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Comprehensive Reliability Planning Process Draft Reliability Needs Assessment

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

September 1, 2005

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 ensured by a combination of resources provided by market forces and regulated wires companies. 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 ensure 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 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 provide input into the development of the final RNA.

This report is 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 ensure 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 ensuring 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 an overview of the CRPP followed by a summary of the major findings and conclusion of the draft RNA and presents the methodology and analysis that supports those findings and conclusion.

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 ensure 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.

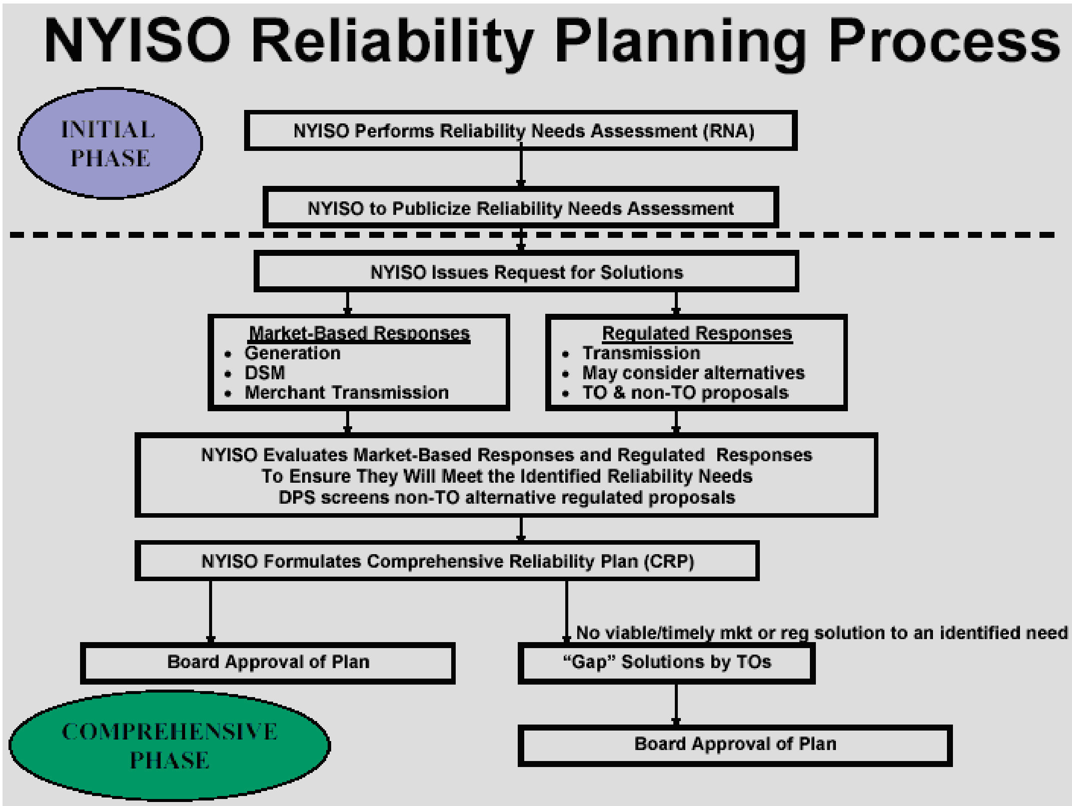
As the first step in the CRPP, the NYISO conducts a Reliability Needs Assessment (RNA) to determine whether there are any violations of existing reliability rules with respect to either resource adequacy or transmission reliability. Following the review of the RNA by the NYISO committees and final approval by the NYISO Board, the NYISO will request solutions to its identified reliability needs from the marketplace. At the same time, the responsible Transmission Owner's 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 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 NYSPSC. Such a gap solution is intended to be temporary in nature so as 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.

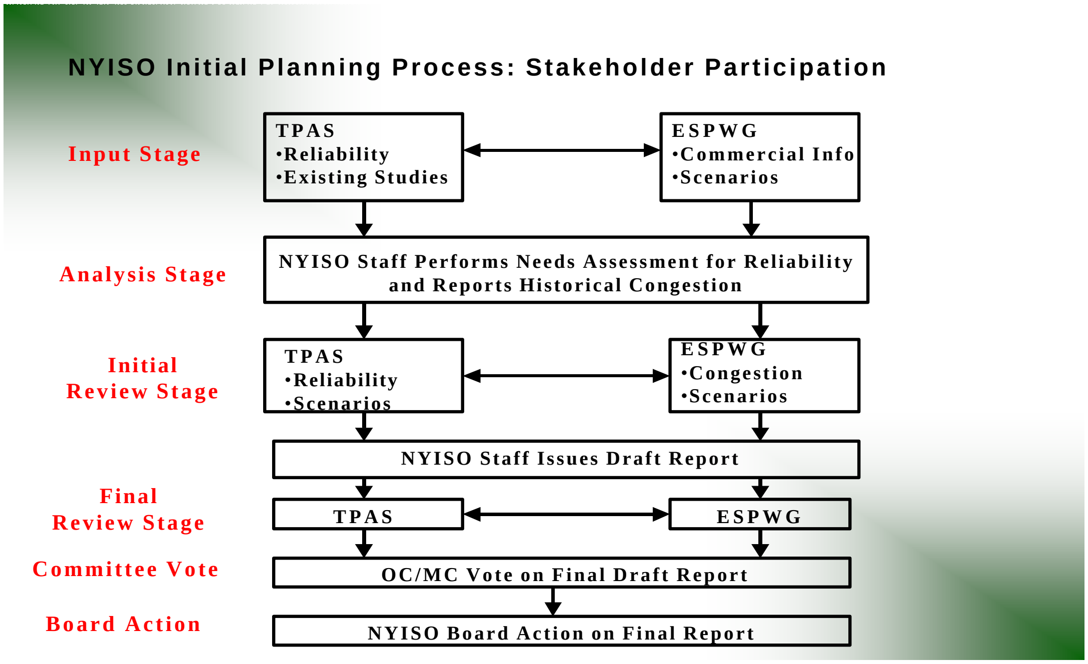
The CRPP also addresses the respective roles of the NYISO, the FERC and the NYSPSC with regard to the NYISO planning process. In the event of a dispute regarding the NYISO's findings in either the RNA or the final CRP that cannot be resolved by the normal NYISO governance procedures, the Tariff provides 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.



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 had primary responsibility for the reliability analyses, while the ESPWG had 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 below the system's requirement. The New York State Power System is planned to meet or exceed a loss of load expectation (LOLE) of once in 10 years. This requirement forms the basis of New York's installed capacity 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 and Standards and Operating Policies; NPCC Criteria, Guidelines and Procedures; New York-specific reliability rules; and local 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 ensure 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 Summary of Findings and Conclusion

Below is a summary of major findings and conclusions that were developed from the work conducted for the draft Reliability Needs Assessment. The summary is organized into three sections. The first summarizes the findings of the base case analysis, the second summarizes the findings of the assessment of the key scenarios and sensitivities, and the third presents the conclusions.

Base Case Findings:

1. Under the baseline assumptions and system representation, resources are adequate to meet resource adequacy criteria through 2009. The first year of need is 2010 when approximately 500 MW will be needed in the New York City (NYC) or Zone J.

2. By the end of the planning period in 2015, the identified resource need totals 2250 MW. Three zones have been identified as requiring additional resources. They are Zones G through K with 250 MW in G, 1500 MW in J and 500 MW in K.

3. The proposed 660 MW HVDC under water tie line knows as "Neptune Project" between Long Island, NY and New Jersey where it interconnects with the PJM control area provides significant benefits to the NYCA.

4. Energy and capacity transfers from Upstate NY (UPNY) which includes load Zones A-F to South East NY (SENY) which includes load Zones G-K are adversely affected by voltage limitations in the lower Hudson Valley which is that part of the transmission system between the UPNY/SENY interface and the NYC cable interface. These voltage limitations are sensitive to many different parameters and show a sharp degradation through time with load growth and generating unit retirements. For purposes of resource adequacy simulations, constant transfer limits were employed for the entire ten year period although there are identified reactive deficiencies that would lead to much lower transfer limits without any corrective actions.

5. The 823 MW Charles A. Poletti generating unit provides important reactive capability to the Consolidated Edison transmission system and the impact on the transfer limits used for resource adequacy evaluations would need to be thoroughly evaluated in conjunction with whatever corrective actions are employed in 4) above before its retirement in 2008. However, under the base case assumption used in the multi-area reliability simulation (MARS) model which is the primary tool used to determine whether the NYCA meets resource adequacy criteria, the retirement of the generating unit in February 2008 does not result in the NYCA being out of compliance with resource adequacy criteria.

6. The retirement of the Lovett generating station in Stony Point, NY which is interconnected to Orange and Rockland's 138 kV transmission facilities which are non-bulk power facilities has adverse impacts on the local transmission system as well as the bulk power system. The retirement has an adverse impact on the voltage profile in the lower Hudson Valley which can adversely affect transfer capability of the transmission system between UPNY-SENY and the NYC cable interface.

Key Scenarios and Sensitivity Findings:

1. Consolidated Edison has proposed a 345 kV transmission addition between Dunwoodie and Sherman Creek that did not meet the screening criteria for inclusion in the base case but was included as a scenario. The line results in an increase in transfer capability between load zone I (Westchester County) and NYC/Zone J of approximately 350 MW. It did not result in a change in the initial year of need but reduced the overall resource need by a small amount. It also improves the system voltage performance in the lower Hudson Valley.

2. The transmission network topology utilized in the MARS model is not a MW flow or shift factor based methodology but instead utilizes a transportation or bubble and pipe transmission topology. The topology employed for the baseline analysis was reviewed and approved for use by the New York State Reliability Council (NYSRC) in its IRM studies. Upon investigation of the results of employing this topology, an alternative, more robust topology model was developed and assessed as a scenario. This new topology when applied to the assessment of the first year of need which is 2010 increased the additional resources needed to meet resource adequacy criteria from 500 MW to a 1000 MW.

3. The retirement of the Indian Point nuclear power plants (IP2 & IP3) significantly increases the amount of additional resources needed to meet resource adequacy criteria and significant adverse impact on the voltage profile in the lower Hudson Valley.

Conclusion:

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 NY 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.*

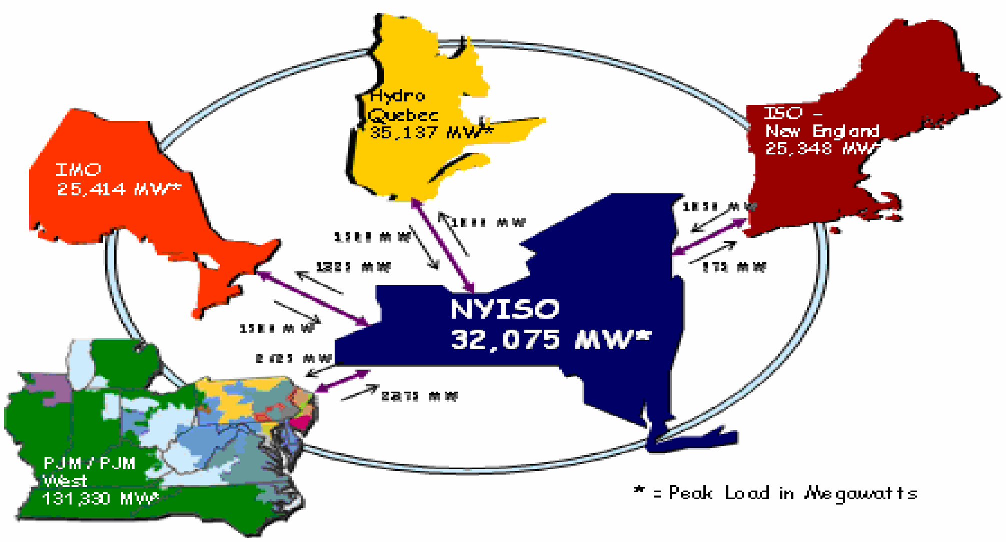


Figure 4.1

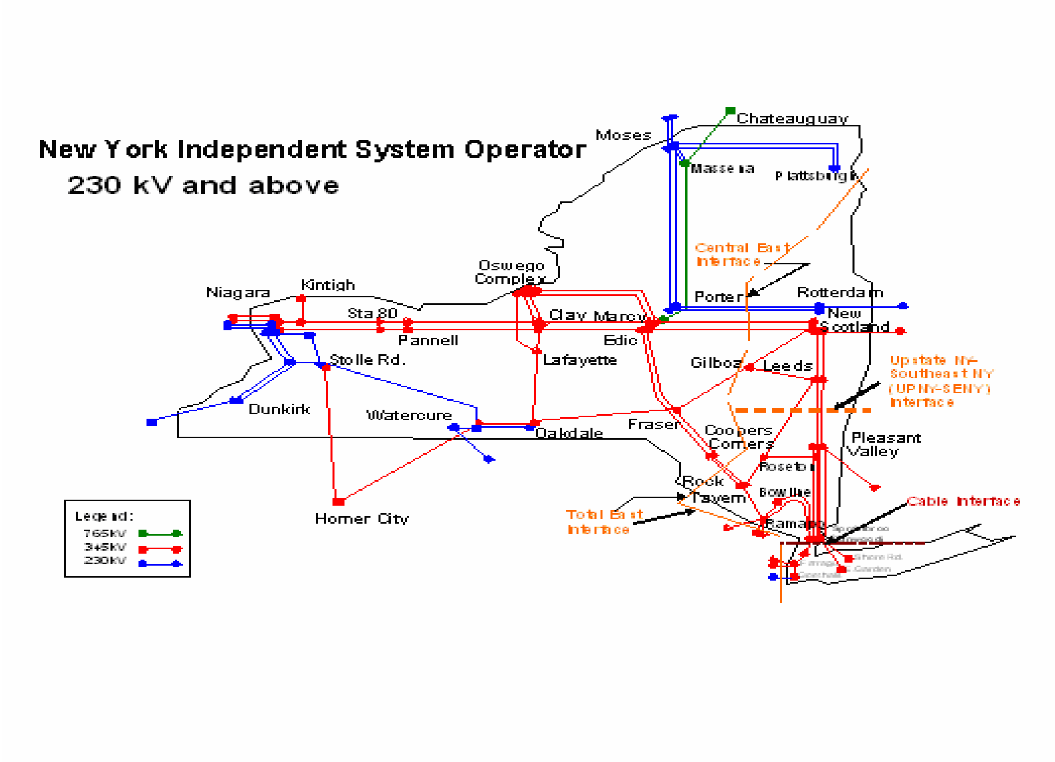


Figure 4.2

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.

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.

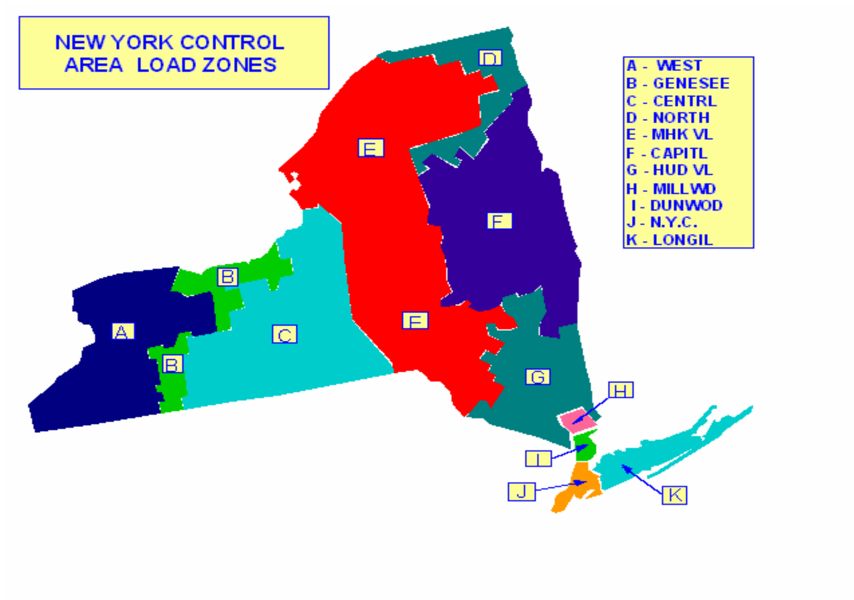


Figure 4.3

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 to provide peaking 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 Albany, New York City and Long Island (Economic transfer is the transmission of power from a lower cost region to a higher cost region.). However, it should also be recognized that hydro, nuclear and coal are either susceptible to re-licensing or environmental uncertainties or both.

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 Vs a net of 4,100 MW for the NYCA.

Generating Capability

Table 6.1 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 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.

If the summer of 2005 is included, the load growth is expected to increase by 560 MW to a total 31,960 MW but the capacity will increase 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 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 10,631 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 contracted. The transmission and sub-transmission (i.e., 69 kV and 34.5 kV) system has been expanded to accommodate local load growth requirements. The primary explanation for the reduction in the reported mileage between the 1994 book and 2005 book was the transfer of Orange and Rockland Utilities, Inc operation in Northern New Jersey from the NYCA to the PJM control area.

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.

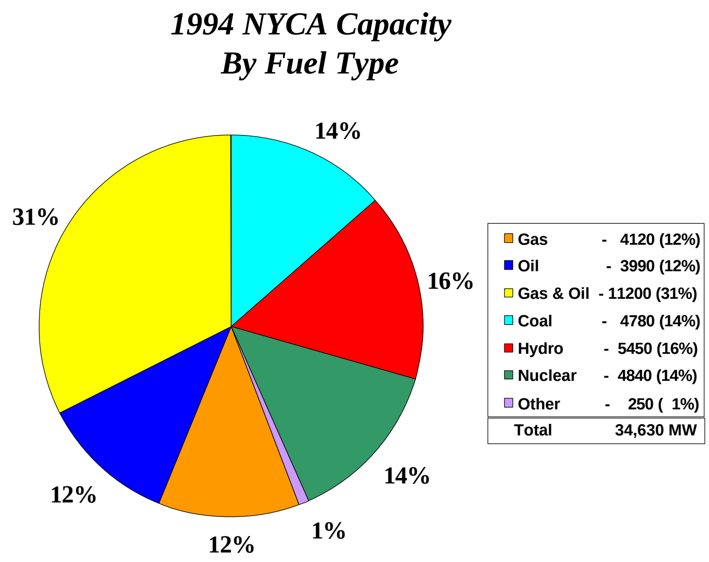


Figure 5.1

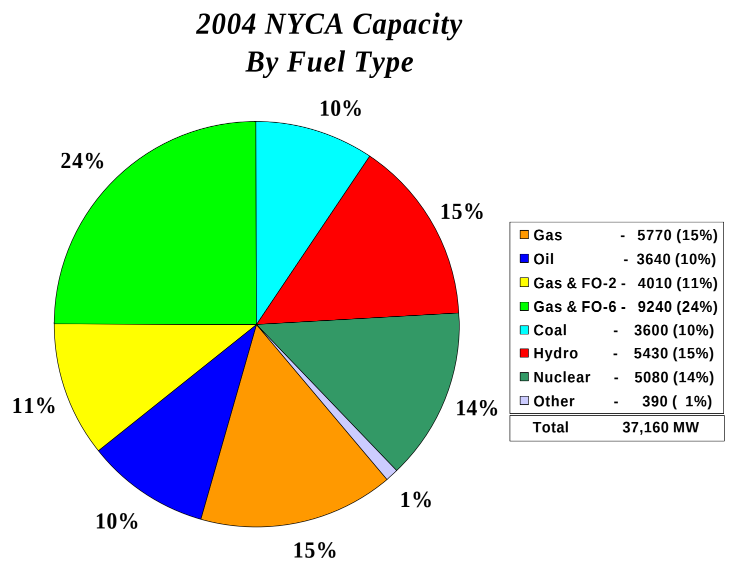


Figure 5.2

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 1970's. 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). The real challenge on a going forward basis will be to maintain the benefits that fuel diversity, in particular dual fuel capability, provides today.

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) to assess the adequacy of New York's electricity infrastructure for meeting reliability and market needs over the 2004 – 2013 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 2003. 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%

Caution and Disclaimer

6.2 Historical Overview

NYCA System

Table 1 shows the New York Control Area's (NYCA) historic peak and energy growth since 1984.

Table 1

21 Year Historic Peak and Energy Data and Growth Rates

Calendar	Annual Energy		Summer Peak			Winter Peak	
Year	(GWH)	Growth (%)	(MW)	Growth (%)	Winter	(MW)	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 respond to essentially the weather conditions on an extreme day each year. Annual energy is influenced by weather conditions over an entire year, which are much less variable.

Table 2 shows trends in weather-normalized sendout and peaks for the NYCA system .

Table 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 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 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 3

	West	UHV	LHV	J	K	NYCA
Weather-normalized Zonal Sendout and Forecast						
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 4

	West	UHV	LHV	J	K	NYCA
Weather-normalized Zonal Summer Peaks and Forecast						
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.

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

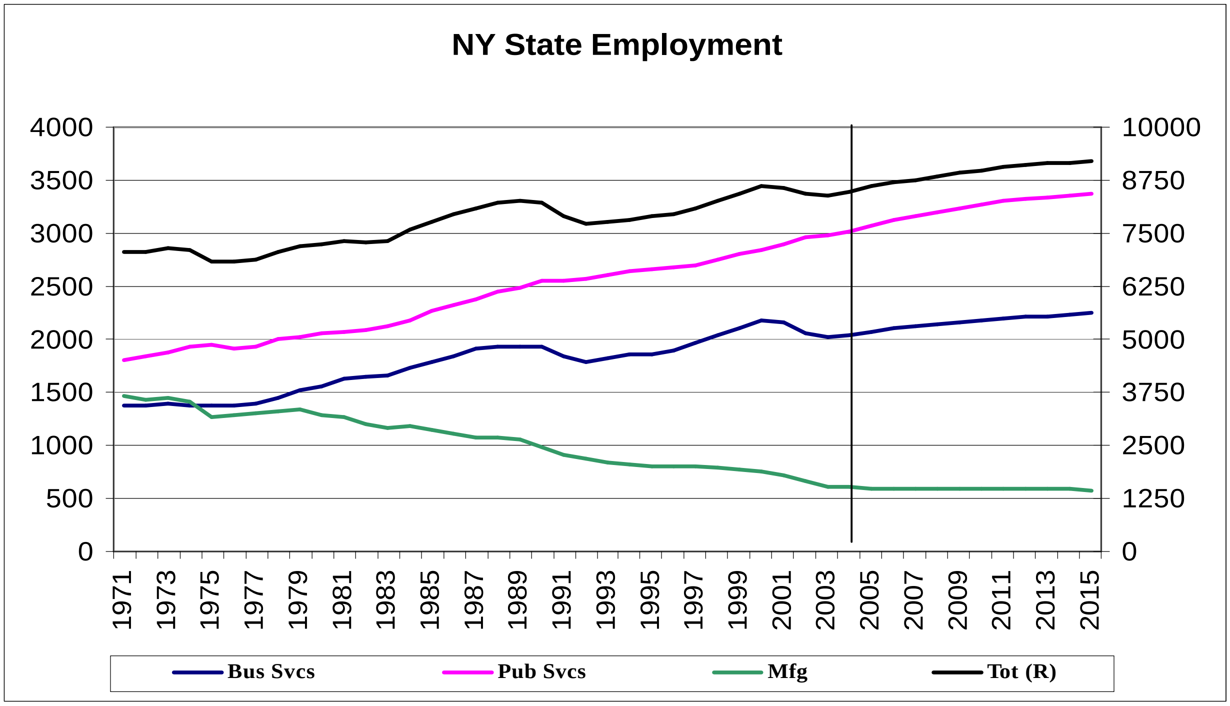
6.3 Trends Effecting Electricity in New York

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.

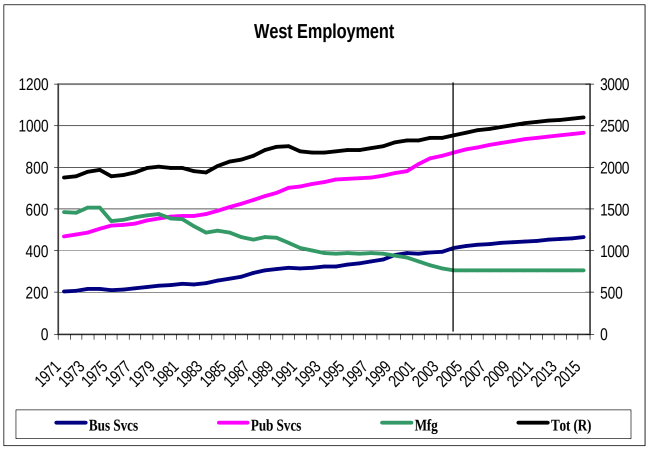
For much of the latter half of the twentieth century New York was home to much of the US financial industry. New York City was considered, along with London, one of the financial capitals of the world. Virtually all US investment banking, securities trading, and major bank headquarters were located there.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

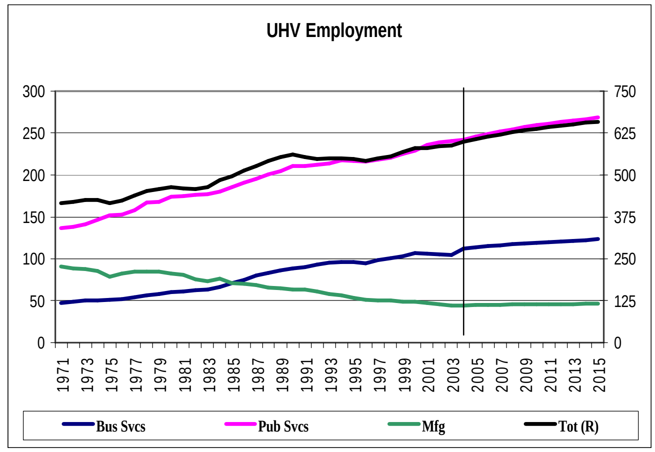
Today, New York's economy is dominated by public services. These include all levels of government employment, education and health care. These industries share the common feature that most, at least, of their revenue is provided by governments or taxing authorities of one kind or another.

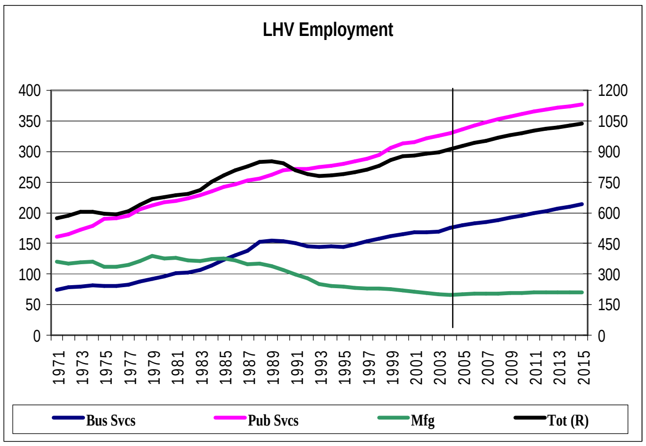


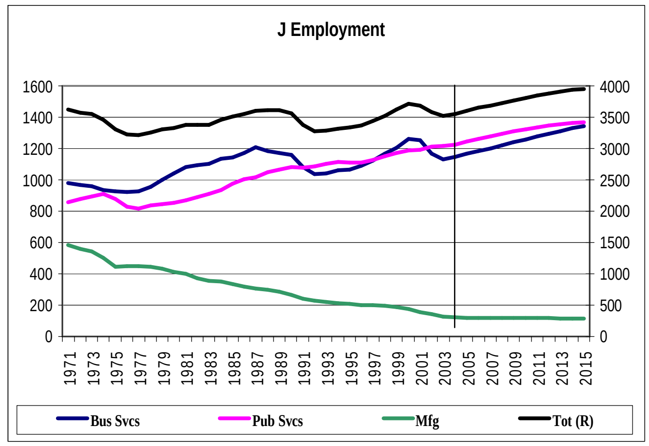
Public service employment began the 1970's roughly comparable to business service (finance, professional, managerial and administrative services) and manufacturing . Since then it has almost doubled, while business services have grown by about one-third and manufacturing has declined by about two-thirds. 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-1970's.

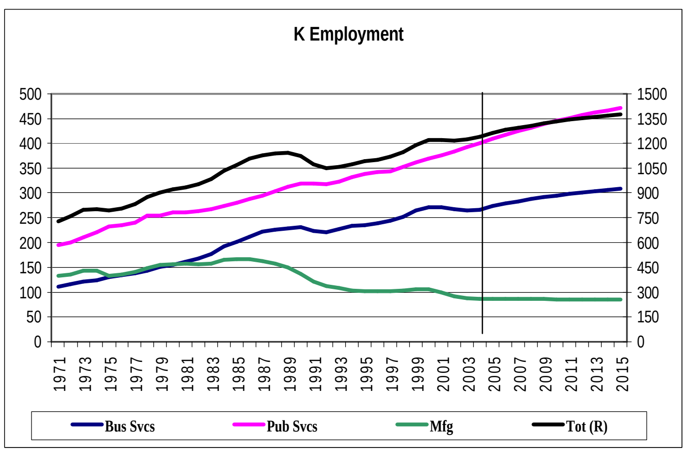
These trends have held in all New York regions, as is shown in Exhibit XXXXX









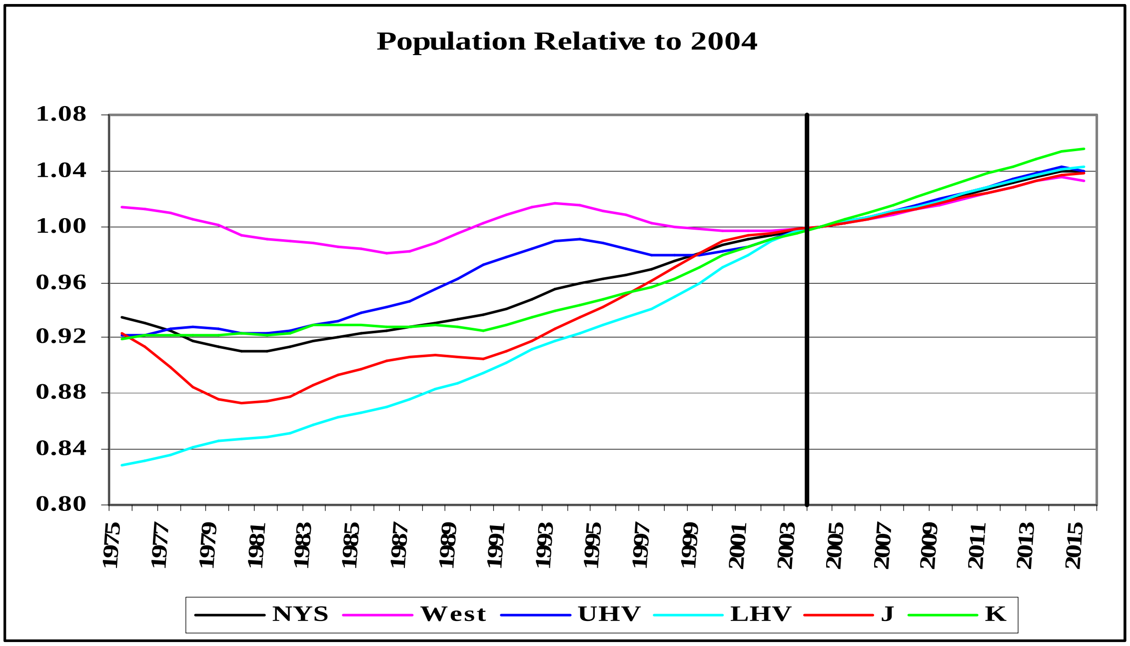


In every region, manufacturing employment has receded. The region this has had the greatest effect on is the West, where it used to be the largest source of employment. It is now the smallest. The decline of manufacturing has carried over to this region's demographic trends.

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

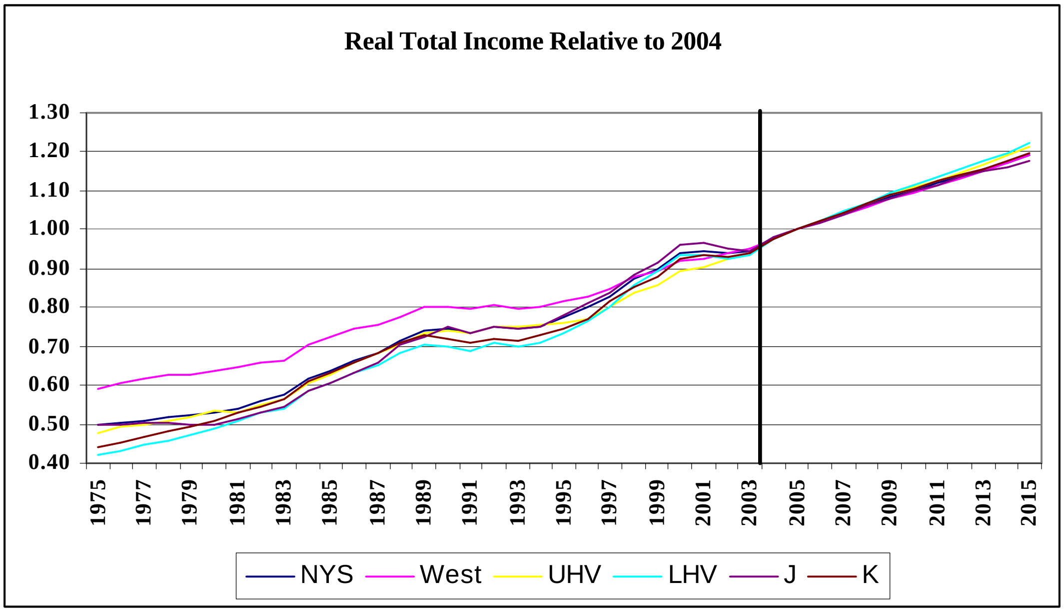
The economic trends the regions have experienced are reflected in their population growth. In the West, which is basically all of New York State west of Schenectady, population is 1.4% lower today than is was in 1975. The Lower Hudson Valley has seen the most population growth, adding 20% to its 1975 starting point. Other regions fall in between. New York State has added over 8% to its 1975 population base.



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

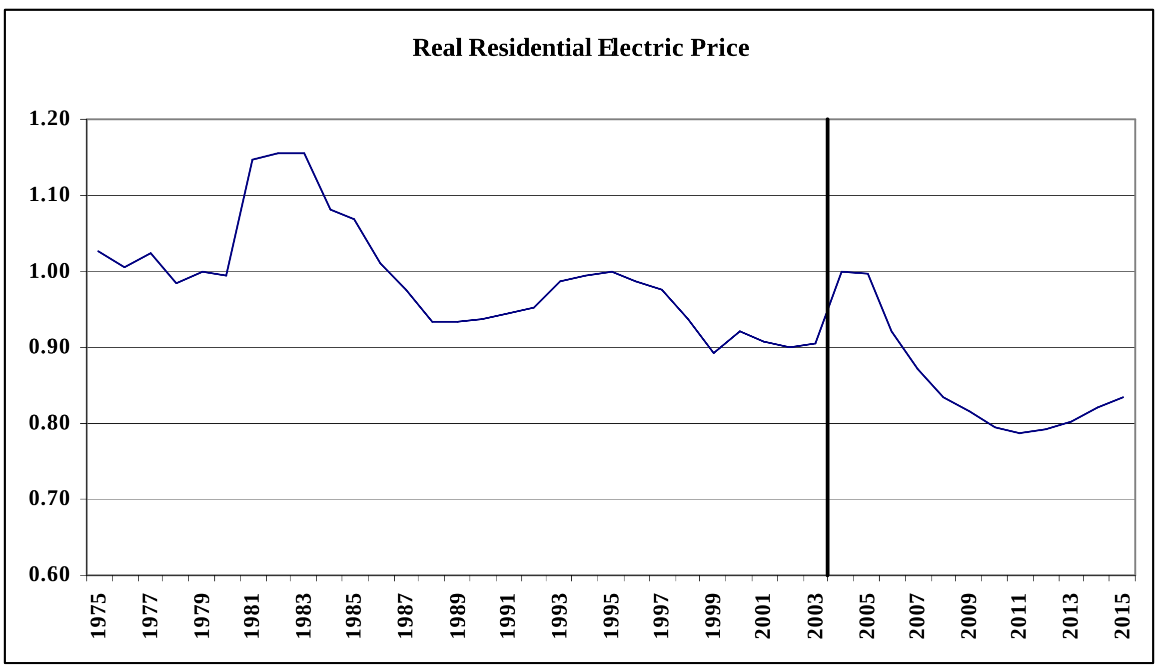
Employment and population trends carry over into total income. The West is again shown to have the slowest growth historically, by a considerable margin. As its employment base has declined, population has left and taken its income with it.



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.



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 5.

Table 5

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:

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

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

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 Table 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 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, the network model for the second five year period was identical to the network model for the year 2010 in the Five Year 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 will review the ATRA, the plans submitted by the TOs, and other information submitted as part of the input phase of the Comprehensive Planning Process.

The following three categories of projects will be 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. .TO projects on non-bulk power facilities will be included. Projects that are in service or under construction will be included.

B. TO projects on non-bulk power facilities will be included. Projects that are in service or under construction will be included.
C. C. For those projects and plans not already in-service or under construction:

- Category 1 projects will be 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 will be 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 will be included if they satisfy one of the following conditions:

1. The project is a Backstop Regulated Solution triggered in a prior year's Comprehensive Reliability Plan; or
2. The project is related to any projects and plans that are included in the Base Case; or
3. The project is expected to be in service within 3 years, has an approved SRIS (if applicable), and has received PSC certification (or SEQRA approval), if required.

All other TO plans and projects on the bulk power system will be addressed in a scenario analysis.

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

Table 7.1 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 7.1

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

7.3 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. TO projects on non-bulk power facilities.
B. The Neptune project.
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. Transmission upgrades related to any projects and facilities that are included in the Base Case, as defined above.

The NYISO's scenario analyses will 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 NYISO's final 2005 RNA will not find a Reliability Need with respect to a reliability violation that is resolved by a TO or merchant project that reaches one of the milestones set out in (C) above after March 31, 2005, provided the NYISO's scenario analysis confirms the ability of the project to resolve the violation.

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	
									Rev. #4 - 5/31/05

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. Reliability simulation used the MARS set-up from the latest IRM study. 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 Resource Adequacy Analysis

Introduction

This task focused on evaluating the adequacy of the NYCA transmission system as it impacts 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. 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 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.

8.2 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 (e.g., 2013) 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 described in the following sections.

Objective

The objective of the screening analysis was to identify the regions or corridors requiring significant transmission system upgrades, if any, to meet system reliability criteria. In particular, the goal was to determine which transmission reinforcement areas could provide the most system performance benefit, over the broadest range of possible system future conditions. Multiple scenarios representing different possible system conditions (e.g., generation, load, transmission variations) were evaluated.

Power flow analysis alone was performed, focusing on the voltage and thermal performance of the bulk power transmission system as well as limited transfer analysis of selected NY power system interfaces.

Study Approach

The Comprehensive Reliability Planning Process assessed the performance of Baseline conditions for each year from 2006 to 2015.

Task 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 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.

Task 2. 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. Any remaining pre-contingency violations were flagged as potential components of a required transmission system upgrade to a particular region or corridor.

Task 3. Emergency Thermal Transfer Analysis

Emergency thermal transfer analysis was performed using the 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.

Task 4. 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 Task 3.

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 one side of the interface, and adjusting generation by a like amount at one or more locations on the other side of the interface. The assumed locations for adjusting generation for evaluating transfer limits of the various interfaces were similar to the study assumptions for the 2005 ATR.

Task 5. Evaluation of Analytical Results

The results of the analysis described in Tasks 3 and 4 was evaluated to develop the transmission constraint model used in the MARS analysis.

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 was performed to determine whether the fault current seen by a specific breaker exceeded that breaker's rating.

9 System Planning Issues

9.1 Introduction

There are many issues that, potentially at least, can 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 are not only reviewed for the development 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 electric energy needs for the state be supplied each year by renewable forms of energy. Starting in a specified year, this percentage increases each year to some maximum amount. 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 by 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 interconnected with only minor adjustments to existing planning, operating, and reliability practices.

Environmental Compliance

The 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 can 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 policies, 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 1990's 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. The power plant industry and regulatory agencies disagree on this interpretation, but 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 shut down plants. 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. However, EPA implements the cap by setting a mercury

budget for each state, but 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). In comments submitted to EPA, New York has indicated that they do not support the cap-and-trade program, and thus would not allow mercury allowance trading if given the option.

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 August 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., SO_2, NO_x 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 SO_2 scrubbers, selective catalytic reduction of NO_x and fabric filter particulate controls.

Although there are significant number of initiatives whose ultimate disposition and impact have not yet been determined, the NYISO primary concern at this point is that these impacts be determined with sufficient lead time that any adverse impact on system reliability can be mitigated within the NYISO comprehensive 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 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~~Political issues could also lead to potential retirements. For example, the Indian Point nuclear plant's proximity to population centers has created political pressure for the plant to be shut down. ~~for safety reasons.~~ Re-licensing of this plant may not occur due to this pressure. This plant helps New York City to meet load obligations. ~~Upstate~~Additional new generation would be needed to help fill this potential void and depending where they are sited could cause more loading on the existing transmission system.

Transmission Owner Plans

Transmission owners in NY State could possibly build new interconnections with neighboring systems. However, it is likely that neighboring systems will also need new capacity at the same time NY State needs new capacity. Therefore, while adding new interconnections ~~This would~~could increase the import capability into New York State and allow more power to flow, it is unlikely that ~~and hence increase~~ loading on the existing transmission system within NY would increase during peak hours when neighboring systems also need their capacity.

Existing Transmission Infrastructure Aging

As the current transmission infrastructure ages, the amount of power that can flow on the transmission lines will steadily decrease. This could potentially cause trouble for load pockets that depend on imports to meet load.

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 or charge higher prices if the natural gas is available but at higher opportunity costs. 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 larger older units that if retired would have impacts other than fuel mix.

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 voltages 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.

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 considered in this study include:

1. Coal Retirement of Older Plants
    a. All, Cayuga and Somerset remain
    b. Scenario a plus retirement of Cayuga and Somerset
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:

1. Wind/Renewable Additions – this issue has been covered in a separate study sponsored by NYSERDA and NYISO.
2. Infrastructure Aging – assumed to have no effect over the study period
3. New Technologies – insufficiently defined to include as any different identifiable impact
4. Neighboring System Plans – not assumed to change, but may merit additional investigation if dependence on external support is shown to increase significantly under any of the scenarios.

5. Demand response systems – effectively decreases load. Will likely be accompanied by some form of generation reduction that drives the need. Thus, this could be viewed as 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 Resource Adequacy Assessment

11.1.1.1 Free Flow Transmission Model

Table 11.1 illustrates the NYCA LOLE and Capacity Reserve Margins for a 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. Thru time, load growth in South East New York and the limited number of new generating units which presently under construction would reduce the NYCA Reserve Margin to 8% and increase the NYCA LOLE to .012.

Table 11.1

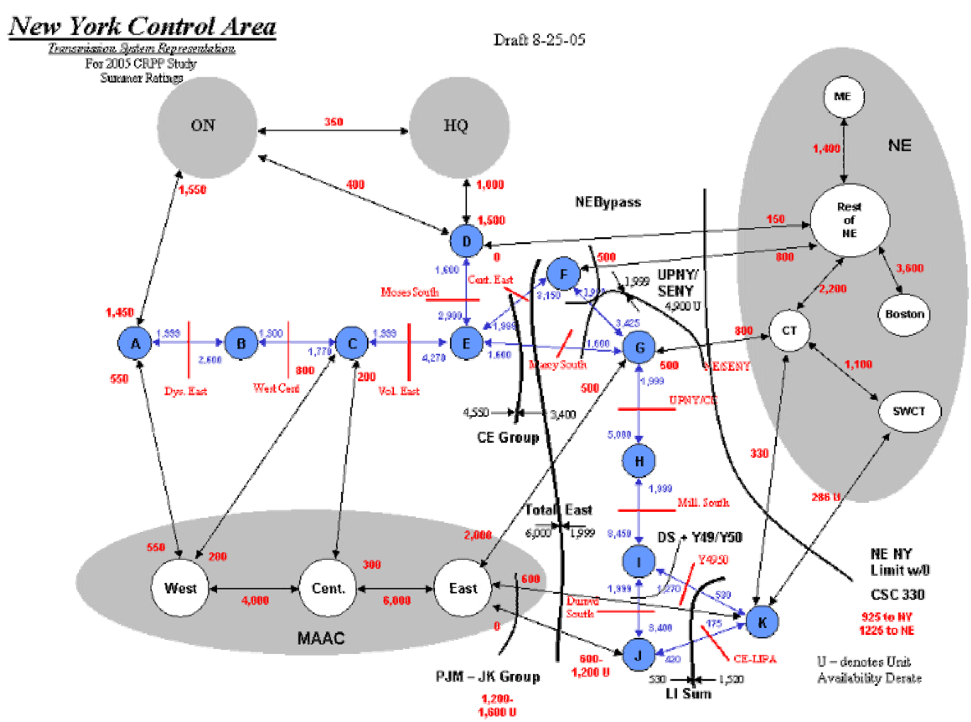
AREA OR POOL	2006	2007	2008	2009	2010
AREA-A	0.000	0.000	0.000	0.000	0.000
AREA-B	0.000	0.000	0.000	0.000	0.008
AREA-C	0.000	0.000	0.000	0.000	0.000
AREA-D	0.000	0.000	0.000	0.000	0.000
AREA-E	0.000	0.000	0.000	0.000	0.001
AREA-F	0.000	0.000	0.000	0.000	0.000
AREA-G	0.000	0.000	0.000	0.000	0.001
AREA-H	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
NYCA Reserve Margin	20%	17%	11%	10%	8%
NYCA Reserve Margin	20%	17%	11%	10%	8%

11.1.1.2 Transmission Constraint Model

Table 11.2 illustrates the NYCA LOLE and Capacity Reserve Margins for the Baseline transmission constraint model which is illustrated in the figure below.

Table 11.2

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	0.001
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	0.004
AREA-H	0.000	0.000	0.001	0.001	0.004
AREA-I	0.000	0.000	0.017	0.040	0.205
AREA-J	0.000	0.001	0.041	0.080	0.261
AREA-K	0.020	0.001	0.012	0.028	0.133
NYCA	0.021	0.002	0.050	0.099	0.325
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
NYCA Reserve Margin	20%	17%	11%	10%	8%



The transmission constraint model restricts the emergency assistance the upstate and external pools can provide to Southeast New York (Areas I-K). The initial reliability need occurs in 2010. For the Baseline system, 2 generic 250 MW combined cycle generating unit would be needed to reduce the NYCA LOLE to the acceptable reliability criterion assuming that there were no transmission constraints prohibiting the delivery of energy within the Area.

The majority of the load growth in NYCA is in Area J. Therefore the most effective Area to add capacity to NY would be in Area J. 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.

11.1.1.3 Alternate Transmission Constraint Model

While reviewing the transmission flows in the MARS analysis for the Baseline system, it was observed that the transmission constraints across the F to G transmission interface was causing a significant amount of power to flow from Area F in New York into New England and out of New England to Area G and K in New York. An alternate transmission constraint model was developed to restrict the amount of loop flow through the New England transmission system. The following Table 11.3 illustrates the impact of this model on the LOLE results:

Table 11.3
Alternate NE 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	0.000	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	0.001	0.003	0.017
AREA-H	0.000	0.000	0.001	0.002	0.008
AREA-I	0.001	0.003	0.058	0.122	0.617
AREA-J	0.001	0.003	0.095	0.186	0.785
AREA-K	0.021	0.003	0.051	0.112	0.418
NYCA	0.022	0.006	0.122	0.235	0.966
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
NYCA Reserve Margin	20%	17%	11%	10%	8%

For the 2010 load forecast, the additional transmission constraint would increase the reliability need to 5 units in Area J and 1 unit in Area K (1500 MW).Transmission Adequacy Assessment

The power flow analyses, including both conventional thermal and voltage contingency analysis as well as thermal transfer limit analysis, performed in this study are described in the following subsections. A description of the study approach, system conditions, analytical tools, and contingency lists is provided.

11.1.2 Power System Databases

Table 11.4 below summarizes the power flow Area load plus losses for the first five years.

Table 11.4
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 11.5 below summarizes the Area generation dispatched for the Baseline system.

Table 11.5
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

The definition of the transmission interfaces are shown in *Appendix E*.

11.1.3 Performance Criteria

The pre- and post-contingency voltage criteria are shown in Table 11.6. Individual bus voltage criteria was employed when more stringent than any given area criteria.

Under normal conditions, thermal branch loading was required to be below 1.00pu of the element's continuous rating. Under post-contingency conditions, the branch loading was required to be below 1.00pu of the element's long-term emergency rating. Several branches that represent cables were allowed loadings up to 1.00pu of the short-term emergency rating under post-contingency conditions. These branches are shown in Table 11.11, as well as their long-term emergency (LTE – rate 2) and short-term emergency (STE – rate 3) MVA ratings.

All NY bus voltages, line and transformer flows at 115kV and above were monitored for criteria violations. The areas monitored were 1 (WEST), 2 (GENESSEE), 3 (CENTRAL), 4 (NORTH), 5 (MOHAWK), 6 (CAPITAL), 7 (HUDSON), 8 (MILLWOOD), 9 (DUNWOODIE), 10 (NYC), 11 (L ISLAND).

Table 11.6

Voltage Criteria

	All Lines In		Contingency	
Area/Bus	**Vmin**	**Vmax**	**Vmin**	**Vmax**
Areas 1-11	0.95	1.05	0.90	1.05
74310	1.000	1.050	0.950	1.050
74311	1.000	1.050	0.950	1.050
74313	1.003	1.050	0.950	1.100
77400	1.000	1.050	0.950	1.050
75400	0.980	1.050	0.950	1.100
74316	1.003	1.050	0.950	1.100
78450	1.006	1.050	0.950	1.050
74327	0.980	1.050	0.950	1.100
75403	0.980	1.050	0.950	1.100
79581	1.009	1.050	0.950	1.050
74333	0.980	1.050	0.950	1.100
74336	0.980	1.050	0.950	1.100
74340	1.003	1.050	0.950	1.100
78701	1.000	1.050	0.950	1.078
79583	1.009	1.050	0.950	1.100
74341	0.997	1.050	0.950	1.100
78702	1.009	1.050	0.950	1.050
78703	1.009	1.050	0.950	1.050
79584	0.980	1.050	0.950	1.050
75405	0.971	1.050	0.928	1.100
79801	1.003	1.041	0.950	1.050
74344	0.994	1.050	0.950	1.100

Table 11.6
(continued) Voltage Criteria

	All Lines In		Contingency	
Area/Bus	**Vmin**	**Vmax**	**Vmin**	**Vmax**
74345	0.980	1.050	0.950	1.100
74347	1.003	1.050	0.950	1.100
74001	1.009	1.050	0.950	1.050
74002	1.000	1.050	0.950	1.050
75404	0.980	1.050	0.950	1.100
74348	1.003	1.050	0.950	1.100
79800	1.003	1.041	0.950	1.050
74331	0.950	1.050	0.950	1.050
74000	0.950	1.050	0.950	1.050
75000	0.950	1.050	0.950	1.050
77406	0.950	1.050	0.950	1.050
75407	0.950	1.050	0.950	1.050
84819	0.950	1.050	0.950	1.050
79577	0.950	1.050	0.950	1.050
79578	0.950	1.050	0.950	1.050
74300	1.000	1.100	1.000	1.150
79591	0.978	1.050	0.950	1.050
79592	0.978	1.050	0.950	1.050
76663	0.943	1.050	0.900	1.050
76500	0.950	1.050	0.950	1.050
75414	0.950	1.050	0.950	1.050
75415	0.950	1.050	0.950	1.050
78980	0.950	1.050	0.950	1.050
79590	0.978	1.050	0.950	1.050
75418	0.935	1.050	0.900	1.050
75051	0.978	1.050	0.950	1.050
85219	0.950	1.050	0.950	1.050
85119	0.950	1.050	0.950	1.050
78733	0.950	1.050	0.950	1.050
75424	0.950	1.050	0.950	1.050
75426	0.950	1.050	0.950	1.050
77431	0.950	1.050	0.950	1.050
75444	0.950	1.050	0.950	1.050
75446	0.950	1.050	0.950	1.050
76527	0.950	1.050	0.950	1.050
75457	0.950	1.050	0.950	1.050
75476	0.950	1.050	0.950	1.050
79599	0.950	1.050	0.950	1.050
79600	0.950	1.050	0.950	1.050
79601	0.950	1.050	0.950	1.050
75486	0.950	1.050	0.950	1.050

Table 11.6
(continued) Voltage Criteria

	All Lines In		Contingency	
Area/Bus	**Vmin**	**Vmax**	**Vmin**	**Vmax**
75488	0.950	1.050	0.950	1.050
79602	0.950	1.050	0.950	1.050
74043	0.950	1.050	0.950	1.050
78485	0.950	1.050	0.950	1.050
74046	0.950	1.050	0.950	1.050
78782	0.950	1.050	0.950	1.050
74048	0.950	1.050	0.950	1.050
79811	0.950	1.050	0.950	1.050

Table 11.7
Branches (i.e, Cables) with Short Term Emergency Criteria

Branch Identification	LTE (MW)	STE (MW)
Dunwoodie-Rainey "3" 345kV	817	1081
Dunwoodie-Rainey "4" 345kV	817	1081
Sprainbrook-W. 49th St. "1" 345kV	866	1291
Sprainbrook-W. 49th St. "2" 345kV	866	1291
Sprainbrook-Tremont "1" 345kV	729	758
Farragut-Rainey "1" 345kV	758	1081
Farragut-Rainey "2" 345kV	791	1097
Farragut-Rainey "3" 345kV	758	1081
E. 15th St. 45-Farragut "1" 345kV	882	1258
E. 15th St. 45-W. 49th St. "1" 345kV	866	1291
E. 15th St. 46-Farragut "1" 345kV	882	1258
E. 15th St. 46-W. 49th St. "1" 345kV	866	1291
E. 15th St. 47-Farragut "1" 345kV	683	1124
E. 15th St. 47-Astoria "1" 345kV	621	1476
E. 15th St. 48-Farragut "1" 345kV	683	1124
E. 15th St. 48-Astoria "1" 345kV	621	1476
Farragut-Gowanus N. "1" 345kV	807	1183
Farragut-Gowanus S. "1" 345kV	807	1183
Goethals N.-Gowanus N. "1" 345kV	683	1022
Goethals S.-Gowanus S. "1" 345kV	683	1022

The base cases were solved with all phase shifting transformers (PARs), load tap changing (LTC) transformers and voltage switched shunts (SVDs) acting. Contingencies were solved with PARs, LTCs and SVDs fixed at their pre-outage state. For generator outages, a system redispatch was performed with approximately 30% of the tripped generation picked up in NY at NYISO selected generators. The remaining 70% was picked up at the swing machine, TVA's Browns Ferry Unit 3.

11.1.4 Transfer Limit Analysis

Linear transfer limit analysis was used to determine the maximum loading levels of selected interfaces, based on thermal loadings of lines and transformers in the study area. The transfer limit analysis was performed for all contingencies and criteria as described in Section 11.1.4.

The analysis was performed by first running all N-1 contingencies on a base transfer condition. All N-1 contingencies are then run on a case with an increase in transfers (e.g. a 200MW transaction from western NY to NYC). Linear extrapolation/interpolation, from these full AC power flow results, was used to calculate the incremental transfer level at which normal and post-contingency overloads began to occur. From that, maximum interface flows were determined.

While the limiting element may be located anywhere in NY, additional screening was performed to ensure that interfaces were limited by relatively local lines or transformers. Branches with low distribution factors (less than 0.02) were ignored. In addition, the focus was on limiting elements at 230kV and above.

The transfer limit analysis was used to determine maximum flow levels of selected interfaces, based upon thermal loadings of lines and transformers in the study area. The analysis was performed in accordance with the study approach as described above.

A detailed summary of the interface limits will be provided as appendicies on request.

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 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					
NL/EL	4805	4099	4003	Dunwoodie	L/O Rav#3
Scenario 2 - Ramapo @ 1000 MW					
NL/EL	5124	4296	4203	Dunwoodie	L/O Rav#3
Scenario 3 - Ramapo @ 1000 MW, Lovett off					
EL	5131	4060	3973	Sprainbrook	L/O Rav#3
Scenario 4 - Ramapo @ 1000 MW, Lovett off, reactive compensation in SENY added					
EL	5761	4672	4572	Dunwoodie	L/O Rav#3
Shift Zone G -> NYC, Y49/Y50 @ 1240 MW					
Scenario 1 - UPNY-SENY @ 4800 MW, PV-Long Mtn. @ 100 MW					
NL/EL		4902	4797	Sprainbrook	L/O Rav#3
Scenario 2 - UPNY-SENY @ 5300 MW, PV-Long Mtn. @ 70 MW					
NL/EL		4603	4500	Dunwoodie	L/O Rav#3

Sum10

Shift Ontario/Oswego -> NYC & LI					
Scenario 1 - Ramapo @ 440 MW					
EL	5180	3999	3788	Dunwoodie	L/O Rav#3
Shift Zone G -> NYC, Y49/Y50 @ 1000 MW					
Scenario 1 - Ramapo @ 1000 MW					
EL		4297	4083	Dunwoodie	L/O Rav#3
Scenario 2 - Ramapo @ 1000 MW, Y49/Y50 @ 1200 MW, Lovetts & Poletti Retired					
EL	5642	4450	4233	Dunw	L/O Rav#3
Scenario 3 = Scenario 2 plus M29					
EL	5959[e]	4751[e]	4532[e]	Dunw	L/O Rav#3

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 Resource Adequacy Assessment

11.2.1.1 Freeflow Transmission Model

Table 11.8 illustrates the NYCA LOLE and Capacity Reserve Margins for a unconstrainted 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~~99% for Long Island in 2006. Thru time, load growth in South East New York and the limited number of new generating units which presently under construction would reduce the NYCA Reserve Margin to 8% and increase the NYCA LOLE to .012.

Table 11.8

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
NYCA Reserve Margin	7%	6%	5%	5%	4%

11.2.1.2 Transmission Constraint Model

Table 11.9 illustrates the NYCA LOLE and Capacity Reserve Margins for the Baseline transmission constraint model.

Table 11.9

AREA OR POOL	2011	2012	2013	2014	2015
AREA-A	0.000	0.000	0.000	0.000	0.000
AREA-B	0.000	0.001	0.001	0.000	0.001
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	0.002	0.001	0.006	0.006
AREA-G	0.006	0.011	0.029	0.065	0.099
AREA-H	0.006	0.009	0.013	0.019	0.019
AREA-I	0.334	0.571	0.963	1.641	2.171
AREA-J	0.409	0.631	1.022	1.663	2.199
AREA-K	0.207	0.409	0.706	1.223	1.588
NYCA	0.508	0.805	1.300	2.089	2.692
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
NYCA Reserve Margin	7%	6%	5%	5%	4%

The transmission constraint model restricts the emergency assistance the upstate and external pools can provide to Southeast New York (Areas I-K). Table 11.10 identifies the reliability needs assuming that a generic 250 MW combined cycle generating unit was installed and there were no transmission constraints prohibiting the delivery of energy within the Area.

Table 11.10
Baseline System Reliability Needs

	Area G	Area J	Area K
2011		4 units – 1000 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. Therefore the most effective Area to add capacity to NY would be in Area J. 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.

11.2.2 Transmission Adequacy Assessment

The power flow analyses, including both conventional thermal and voltage contingency analysis as well as thermal transfer limit analysis, performed in this study are described in the following subsections. A description of the study approach, system conditions, analytical tools, and contingency lists is provided.

11.2.3 Power System Databases

Table 11.11below summarizes the power flow Area load plus losses for the first five years.

Table 11.11
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 11.12 below summarizes the Area generation dispatched for the Baseline system.

Table 11.12
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

11.2.4 Transfer Limit Analysis

A summary of the interface limits will be provided in the appendicies upon request.

11.2.5 Short Circuit Assessment

Since there were no network changes in the short circuit database for the year 2015 versus year 2010, the fault levels are identical for both years.

11.2.6 Conclusions

12 Scenario Evaluation

12.1 Stakeholder and Neighboring Control Area Input

12.2 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.

The following Table 12.1 illustrates the NYCA LOLE for the Base, High and Low Load Forecasts:

Table 12.1

NYCA LOLE vs Load Forecast

Year	Base	High	Low
2006	0.021	0.030	0.019
2007	0.002	0.007	0.004
2008	0.042	0.110	0.024
2009	0.095	0.249	0.046
2010	0.333	0.848	0.146
2011	0.508	1.404	0.204
2012	0.793	2.112	0.310
2013	1.280	3.368	0.479
2014	2.080	5.101	0.762
2015	2.680	6.538	0.960

12.3 Nuclear Retirement Scenarios

12.3.1 Indian Point 2 & 3

MARS analysis of the 2008 and 2010 system was performed with 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 12.2 illustrates the Area and NYCA LOLE for these retirement schedules:

Table 12.2
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

12.4 Coal Retirement Scenarios

12.4.1 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 on the Area or NYCA LOLE.

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

12.5 TO Projects

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 12.3 illustrates the impact of M29 transmission project on the Area and NYCA LOLE.

Table 12.3
Impact of M29 Transmission Project on LOLE

	Without M29		With M29	
AREA OR POOL	**2007**	**2010**	**2007**	**2010**
AREA-A	0.000	0.000	0.000	0.000
AREA-B	0.000	0.001	0.000	0.001
AREA-C	0.000	0.000	0.000	0.000
AREA-D	0.000	0.000	0.000	0.000
AREA-E	0.000	0.000	0.000	0.000
AREA-F	0.000	0.000	0.000	0.001
AREA-G	0.000	0.004	0.000	0.005
AREA-H	0.000	0.004	0.000	0.004
AREA-I	0.000	0.205	0.000	0.216
AREA-J	0.001	0.261	0.000	0.208
AREA-K	0.001	0.133	0.001	0.150
NYCA	0.002	0.325	0.001	0.290

13 Identification of Resource Needs – An Example

Once the reliability analysis of the Baseline system had been completed, the identification of reliability needs was performed by the addition of new generation with a capacity of 250 MW and a forced outage rate equivalent to a new combined cycle unit. Units were initially added to the Area with the highest LOLE until the NYCA LOLE was lower than 0.10 or the additions of units no longer affect the NYCA LOLE. For the latter case, if the NYCA LOLE still was above criterion, additional units were added to the Area with the next largest LOLE. Other combinations of unit additions in the zones could satisfy resource adequacy criteria.

The Upstate New York Areas (A-F) had sufficient generation and transmission resources to meet their reliability criterion for all scenarios tested.

Table 13.1 illustrates the Baseline System reliability needs from 2010 to 2015.

Table 13.1
Baseline System Reliability Needs

	Area G	Area J	Area K
2010		2 units – 500 MW	
2011		4 units – 1000 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

Table 13.2 illustrates the reliability needs for the High Load Forecast.

Table 13.2
High Load Forecast System Reliability Needs

	Area G	Area J	Area K
2009		2 units – 500 MW	
2010		4 units – 1000 MW	1 unit – 250 MW
2011		5 units – 1250 MW	1 unit – 250 MW
2012	1 unit – 250 MW	6 units – 1500 MW	2 unit – 500 MW
2013	1 unit – 250 MW	7 units – 1750 MW	2 unit – 500 MW
2014	1 unit – 250 MW	8 units – 2000 MW	2 unit – 500 MW
2015	1 unit – 250 MW	9 units - 2250 MW	3 units – 750 MW

Table 13.3 illustrates the reliability needs for the Low Load Forecast.

Table 13.3
High Load Forecast System Reliability Needs

	Area G	Area J	Area K
2011		1 units – 250 MW	
2012		2 units – 500 MW	1 unit – 250 MW
2013		3 units – 750 MW	1 unit – 250 MW
2014		4 units – 1000 MW	2 unit – 500 MW
2015		4 units - 1000 MW	2 units – 500 MW

The transmission constraints on the in Southeast New York limit the amount of emergency reliability assistance Areas outside of Southeast New York. With the alternate transmission model constraining the loop power flow from Areas F to New England and New England to Southeast New York. The reliability needs in Area J doubles to 4 units or 1000MW.