NEW YORK INDEPENDENT SYSTEM OPERATOR

Building the Energy Markets of Tomorrow . . . Today

Comprehensive Reliability Planning Process (CRPP)

Reliability Needs Assessment

December 21, 2005

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Introduction

In general, electricity restructuring in New York State and, for the most part, the Northeast quadrant of the United States, has led to the unbundling of generation and transmission development. Largely gone are the days of planning in which generation and transmission plans were highly coordinated. In today's world, the reliability of the power system is dependent on a combination of resources provided by market forces and regulated wires companies. The objectives of the CRPP, are stated in Section 1.1 of NYISO's Open Access Transmission Tariff (OATT) Attachment Y.:

If the Reliability Needs Assessment (RNA) determines the reliability of the system is inadequate, the RNA will identify reliability needs and the TOs responsible for identifying regulated backstop solutions. The RNA is the first step in the development of the Comprehensive Reliability Plan (CRP). The second step in the development of the CRP is the development of solutions to reliability needs. The solutions will consist of both market-based and Transmission Owner (TO) or alternative regulated solutions. Solutions will need to satisfy reliability criteria and not necessarily the specified level of Megawatts (MW) or Megavars (MVAR) need identified in the RNA. There are various combinations of resources and transmission upgrades that could meet the needs identified in the RNA. In addition, reconfiguration of transmission facilities and/or modifications to operating protocols identified in the solution phase could result in changes in or modification of the needs identified in the RNA.

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 address the long-term reliability of the New York State bulk power system. This RNA consists of this document and the supporting documents and appendices attached hereto. Just as important as the electric system plan is the process of planning itself. Electric system planning is an ongoing process of evaluating, monitoring and updating as conditions warrant. In addition to addressing reliability, the CRPP is also designed to provide information that is both informative and of value to the New York wholesale electricity marketplace. A full description of the Comprehensive Reliability Planning Process is contained in Section 2 of the Supporting Document.

Base Case Assumptions, Drivers and Determination of Needs

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

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

The NYISO developed the system representation for the second five years of the Study Period using (1) the most recent Load and Capacity Data Report published by the NYISO on its web site; (2) the most recent versions of NYISO reliability analyses and assessments provided for or published by NERC, NPCC, NYSRC, and Neighboring Control Areas; (3) information reported by neighboring control areas such as power flow data, forecasted load, significant new or modified generation and transmission facilities, and anticipated system conditions that the NYISO determines may impact the bulk-power transmission facilities; and (4) Market Participant input. Based on this process, the network model for the second five-year period was identical to the network model for the year 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.

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 base-case does not include all projects currently listed on the NYISO's interconnection queue.

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.

Table 1 below presents the unit retirements, which were represented in the base case:

Table 1

RETIREMENTS

OWNER / OPERATOR	STATION UNIT	ZONE	DATE	CAPABILITY (kW) SUMMER	CAPABILITY (kW) WINTER	REASON FOR RETIREMENT
Scheduled Retirements with New Projects						
Consolidated Edison Company of NY, Inc.	Waterside 6,8,9	J	7/1/2005	167200	167800	Station Repowering
New York Power Authority	Poletti 1 *	J	2/1/2008	885300	885700	Station Replacement
PSEG Power NY	Albany 1,2,3,4 **	ROS	3/1/2005	312300	364600	Station Replacement
Scheduled Retirements						
NRG Power, Inc.	Huntley 63,64 **	ROS	11/1/2005	60600	96800	Environmental Restrictions
NRG Power, Inc.	Huntley 65,66**	ROS	11/1/2006	166800	170000	Environmental Restrictions
Rochester Gas and Electric Corporation	Russell Station	ROS	12/1/2007	238000	245000	Environmental Restrictions
Planned Retirements						
Mirant Corporation	Lovett 5	ROS	6/1/2007	188500	189700	Company 10-K Report
Mirant Corporation	Lovett 3	ROS	6/1/2008	68500	68500	Company 10-K Report
Mirant Corporation	Lovett 4	ROS	6/1/2008	174000	175500	Company 10-K Report
				2261200	2363600	

* Unit can remain in service for two years beyond scheduled retirement date, if needed to meet reliability requirements.

** Units have been netted out of Existing Generating Capacity.

This table of retirements is set forth in the RNA because it is indicative of potential adverse impacts to the reliability of the NY BPTFs.

Table 2 below presents the unit additions, which were represented in the base case:

Table 2

OWNER / OPERATOR	STATION UNIT	ZONE	DATE	CAPABILITY (kW) SUMMER	CAPABILITY (kW) WINTER	UNIT TYPE
Projects Under Construction						
Consolidated Edison of NY, Inc.	East River Repowering	J	7/1/2005	288000	288000	Combined Cycle
New York Power Authority	NYPA 500 MW Project	J	1/1/2006	500000	500000	Combined Cycle
SCS Energy, LLC	Astoria Energy (Phase 1)	J	4/1/2006	500000	500000	Combined Cycle
Calpine Eastern Corporation	Bethpage 3	K	5/1/2005	79900	79900	Combined Cycle
Pinelawn Power, LLC	Pinelawn Power I	K	5/1/2005	79900	79900	Combined Cycle
PSEG Power NY	Bethlehem Energy Center	ROS	7/1/2005	750000	750000	Combined Cycle
				2197800	2197800	

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

Reliability Criteria

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

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

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

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

Reliability Needs

This reliability needs assessment for the New York State bulk-power[1] baseline system for the first Five Year period indicates that the forecasted system does not meet reliability criteria. Therefore, because of continued load growth and no resource additions, the second Five Year period does not meet reliability criteria. Load growth in excess of two percent per year which totals almost 5,000 MW in Southeast New York State (SENY), defined as load zones G-K, with the minimal addition of approximately 1250 MW of net new generating capacity in that area over the last ten years, has led to increasing dependence on the transmission system to meet capacity and energy needs in SENY. The

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

demands that are increasingly being placed on the transmission system in conjunction with other system changes, consisting primarily of generating unit retirements listed in table 1, neighboring system changes, and load growth have and will continue to result in voltage criteria violations at much lower transfer levels than had been previously observed. The result is that transfers into SENY will be limited by voltage constraints rather than thermal constraints. This reduced capability to make power transfers to SENY due to these voltage constraints, coupled with continuing load growth in SENY results in a resource adequacy criterion violation as early as 2008. Below are the major findings of the Reliability Needs Assessment:

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

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

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

2 See Supporting Document Section 11 Table 11.1.4 page 53
3 See Supporting Document Section 11 Table 11.1.9 page 50
4 See Supporting Document Section 11 Table 11.1.4 page 53

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

Base Case Compensatory MW (MW are cumulative)

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

LOLE Results after the Addition of the Compensatory MW

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

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

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

as the addition of the series reactors in the New York City cable system. The voltage criteria violations exist both pre- and post- contingency. Also impacting the voltage limits are severe tower contingencies that include generation, shunt capacitor, and /or transformer loss. Depending on the amount of supply, transmission and demand-side resources that are added to the system, the degree to which it will be necessary to correct the identified voltage constraints will vary.

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

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

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

Compensatory MW Thermal Sensitivity Case

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

LOLE Thermal Sensitivity Case

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

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

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

Scenarios

Scenarios are variations on key assumptions in the base case to assess the impact of possible changes in circumstances that could impact the RNA. The following scenarios were evaluated as part of the RNA.

1. Retirement of Older Coal Plants

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

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

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

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

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

3. M29 Transmission Project

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

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

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

4. Load Forecast Uncertainty

a. High Load Forecast

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

Impact of High Load Forecast on LOLE

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

Historic Congestion

The graph below presents cumulative historical congestion dollars as determined by the bid-production-cost-savings methodology for the years 2003, 2004 and the first two quarters of 2005. The results through 2005 Q2 are comparable to previous years. The total congestion for 2005 through Q2 is slightly higher than previous years. It is higher than 2004 Q2, similar to 2003 Q2. There were no unusual days in 2005 and the binding constraints are similar to previous years. The detailed congestion information can be found on the NYISO web site under Services Planning.