ 1000 MW into PJM, Y49/Y50 @ 1200 MW, Lovetts Retired, M29, & Poletti I/S								
NL	4178^{e}	4948^{e}	3185^{e}	5240^{e}			Ramapo 500	TWR 67/68
XL	**4133**	**4985**	**3263**	**5254**	**3068**	**5059**		TWR 67/68
NL							Ramapo 345	TWR 67/68
PL	4274^{e}	5085^{e}	3299^{e}	5373^{e}			Rock Tavern	Pre-fault
NL	4257^{e}	5115^{e}	3324^{e}	5402	3118^{e}	5197^{e}	PV	TWR 34/42
PL					3448	5600	PV	Pre-fault
EL	4543	5548	3668	5823			Ramapo 500	L/O Rav#3
EL	4653	5761	3802	6028			Coopers Corners 345	L/O Rav#4
EL					3602	5842	PV	L/O Rav#3

Note:

NL	–	Normal Criteria Voltage Limit
EL	–	Emergency Criteria Voltage Limit
XL	–	95% Voltage Collapse Criteria Limit
PL	–	Pre-fault Contingency Limit
e	–	Extrapolated limit

11.1.4 Resource Adequacy Assessment

11.1.4.1 Free Flow Transmission Model

Table 11.1.7 illustrates the NYCA LOLE and Capacity Reserve Margins for an unconstrained freeflowing transmission model. Initially, in 2006 the Baseline System NYCA Capacity Reserve Margin initially is well above the 18% IRM and the Locational Requirements of 80% percent In City and the 95% for Long Island in 2006. 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 ~~115~~114% and increase the NYCA LOLE to .012.

Table 11.1.7: LOLE for Unconstrained Transmission Model

AREA OR POOL	2006	2007	2008	2009	2010
AREA-A	0.000	0.000	0.000	0.000	0.000
AREA-B	0.000	0.000	0.000	0.000	0.008
AREA-C	0.000	0.000	0.000	0.000	0.000
AREA-D	0.000	0.000	0.000	0.000	0.000
AREA-E	0.000	0.000	0.000	0.000	0.001
AREA-F	0.000	0.000	0.000	0.000	0.000
AREA-G	0.000	0.000	0.000	0.000	0.001
AREA-H	0.000	0.000	0.000	0.000	0.000
AREA-I	0.000	0.000	0.000	0.001	0.011
AREA-J	0.000	0.000	0.000	0.001	0.009
AREA-K	0.000	0.000	0.000	0.000	0.007
NYCA	0.000	0.000	0.000	0.001	0.012
NYCA Capacity @ peak	38,745	38,387	37,039	37,039	37,039
NYCA Peak Load	32,401	32,840	33,330	33,770	34,200

11.1.4.2 Transmission Constraint Model

Table 11.1.8 illustrates the NYCA LOLE and Capacity Reserve Margins for the 2005 IRM transmission constraint model with the Baseline load forecast and generation additions and retirements from 2006 to 2010:

Table 11.1.8: MARS Version 2.59 and 2005 IRM Transmission Constraint Model

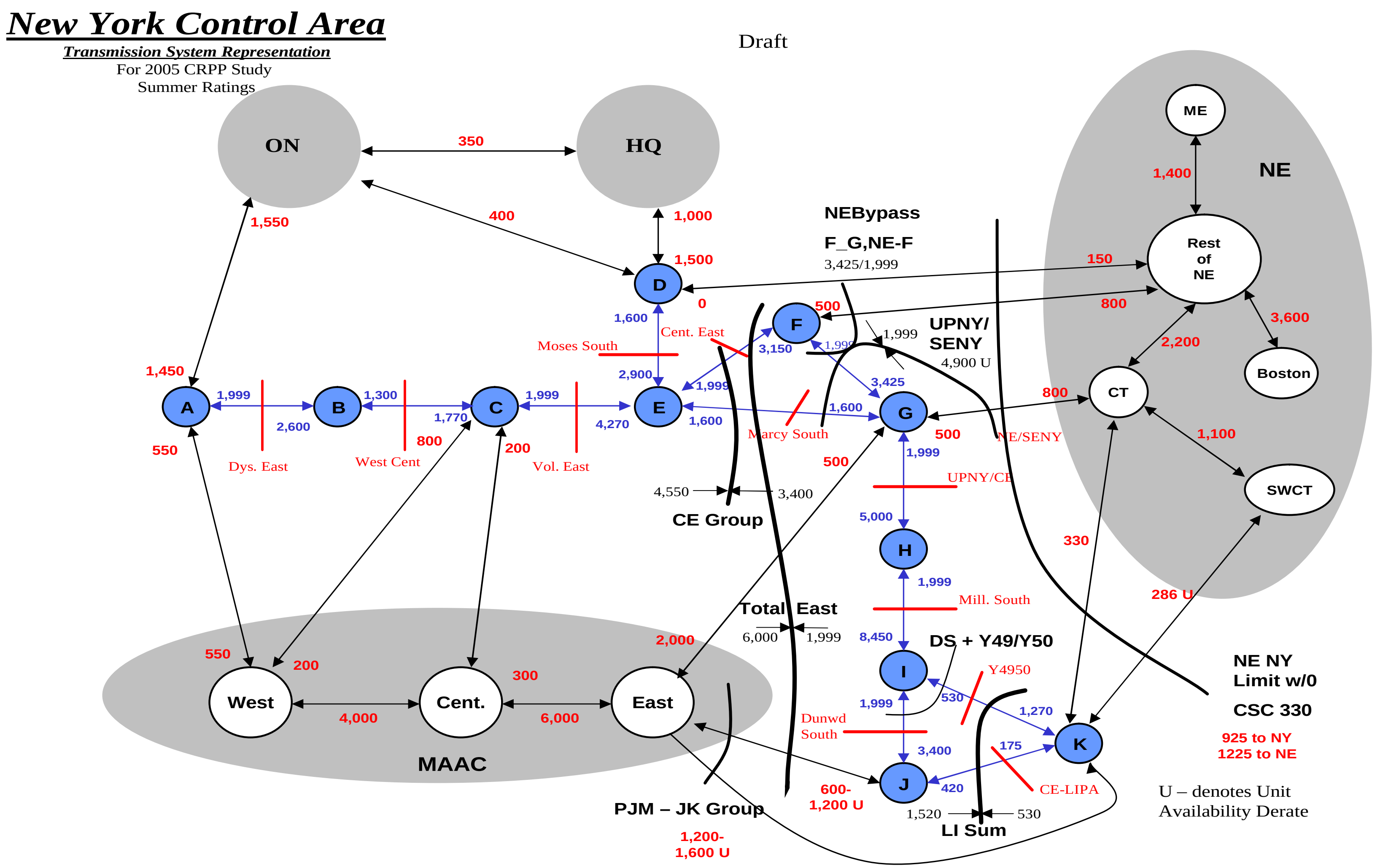
AREA OR POOL	2006	2007	2008	2009	2010
AREA-A	0.000	0.000	0.000	0.000	0.000
AREA-B	0.000	0.000	0.006	0.012	0.027
AREA-C	0.000	0.000	0.000	0.000	0.000
AREA-D	0.000	0.000	0.000	0.000	0.000
AREA-E	0.000	0.000	0.002	0.003	0.007
AREA-F	0.000	0.000	0.000	0.000	0.001
AREA-G	0.000	0.000	0.000	0.001	0.003
AREA-H	0.000	0.000	0.000	0.000	0.000
AREA-I	0.000	0.000	0.006	0.014	0.003
AREA-J	0.003	0.002	0.022	0.063	0.112
AREA-K	0.027	0.001	0.005	0.012	0.026
NYCA	0.029	0.002	0.023	0.066	0.116
NYCA Capacity @ peak	38,745	38,387	37,039	37,039	37,039
NYCA Peak Load	32,401	32,840	33,330	33,770	34,200

Since the development of the 2005 IRM transmission constraint model, NYISO staff and General Electric has been reviewing the results of the model and have ~~discovered~~ modified the software and data to address the following modeling issues:

- Correction for accounting of EOP
- New England modeling with 5 zones instead of one
- PJM modeling with 3 zones instead of one
- Correction for load shape data for Area H
- Correction for the increase in NYCA LOLE as HQ imports were increased
- Correction for the excess loop flow from NY to NE to SENY which bypassed UPNY-SENY transmission constraints to more accurately model actual power flows in the system.

~~The resolution of these issues have resulted in modifications to the MARS software and data used to transmission constraint model.~~ A diagram of the new transmission model is illustrated on the next page.

Table 11.1.9: Alternate NE Transmission Constraint Model



11.1.4.3 CRPP Transmission Constraint Model With Thermal Limits Only

Table 11.1.10 below illustrates the thru-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 base case which assumed that voltage constraints were eliminated.

Table 11.1.10 Thru-Time Thermal Transfer For CRPP Transmission Constraint Model

INTERFACE-TRANSFER-LIMITS

EFFECTIVE DATE	INTERFACE OR INTF. GROUP NAME	POSITIVE DIRECTION TIE LIMIT (MW)	NEGATIVE DIRECTION TIE LIMIT (MW)	ZERO TIE LIMITS BEFORE NON-FIRM ASSISTANCE ?
		.TIEMW.	.TIEMW.	.LIMZER.
MMMYYYY	AAAAAAAA	#	#	Y/N
01JAN2006**	'DYSINGER'	3200	1999	N
01JAN2006**	'W.CENTRL'	1925	1300	N
01JAN2007**	'W.CENTRL'	2000	1300	N
01JAN2006**	'VOLNEY-E'	4975	1999	N
01JAN2006**	'MOSES SO'	2550	1600	N
01JAN2008**	'MOSES SO'	2575	1600	N
01JAN2006**	'CEN EAST'	3375	1999	N
01JAN2007**	'CEN EAST'	3400	1999	N
01JAN2008**	'CEN EAST'	3375	1999	N
01JAN2006**	'MARCY-SO'	1600	1600	N
01JAN2006**	'F TO G '	3425	1999	N
01JAN2006**	'UP-CONED'	5775	1999	N
01JAN2007**	'UP-CONED'	5950	1999	N
01JAN2008**	'UP-CONED'	5700	1999	N
01JAN2006**	'MILLWOOD'	8700	1999	N
01JAN2007**	'MILLWOOD'	8600	1999	N
01JAN2008**	'MILLWOOD'	8450	1999	N
01JAN2006**	'DUNWOOD.'	3700	1999	N
01JAN2007**	'DUNWOOD.'	3650	1999	N
01JAN2008**	'DUNWOOD.'	3500	1999	N
01JAN2006**	'CN-LILCO'	175	420	N
01JAN2006**	'Y49Y50 '	1270	530	N
01JAN2006**	'F - NE '	800	500	N
01JAN2006**	'G - NE '	800	500	N
01JAN2006**	'D - NE '	150	0	N
01JAN2006**	'K - NE '	286	286	N
01JAN2006**	'K-NECSC '	330	330	N
01JAN2006**	'ME-ROP '	1400	1400	N
01JAN2006**	'ROP-BSTN'	3600	3600	N
01JAN2006**	'ROP-ROCT'	2200	2200	N
01JAN2006**	'ROCTSWCT'	2000	1650	N
01JAN2006**	'A - PJMW'	550	550	N
01JAN2006**	'C - PJMW'	200	800	N
01JAN2006**	'C - PJMC'	300	200	N
01JAN2006**	'G - PJME'	2000	500	N
01JAN2006**	'J - PJME'	0	1200	N
01JAN2006**	'K - PJME'	0	0	N
01JAN2007**	'K - PJME'	660	660	N
01JAN2006**	'D - HQ '	1000	800	N
01APR2006**	'D - HQ '	1000	1200	N
01NOV2006**	'D - HQ '	1000	800	N
01JAN2006**	'A - OH '	1550	1450	N

```
01JAN2006**            'D - OH  '     400           400            N
01JAN2006**            'OH - HQ '     350           350            N
01JAN2006**            "C_TO_E"      6000          6000            N
01JAN2006**            "W_TO_C"      4000          4000            N
                            *****GROUPS
01JAN2006**            'TOTAL-ES'    6125          1999            N
01JAN2007**            'TOTAL-ES'    6700          1999            N
01JAN2008**            'TOTAL-ES'    6625          1999            N
01JAN2006**            'TOTAL-ES'    6625          1999            N
01JAN2006**            'UPNYSENY'    4900          1999            N
01JAN2006**            'CE GRP  '    6050          3400            N
01JAN2007**            'CE GRP  '    6075          3400            N
01JAN2008**            'CE GRP  '    5975          3400            N
01JAN2006**            'NY-IMPTS'   99999         99999            N
01JAN2006**            'NESENY  '       0             0            N
01JAN2006**            'LI SUM  '    1450           530            N
01JAN2006**            'I TO JK '    5000          2229            N
01JAN2007**            'I TO JK '    4925          2229            N
01JAN2008**            'I TO JK '    4825          2229            N
01JAN2006**            "PJM_JK  "    1600          2600            N
01JAN2006**            "NY TO NE"     1225           925            N

                  ;;;; END OF &INF-TRLM-00 ;;;;
```

Table 11.1.11 below illustrates the LOLE results utilizing the thru-time thermal transfer limits for the CRPP Transmission Constraint Model.

Table 11.1.11: LOLE Results Utilizing MARS Version 2.69 and 2005 CRPP Emergency Thermal Constraint Model

AREA OR POOL	2006	2007	2008	2009	2010
AREA-A	0.000	0.000	0.000	0.000	0.000
AREA-B	0.000	0.000	0.000	0.000	0.000
AREA-C	0.000	0.000	0.000	0.000	0.000
AREA-D	0.000	0.000	0.000	0.000	0.000
AREA-E	0.000	0.000	0.000	0.000	0.000
AREA-F	0.000	0.000	0.000	0.000	0.000
AREA-G	0.000	0.000	0.000	0.001	0.017
AREA-H	0.000	0.000	0.001	0.001	0.007
AREA-I	0.000	0.001	0.038	0.088	0.505
AREA-J	0.000	0.001	0.055	0.124	0.583
AREA-K	0.021	0.002	0.029	0.070	0.309
NYCA	0.021	0.003	0.073	0.160	0.752
NYCA Capacity @ peak	38,745	38,387	37,039	37,039	37,039
NYCA Peak Load	32,401	32,840	33,330	33,770	34,200

The first year of reliability need would be in 2009 and could be satisfied by adding 250 compensatory MW ~~or one 250 MW~~ unit in Area J. For the 2010 load forecast, the system would need a total of 1250 compensatory MW ~~or~~ modeled as five 250 MW units (1 unit in Area I, 3 units in Area J, and 1 unit in Area K).

11.1.4.4 CRPP Transmission Constraint Model With Thermal and Voltage Limits Invoked

Table 11.1.12 below illustrates the thru-time transfer limits utilizing both thermal and voltage transfer limits:

Table 11.1.12: Thru-Time Thermal And Voltage Transfer Limits For CRPP Transmission Constraint Model

```
&INF-TRLM-00     ITL
 *                           INTERFACE-TRANSFER-LIMITS
 *--------------------------------------------------------------------------------
--
 *                     INTERFACE     POSITIVE      NEGATIVE
 *                        OR         DIRECTION     DIRECTION      ZERO TIE LIMITS
 *   EFFECTIVE        INTF. GROUP    TIE LIMIT     TIE LIMIT      BEFORE NON-FIRM
 *     DATE              NAME          (MW)          (MW)          ASSISTANCE ?
 *--------------------------------------------------------------------------------
--
 *                                   .TIEMW.       .TIEMW.           .LIMZER.
 *--------------------------------------------------------------------------------
--
 *    MMMYYYY          AAAAAAAA         #             #               Y/N
 *    -------          --------      -------       -------            ---
    01JAN2006**         'DYSINGER'     2825          1999             N
    01JAN2007**         'DYSINGER'     2825          1999             N
    01JAN2008**         'DYSINGER'     2900          1999             N
    01JAN2009**         'DYSINGER'     2825          1999             N
    01JAN2010**         'DYSINGER'     2825          1999             N
    01JAN2006**         'W.CENTRL'     1500          1300             N
    01JAN2007**         'W.CENTRL'     1600          1300             N
    01JAN2008**         'W.CENTRL'     1675          1300             N
    01JAN2009**         'W.CENTRL'     1600          1300             N
    01JAN2010**         'W.CENTRL'     1600          1300             N
    01JAN2006**         'VOLNEY-E'     3750          1999             N
    01JAN2007**         'VOLNEY-E'     3500          1999             N
    01JAN2008**         'VOLNEY-E'     3500          1999             N
    01JAN2009**         'VOLNEY-E'     3750          1999             N
    01JAN2010**         'VOLNEY-E'     3750          1999             N
    01JAN2006**         'MOSES SO'     2000          1600             N
    01JAN2007**         'MOSES SO'     2050          1600             N
    01JAN2008**         'MOSES SO'     2000          1600             N
    01JAN2009**         'MOSES SO'     2000          1600             N
    01JAN2010**         'MOSES SO'     2000          1600             N
    01JAN2006**         'CEN EAST'     2900          1999             N
    01JAN2007**         'CEN EAST'     2850          1999             N
    01JAN2008**         'CEN EAST'     2800          1999             N
    01JAN2009**         'CEN EAST'     2825          1999             N
    01JAN2010**         'CEN EAST'     2800          1999             N
    01JAN2006**         'MARCY-SO'     1600          1600             N
    01JAN2006**         'F TO G  '     3425          1999             N
    01JAN2006**         'UP-CONED'     4700          1999             N
    01JAN2007**         'UP-CONED'     4600          1999             N
    01JAN2008**         'UP-CONED'     4600          1999             N
    01JAN2009**         'UP-CONED'     4350          1999             N
    01JAN2010**         'UP-CONED'     4000          1999             N
    01JAN2006**         'MILLWOOD'     7375          1999             N
    01JAN2006**         'DUNWOOD.'     3300          1999             N
    01JAN2007**         'DUNWOOD.'     3300          1999             N
    01JAN2008**         'DUNWOOD.'     2600          1999             N
    01JAN2009**         'DUNWOOD.'     2500          1999             N
    01JAN2010**         'DUNWOOD.'     2200          1999             N
    01JAN2006**         'CN-LILCO'      175           420             N
    01JAN2006*          'Y49Y50  '     1270           530             N
    01JAN2006**         'F - NE  '      800           500             N
    01JAN2006**         'G - NE  '      800           500             N
```

```
    01JAN2006**          'D - NE  '      150            0              N
    01JAN2006**          'K - NE  '      286          286              N
    01JAN2006**          'K-NECSC '      330          330              N
    01JAN2006**          'ME-ROP  '     1400         1400              N
    01JAN2006**          'ROP-BSTN'     3600         3600              N
    01JAN2006**          'ROP-ROCT'     2200         2200              N
    01JAN2006**          'ROCTSWCT'     2000         1650              N
    01JAN2006**          'A - PJMW'      550          550              N
    01JAN2006**          'C - PJMW'      200          800              N
    01JAN2006**          'C - PJMC'      300          200              N
    01JAN2006**          'G - PJME'     2000          500              N
    01JAN2006**          'J - PJME'        0         1200              N
    01JAN2006**          'K - PJME'        0            0              N
    01JAN2007**          'K - PJME'      660          660              N
    01JAN2006**          'D - HQ  '     1000          800              N
    01APR2006**          'D - HQ  '     1000         1200              N
    01NOV2006**          'D - HQ  '     1000          800              N
    01JAN2006**          'A - OH  '     1550         1450              N
    01JAN2006**          'D - OH  '      400          400              N
    01JAN2006**          'OH - HQ '      350          350              N
    01JAN2006**          "C_TO_E"       6000         6000              N
    01JAN2006**          "W_TO_C"       4000         4000              N
*****GROUPS
    01JAN2006**           'TOTAL-ES'    6000         1999             N
    01JAN2006**           'UPNYSENY'    4550         1999             N
    01JAN2010**           'UPNYSENY'    4500         1999             N
    01JAN2006**           'CE GRP  '    4875         3400             N
    01JAN2007**           'CE GRP  '    4825         3400             N
    01JAN2008**           'CE GRP  '    4450         3400             N
    01JAN2009**           'CE GRP  '    4750         3400             N
    01JAN2010**           'CE GRP  '    4725         3400             N
    01JAN2006**           'NY-IMPTS'   99999        99999             N
    01JAN2006**           'NESENY  '    3425         1999             N
    01JAN2006**           'LI SUM  '    1520          530              N
    01JAN2006**           'I TO JK '    4570         2229             N
    01JAN2006**           "PJM_JK  "    1600         2600             N
    01JAN2006**           "NY TO NE"    1225          925              N

;;;; END OF &INF-TRLM-00 ;;;;
```

Table 11.1.13 below illustrates the LOLE results utilizing the thru-time thermal and voltage transfer limits for the CRPP Transmission Constraint Model.

Table 11.1.13: LOLE Results Utilizing MARS Version 2.69 and 2005 CRPP Emergency Thermal and Voltage Constraint Model

AREA OR POOL	2006	2007	2008	2009	2010
AREA-A thru AREA-F	0.000	0.000	0.000	0.000	0.000
AREA-G	0.000	0.000	0.000	0.000	0.003
AREA-H	0.000	0.000	0.001	0.007	0.010
AREA-I	0.001	0.001	0.029	0.079	0.148
AREA-J	0.001	0.002	0.383	0.764	2.400
AREA-K	0.021	0.001	0.031	0.071	0.179
NYCA	0.022	0.004	0.395	0.786	2.429

The first year of reliability need would be in 2008 and could be satisfied by adding two 250 MW units in Area J. For the 2009 load forecast, the system could be satisfied by adding a total of 1000 MW or four 250 MW units in Area J. For the 2010 load forecast, the system could be satisfied by adding a total of 1750 MW (one unit in Area I, five units in Area J, and 1 units in Area K). The exact location of the MW additions, whether in Zones G through K or a combination, impacts the level of compensatory MWs required. The location of the new also affects the reactive compensation in the Areas and the overall voltage performance of the system.

11.1.5 Short Circuit Assessment

As noted previously a separate short circuit assessment was done for this 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 2005 ATRA fault current assessment. The base case included projects according to the CRPP project list. The 2010 Fault Levels were compared against the Class Year 2002 fault levels and this indicated no significant differences.

11.2 Second Five Year Base Case Analysis

11.2.1 Baseline System Case Development

Table 11.2.1 below summarizes the power flow Area load plus losses for the first five years.

Table 11.2.1: Area Load Plus Losses (MW)

	2011	2012	2013	2014	2015
LOAD+LOSS MW					
WEST	2599	2596	2564	2519	2510
GENESEE	1803	1802	1780	1748	1742
CENTRAL	2827	2826	2792	2741	2732
NORTH	704	703	695	682	680
MOHAWK	1285	1286	1273	1257	1253
CAPITAL	2275	2309	2344	2380	2417
HUDSON	2616	2684	2757	2849	2921
MILLWOOD	774	795	818	842	866
DUNWOODI	1625	1667	1715	1756	1797
NYC	12180	12286	12429	12564	12659
LISLAND	5778	5883	5991	6091	6119
	34466	34837	35158	35429	35696

Table 11.2.2 below summarizes the Area generation dispatched for the Baseline system.

Table 11.2.2: Generation Dispatched (MW)

	2011	2012	2013	2014	2015
GEN DISP MW					
WEST	4861	4861	4826	4781	4772
GENESEE	639	639	615	583	577
CENTRAL	5513	5517	5479	5429	5419
NORTH	1217	1217	1208	1195	1193
MOHAWK	654	658	643	624	622
CAPITAL	2250	2284	2318	2701	2741
HUDSON	3070	3138	3210	3052	3126
MILLWOOD	2217	2239	2260	2283	2308
DUNWOODI	3	3	3	3	3
NYC	8562	8667	8811	8846	8940
LISLAND	3978	4083	4191	4293	4319

Due to the capacity limitations in Southeast New York, these power flow case experienced power flow solution problems with the initial reactive power load forecasts. To achieve a power flow solution the reactive power load in Southeast New York was reduced by the following amounts:

2011	96 MVARs
2012	94 MVARs
2013	87 MVARs
2014	246 MVARs
2015	644 MVARs

Appendix 1B contains the summary of significant system performance results of each of the base cases. These summaries indicate that there are significant predisturbance low voltage violations which would require additional reactive compensation in order to meet NYSRC reliability criteria.

11.2.2 Emergency Thermal Transfer Limit Analysis

Baseline emergency thermal transfer limits analysis was performed according to the methodology described in Section 8.1.2. The definition of the transmission interfaces are described in Appendix 2.

Table 11.2.3 illustrates the Emergency thermal transfer limits for the base case system conditions:

Table 11.2.3 Emergency Thermal Transfer Limits

	2011		2012		2013		2014		2015	
Dys East	3200	1	3200	1	3200	1	3200	1	3200	1
West Cent	2025	1	2025	1	2025	1	2025	1	2025	1
Moses South	2550	2	2550	2	2550	2	2550	2	2575	2
Vol East	4850	3	4850	3	4825	3	4755	3	4750	3
Total East	6600	4	6550	4	6650	3	6600	4	6750	3
Central East	3350	4	3350	4	3425	4	3450	4	3450	4
Cent E+Fgilb	3975	4	4000	4	4025	3	3950	4	3975	3
CE Group	5900	4	5900	4	6050	4	6050	4	6100	4
F to G	3425	6	3425	6	3450	6	3450	6	3475	6
UPNY-S Open	5375	6	5350	6	5275	6	5250	6	5250	6
UPNY-C Open	5500	7	5500	7	5550	7	5600	7	5650	7
Millwd South Closed	8300	7	8325	7	8375	7	8450	7	8450	7
Dunw-South Plan	4600	9	4650	9	4725	9	4475	9	4725	9
Dunw-South Oper	3775	9	3775	9	3775	9	3775	9	3775	9
I to J	3475	9	3500	9	3475	9	3475	9	3475	9
LI Import	2100	8	2050	8	2100	8	2100	8	2100	8

	Limiting Facility	Limiting Rating	Contingency
1	Niagara-Rochester 345	1685	L/O Kintingh-Rochester 345
2	Adirondack-Moses 230	440	L/O Massena-Marcy 765, Generation Reject Chataeuguay
3	Coopers Corners-Fraser 345	1792	Predisturbance
4	New Scotland-Leeds 345	1724	L/O New Scotland-Leeds 345
5	Coopers Corners-Fraser 345	1404	L/O Porter-Rotterdam 230, Marcy-Coopers Corners 345
6	Pleasant Valley-Leeds 345	1724	L/O Athens-Pleasant Valley 345
7	N.M. Tap-Coopers Corners 345	1793	L/O Coopers Corners-Rock Tavern 345
8	Dunwoodie-Shore Rd 345	599	Predisturbance
9	Dunwoodie-Rainey 345	715	Predisturbance

11.2.3 Resource Adequacy Assessment

11.2.3.1 Freeflow Transmission Model

Table 11.2.4 illustrates the NYCA LOLE and Capacity for an unconstrained free-flowing transmission model for the second five years of the planning horizon. The table shows that under a theoretical unconstrained or free flowing system an LOLE violation does not occur until 2014.

Table 11.2.4:LOLE Results with FREEFLOW Transmission Constraints

AREA OR POOL	2011	2012	2013	2014	2015
AREA-A	0.000	0.000	0.000	0.000	0.000
AREA-B	0.024	0.036	0.047	0.105	0.130
AREA-C	0.000	0.000	0.000	0.000	0.000
AREA-D	0.000	0.000	0.000	0.000	0.000
AREA-E	0.004	0.005	0.006	0.011	0.018
AREA-F	0.001	0.002	0.002	0.003	0.005
AREA-G	0.002	0.003	0.008	0.018	0.033
AREA-H	0.000	0.000	0.001	0.002	0.001
AREA-I	0.027	0.041	0.058	0.122	0.164
AREA-J	0.022	0.036	0.051	0.108	0.152
AREA-K	0.015	0.030	0.048	0.102	0.138
NYCA	0.029	0.046	0.067	0.141	0.185
NYCA Capacity @ peak	37,039	37,039	37,039	37,039	37,039
NYCA Peak Load	34,581	34,901	35,180	35,419	35,671

11.2.3.2 CRPP Transmission Constraint Model With Thermal Limits Only

Table 11.2.5 below illustrates the thru-time thermal transfer limits used for the CRPP Transmission Constraint Model.

Table 11.2.5: Thru-Time Thermal Transfer For CRPP Transmission Constraint Model

* INTERFACE-TRANSFER-LIMITS

* EFFECTIVE DATE	INTERFACE OR INTF. GROUP NAME	POSITIVE DIRECTION TIE LIMIT (MW)	NEGATIVE DIRECTION TIE LIMIT (MW)	ZERO TIE LIMITS BEFORE NON-FIRM ASSISTANCE ?
*		.TIEMW.	.TIEMW.	.LIMZER.
* MMMYYYY	AAAAAAAA	#	#	Y/N
01JAN2006**	'DYSINGER'	3200	1999	N
01JAN2006**	'W.CENTRL'	1925	1300	N
01JAN2007**	'W.CENTRL'	2000	1300	N
01JAN2006**	'VOLNEY-E'	4975	1999	N
01JAN2006**	'MOSES SO'	2550	1600	N
01JAN2008**	'MOSES SO'	2575	1600	N
01JAN2006**	'CEN EAST'	3375	1999	N
01JAN2007**	'CEN EAST'	3400	1999	N
01JAN2008**	'CEN EAST'	3375	1999	N
01JAN2006**	'MARCY-SO'	1600	1600	N
01JAN2006**	'F TO G '	3425	1999	N
01JAN2006**	'UP-CONED'	5775	1999	N
01JAN2007**	'UP-CONED'	5950	1999	N
01JAN2008**	'UP-CONED'	5700	1999	N
01JAN2006**	'MILLWOOD'	8700	1999	N
01JAN2007**	'MILLWOOD'	8600	1999	N
01JAN2008**	'MILLWOOD'	8450	1999	N
01JAN2006**	'DUNWOOD.'	3700	1999	N
01JAN2007**	'DUNWOOD.'	3650	1999	N
01JAN2008**	'DUNWOOD.'	3500	1999	N
01JAN2006**	'CN-LILCO'	175	420	N
01JAN2006**	'Y49Y50 '	1270	530	N
01JAN2006**	'F - NE '	800	500	N
01JAN2006**	'G - NE '	800	500	N
01JAN2006**	'D - NE '	150	0	N
01JAN2006**	'K - NE '	286	286	N
01JAN2006**	'K-NECSC '	330	330	N
01JAN2006**	'ME-ROP '	1400	1400	N
01JAN2006**	'ROP-BSTN'	3600	3600	N
01JAN2006**	'ROP-ROCT'	2200	2200	N
01JAN2006**	'ROCTSWCT'	2000	1650	N
01JAN2006**	'A - PJMW'	550	550	N
01JAN2006**	'C - PJMW'	200	800	N
01JAN2006**	'C - PJMC'	300	200	N
01JAN2006**	'G - PJME'	2000	500	N
01JAN2006**	'J - PJME'	0	1200	N
01JAN2006**	'K - PJME'	0	0	N
01JAN2007**	'K - PJME'	660	660	N
01JAN2006**	'D - HQ '	1000	800	N
01APR2006**	'D - HQ '	1000	1200	N
01NOV2006**	'D - HQ '	1000	800	N
01JAN2006**	'A - OH '	1550	1450	N
01JAN2006**	'D - OH '	400	400	N
01JAN2006**	'OH - HQ '	350	350	N
01JAN2006**	"C_TO_E"	6000	6000	N

```
01JAN2006**          "W_TO_C"      4000          4000              N
                          *****GROUPS
01JAN2006**          'TOTAL-ES'    6125          1999              N
01JAN2007**          'TOTAL-ES'    6700          1999              N
01JAN2008**          'TOTAL-ES'    6625          1999              N
01JAN2006**          'TOTAL-ES'    6625          1999              N
01JAN2006**          'UPNYSENY'    4900          1999              N
01JAN2006**          'CE GRP  '    6050          3400              N
01JAN2007**          'CE GRP  '    6075          3400              N
01JAN2008**          'CE GRP  '    5975          3400              N
01JAN2006**          'NY-IMPTS'   99999         99999              N
01JAN2006**          'NESENY  '       0             0              N
01JAN2006**          'LI SUM  '    1450           530              N
01JAN2006**          'I TO JK '    5000          2229              N
01JAN2007**          'I TO JK '    4925          2229              N
01JAN2008**          'I TO JK '    4825          2229              N
01JAN2006**          "PJM_JK  "    1660          2600              N
 01JAN2006**          "NY TO NE"   1225           925              N

                 ;;;; END OF &INF-TRLM-00 ;;;;
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Table 11.2.6 below illustrates the LOLE results utilizing the thru-time thermal transfer limits for the CRPP Transmission Constraint Model.

Table 11.2.6 LOLE Results Utilizing MARS Version 2.69 and 2005 CRPP Emergency Thermal Constraint Model

AREA OR POOL	2011	2012	2013	2014	2015
AREA-A	0.000	0.000	0.000	0.000	0.000
AREA-B	0.000	0.000	0.000	0.000	0.000
AREA-C	0.000	0.000	0.000	0.000	0.000
AREA-D	0.000	0.000	0.000	0.000	0.000
AREA-E	0.000	0.000	0.000	0.000	0.000
AREA-F	0.001	0.001	0.001	0.001	0.001
AREA-G	0.021	0.046	0.086	0.191	0.274
AREA-H	0.009	0.170	0.017	0.018	0.014
AREA-I	0.757	1.353	2.119	3.353	4.128
AREA-J	0.837	1.325	2.083	3.200	3.930
AREA-K	0.460	0.937	1.601	2.634	3.185
NYCA	1.049	1.747	2.692	4.024	4.816
NYCA Capacity @ peak	37,039	37,039	37,039	37,039	37,039
NYCA Peak Load	34,581	34,901	35,180	35,419	35,671

Table 11.2.7 Baseline System Reliability Needs (cumulative MW)

	Area G	Area J	Area K
2011		5 units – 1250 MW	
2012		5 units – 1250 MW	1 unit – 250 MW
2013	1 unit – 250 MW	5 units – 1250 MW	1 unit – 250 MW
2014	1 unit – 250 MW	6 units – 1500 MW	1 unit – 250 MW
2015	1 unit – 250 MW	6 units - 1500 MW	2 units – 500 MW

The majority of the load growth in NYCA is in Area J. Also, transmission constraints across the UPNY SENY, SprainBrook – Dunwoodie South and LIPA to NYC transmission interfaces restricts the amount of assistance Area F, G and K can provide to Area J. Therefore the most effective Area to add capacity to NY would be in Area J or alternatively increase transfer capability by increasing transfer capability between UPNY and SENY. ~~Transmission constraints across the UPNY SENY, SprainBrook – Dunwoodie South and LIPA to NYC transmission interfaces restricts the amount of assistance Area F, G and K can provide to Area J~~

12 Scenario Evaluation

12.1 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 lines. ~~vice versa.~~Higher than forecasted loads are likely to result in thermal and voltage criteria violations occurring at an earlier time.

The following Table 12.2.1 illustrates the NYCA LOLE for the Base and High Load Forecasts:

Table 12.2.1: NYCA LOLE vs Load Forecast

Year	Base	High
2006	0.021	0.044
2007	0.003	0.008
2008	0.073	0.111
2009	0.160	0.241
2010	0.752	1.079
2011	1.049	1.641
2012	1.747	2.451
2013	2.692	2.910
2014	4.024	4.581
2015	4.816	5.477

12.2 Nuclear Retirement Scenarios

12.2.1 Indian Point 2 and 3

MARS analysis of the 2008 and 2010 system was performed ~~with~~ to evaluate the retirement of the Indian Point 2 and 3 nuclear plants. The Baseline system capacity was 37039 for 2008 and 2010.

The following Table 12.3.1 illustrates the Area and NYCA LOLE for these retirement schedules:

Table 12.3.1: NYCA LOLE for IP2 and IP3 Retirements

AREA OR POOL	2008 IP2 O/S	2010 IP2 & IP3 O/S
AREA-A	0.000	0.000
AREA-B	0.000	0.002
AREA-C	0.000	0.000
AREA-D	0.000	0.000
AREA-E	0.000	0.001
AREA-F	0.000	0.004
AREA-G	0.001	0.143
AREA-H	0.025	3.014
AREA-I	0.124	3.243
AREA-J	0.117	2.639
AREA-K	0.076	1.669
NYCA	0.171	3.515
NYCA Capacity @ peak	36,077	35,086

12.3 Coal Retirement Scenarios

12.3.1 Older Plants

Voltage PV analysis and MARS analysis of the 2010 system was performed with the older coal plants out of service. The PV analysis indicated that the Dysinger East and West Central voltage limit would be reduced by 600 to 2000 and 1000 MW.

The transfer limit reduction and capacity reductions in Areas A, B, and C did not have any significant ~~affect~~ effect on the Area or NYCA LOLE.

Although the retirement of the older coal units did not have any significant ~~affect~~ effect on the Bulk Power transmission system, local transmission and sub-transmission system reinforcements may be required to maintain acceptable local Transmission Owners reliability requirements. This assessment is beyond the scope of this NYISO study.

12.4 M29 Transmission Project

An analysis of the impact of the M29 Transmission Project was performed on the 2007 and 2010 system conditions. The emergency thermal transfer indicated that the project would increase the I to J transfer capability by approximately 350 MW. The reactive charging available with the project would increase the I to J voltage limit by approximately 300 MW.

The following Table 12.5.1 illustrates the impact of M29 transmission project on the Area and NYCA LOLE.

Table 12.4.1: Impact of M29 Transmission Project on LOLE

AREA OR POOL	Without M29		With M29	
	2007	2010	2007	2010
AREA-A				
AREA-B				
AREA-C				
AREA-D				
AREA-E				
AREA-F				
AREA-G		.017		.019
AREA-H		.007	.002	.007
AREA-I	.001	.505	.001	.516
AREA-J	.001	.583	.001	.404
AREA-K	.002	.309	.003	.337
NYCA	.003	.752	.003	.628

13 Appendices

See NYISO Website ESPWG October 27, 2005 Meeting Material.