



# **TRIENNIAL REVIEW OF RESOURCE ADEQUACY**

**COVERING THE  
NORTHEAST POWER COORDINATING COUNCIL'S**

**NEW YORK CONTROL AREA**

**For the years 2002 – 2006**

**June 26, 2002**



## **1.0 EXECUTIVE SUMMARY**

### **1.1 Major Findings**

The New York Control Area (NYCA) Triennial Review of Resource Adequacy, conducted by the New York Independent System Operator (NYISO), supplants the 1999 Review that was approved by Northeast Power Coordinating Council's (NPCC) Joint Coordinating Committees in April 1999. Since that time there have been several events that have affected the Resource Plan of the NYISO. In December of 1999, the NYISO assumed control of the New York State bulk power transmission system from the New York Power Pool (NYPP). Simultaneously, the NYISO began operation of markets for wholesale energy and Installed Capacity (ICAP), as well as various ancillary services. In addition, a separate, independent not for profit organization, known as the New York State Reliability Council (NYSRC) was formed to promote and preserve the reliability of the New York State Power System.

In terms of load growth, despite the effects of the loss of the Rockland Electric Company load of over 400 MW to the Pennsylvania, New Jersey, Maryland (PJM) Control Area and the World Trade Center disaster, the 2002 load forecast through 2006 is almost 800 MW higher than that of the 1999 forecast through the same period. This is the result of the robust economy after 1999 along with the projected economic recovery of the current mild recession.

The 2002 Triennial Review demonstrates that the number of firm load disconnections range from 0.003 to 0.043 days/year for the base and high load forecasts, recognizing Load Forecast Uncertainty (LFU). For the period 2002 through 2006, the New York Control Area (NYCA) is in compliance and has sufficient existing resource capacity and planned resource capacity additions of 920 MW to meet the NPCC resource adequacy design criterion.

## 1.2 Major Assumptions and Results

Table I shows study results and where in the report to locate the major assumptions. The basis for the assumptions in this study is the New York State Reliability Council's (NYSRC) Installed Reserve Margin (IRM) Study for 2002<sup>1</sup>.

**TABLE I**  
**MAJOR ASSUMPTIONS AND RESULTS**

<u>ASSUMPTION</u>	<u>DESCRIPTION</u>	<u>REF. PAGE</u>
Criterion	NPCC Criterion of 1 day in 10 years disconnection	4
Reliability Study		
Program	GE MARS Program	19
Load Model	8760 Hours	14
Load Uncertainty	Historical Basis	14
Unit Availability		
Definition	NERC-GADS (EFORD)	15
Basis	10 Year History	15
Maintenance Schedule	Planned, modified to reflect 10 Year History	15
Emergency Operating Procedures	Modeled	5
Operating Reserve	Modeled	5
<b><u>RESULTS</u></b>		
Adequacy of System	Through 2006 with base and high load forecast	10
	<b>Base Case</b>	<b>High Forecast Case</b>
	Expected Number of Firm Load Disconnections	Expected Number of Firm Load Disconnections
<u>Year</u>	<u>Days/year</u>	<u>Days/year</u>
2002	0.006	0.010
2003	0.004	0.009
2004	0.003	0.010
2005	0.008	0.021
2006	0.017	0.043

<sup>1</sup> NYSRC Report titled, "New York Control Area Installed Capacity Requirements for the Period May 2002 Through April 2003", dated December 14, 2001.

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### **3.0 INTRODUCTION**

This report was prepared to satisfy the Triennial Review requirements of the Northeast Power Coordinating Council (NPCC) “Guidelines of Area Review of Resource Adequacy (Revised: June 28, 2001).”

The report demonstrates that NYISO is expected to meet the NYSRC and NPCC resource adequacy design criterion (i.e., the frequency of disconnecting non-interruptible customers due to resource deficiencies, on average, will be no more than once in ten years) for the period 2002 through 2006 under both base case and high load forecast scenarios.

#### **3.1 Previous Triennial Review**

The NPCC Joint Coordinating Committees approved the previous NYPP Triennial Review in April 1999. That review concluded that NYPP had adequate capacity planned or available to meet its load forecast for the ten-year planning period.

#### **3.2 Comparison of Current and Previous Resource Plans**

Since the 1999 Review, NYISO has begun operation as an Independent System Operator (12/99). The uncertainties that existed around how the installed reserve requirements would be set and how the market would operate to meet those requirements have been resolved. The New York State Reliability Council (NYSRC) sets the statewide Installed Reserve Margin<sup>2</sup> (IRM) annually consistent with the NPCC reliability criterion and the more stringent NYSRC criterion. The procurement of installed capacity by Load Serving Entities (LSE’s) to meet the IRM is accomplished through the NYISO administered installed capacity market. LSE’s can meet their obligations through bilateral contracts directly with suppliers or through periodic NYISO ICAP auctions. The NYISO, in administering the ICAP market, allows a specified amount of external ICAP resources to be sold into the market. This specified amount is based on the import capability of the external interfaces less an amount for emergency assistance. In this manner, resources required to meet the installed reserve requirement need not be located within the control area, but can be selected on a least cost basis subject to import constraints. Also, the plan allows resources other than generators to play an important role in meeting the reserve requirements.

In 1999, NYPP’s “EIA-411 Report” projected annual peak load growth of 0.9% and annual energy growth of 1.1%. Figure 1 compares this growth with that provided in 2002 by Economy.com (formerly RFA Associates). Despite the effects of the loss of the Rockland Electric Company load of over 400 MW to the Pennsylvania, New Jersey, Maryland (PJM) Control Area and the effects of the World Trade Center disaster, the 2002 forecast is almost 800 MW higher than the 1999 forecast due to the effects of an assumed robust economy.

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<sup>2</sup> NYSRC Report titled, “New York Control Area Installed Capacity Requirements for the Period May 2002 Through April 2003”, dated December 14, 2001.

The comparison of 1999 and 2002 load forecasts is shown in Figure 1. Both forecasts are net of Demand Side Management (DSM).

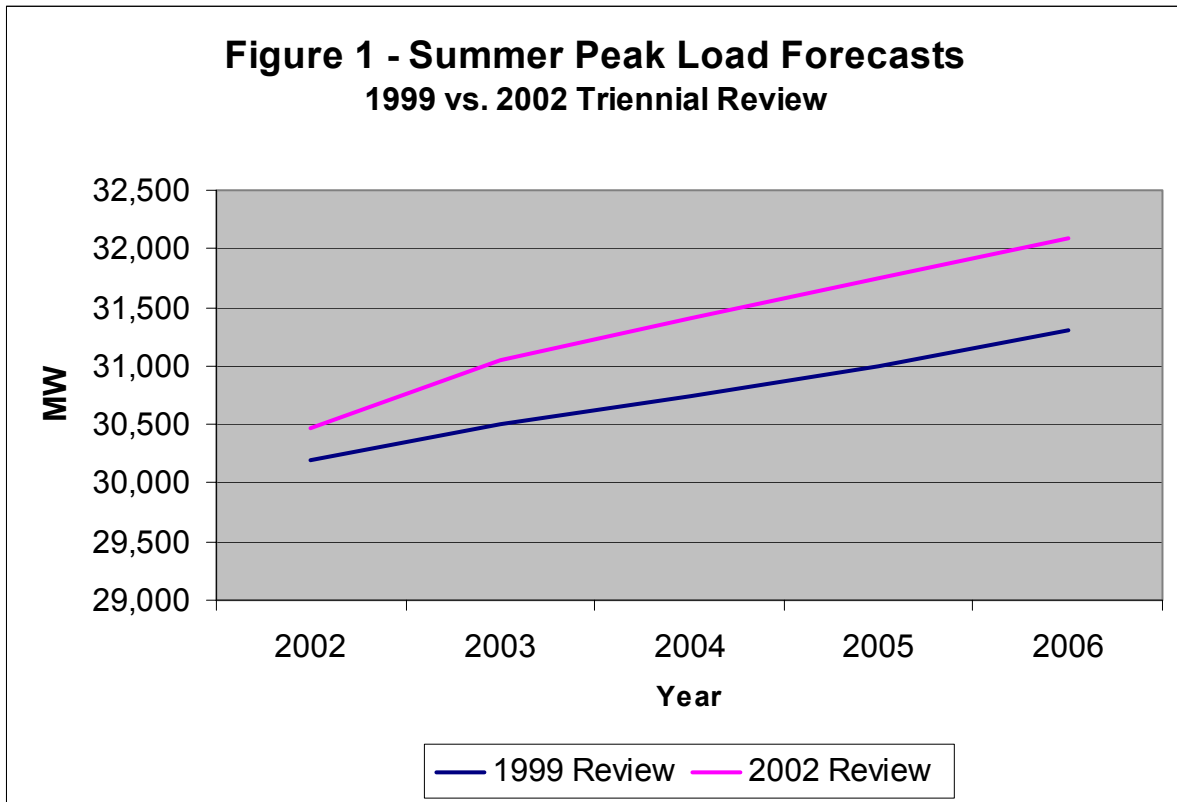
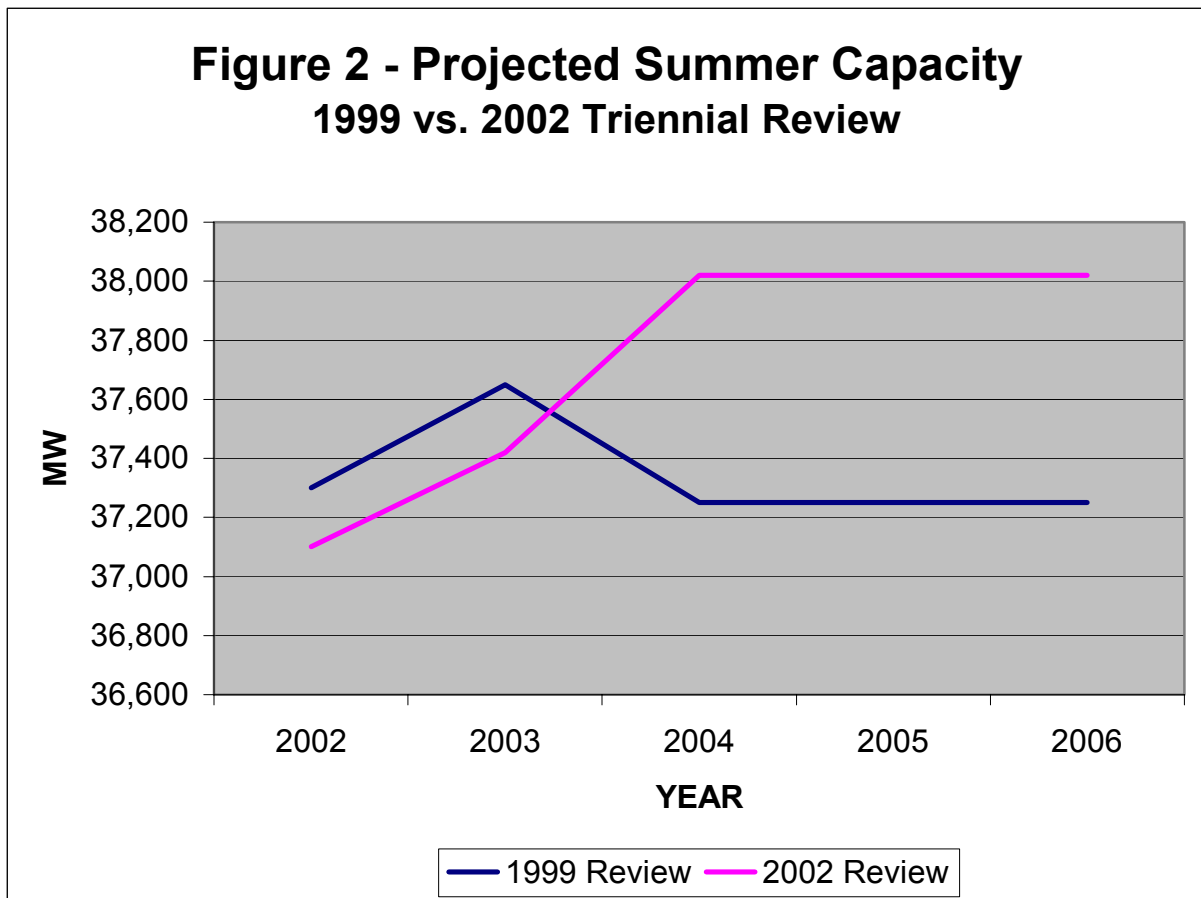




Figure 2 shows the capacity projection made in 1999 versus the current (2002) projection. The 2002 forecast includes a projection of Special Case Resources that are made up of distributed generation and interruptible load customers not metered in real time by the NYISO. The 1999 report did not reference a specific capacity plan. Instead, the report indicated that the resource adequacy criterion would be met through the ICAP market of the then soon to be established NYISO.



## **4.0 RESOURCE ADEQUACY CRITERION**

### **4.1 Statement of NPCC and NYSRC Resource Adequacy Criteria**

The NYISO adheres to the NPCC resource adequacy criterion, which reads:

“Each Area’s resources will be planned in such a manner that, after due allowance for scheduled outages and deratings, forced outages and deratings, assistance over interconnections with neighboring Areas and regions, and capacity and/or load relief from available operating procedures, the probability of disconnecting non-interruptible customers due to resource deficiencies, on the average, will be no more than once in ten years.”

The NYISO also adheres to the more stringent NYSRC resource adequacy criterion (A-R1), which reads:

“Adequate resource capacity shall exist in the New York Control Area (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.”

The NYSRC criterion is more stringent since it recognizes load forecast uncertainty and the New York State Transmission System transfer capability. In addition, NYSRC imposes Installed Capacity Requirements on NYCA Load Serving Entities (A-R2), as follows:

"LSEs shall be required to procure sufficient resource capacity for the entire NYISO defined obligation procurement period so as to meet the statewide IRM requirement determined from A-R1. Further, this LSE capacity obligation shall be distributed so as to meet locational ICAP requirements, considering the availability and capability of the NYS Transmission System to maintain the A-R1 reliability requirements."

This means that NYS Transmission System capability limitations shall not prevent NYISO from meeting the NYSRC resource adequacy criterion.

NYSRC uses these criteria to establish the appropriate NYISO installed reserve requirements. According to these criteria, expected disconnections are limited to once in ten years. However, before a load disconnection will occur, a series of emergency operating procedures (EOP's) will be invoked. These are aimed at either reducing load or increasing capacity. The procedures are described in section 4.2.

## 4.2 Statement of NYISO Emergency Operating Procedures (EOPs)

Table II lists the selection of load control and generator resource supplements that may be available on an emergency basis to reduce the possibility of customer disconnections. These EOPs are initiated when required by the senior NYISO dispatcher. In general, the priority order shown in Table II is followed. These EOP's are also modeled in NYISO and NYSRC reliability studies.

**TABLE II**  
**EMERGENCY OPERATING PROCEDURES**

Step	Procedure	Effect	Percentage	MW Value
1	Purchase	Increase capacity	----	Varies*
2	Cancel firm sales	Load relief	N/A**	0 MW
3	5% manual voltage Reduction	Load relief	0.26	80 MW***
4	Thirty-minute reserve to zero	Allow operating reserve to decrease to largest unit capacity (10-minute reserve)	N/A	600 MW
5	5% remote voltage reduction	Load relief	1.53	470 MW***
6	8% remote voltage reduction	Load relief	0.47	144 MW****
7	Curtail Company use	Load relief	N/A	48 MW
8	Voluntary industrial curtailment	Load relief	N/A	320 MW
9	General public appeals	Load relief	N/A	138 MW
10	Ten-minute reserve to zero	Allow 10-minute reserve to decrease to zero	N/A	1200 MW
11	Customer disconnections	Load relief	N/A	As needed

\* The modeling of emergency purchases is accomplished through the reserve sharing mechanisms of the MARS software.

\*\*N/A indicates that the EOP step is modeled at a fixed MW value instead of as a percentage

\*\*\* These EOPs are modeled in the MARS program as a percentage. The associated MW value is based on a forecast 2002 peak load of 30,650 MW (a later forecast of 30,475 MW has been adopted).

\*\*\*\* If the 8% remote voltage reduction were included the Con Edison system could expect an additional 144 MW of load reduction.

### **4.3 Statement of Required Installed Reserve**

For resource planning, NYSRC requires an 18% installed reserve margin over the NYSIO annual peak load. A recent reliability study (see Section 4.5) demonstrated that this reserve level meets the NPCC resource reliability criterion.

Interconnections to neighboring Areas are considered as a part of NYISO analysis of installed reserve adequacy. The 2002 NYSRC IRM study showed that interconnection support allows the installed reserve margin to be reduced from roughly 25% to 18% for approximately a 2,100 MW benefit.

### **4.4 Comparison of NYSRC and NPCC Resource Reliability Criteria**

The NYSRC resource adequacy criterion is more stringent (see section 4.1) than the criterion established by NPCC. The NYSRC ensures the criterion is met by imposing an Installed Reserve Margin (IRM) requirement on the NYCA.

### **4.5 Reliability Study Results**

Studies<sup>3</sup> conducted since the last Triennial Review resulted in annual IRM requirements of 18%. These studies showed that for a NYCA installed reserve margin of 18%, the expected frequency of disconnecting non-interruptible customers due to resource deficiencies would be less than one day in ten years. The General Electric MARS (Multi-Area Reliability Simulation) model was used for these studies. This model has also been used in other periodic studies such as “Review of Interconnection Assistance Reliability Benefits” and “Summer Multi-Area Probabilistic Reliability Assessment” performed by Working Groups under the direction of NPCC’s Task Force on Coordination of Planning.

These IRM studies also determined that internal NYCA transmission constraints would not cause its resource adequacy design criterion to be violated when an 18% installed reserve margin is maintained. The IRM study demonstrates that when the locational installed capacity requirements are met, internal NYCA constraints do not affect statewide reserve margin requirements. These locational installed capacity requirements are set through an NYISO study<sup>4</sup>.

NYISO has updated the database used in the latest IRM study for use in the currently planned CP-8 “2002 Review of Interconnection Assistance Reliability Benefits” study. Updated load and capacity forecasts and revised forced outage rates are the most significant changes.

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<sup>3</sup> NYSRC Report titled, “New York Control Area Installed Capacity Requirements for the Period May 2000 Through April 2001”, dated January 31, 2000, NYSRC Report titled, “New York Control Area Installed Capacity Requirements for the Period May 2001 Through April 2002”, dated December 14, 2000, and NYSRC Report titled, “New York Control Area Installed Capacity Requirement for the Period May 2002 - April 2003”, dated December 14, 2001.

<sup>4</sup> “Locational Installed Requirements Study, Covering the New York Control Area, For the 2001-2002 Capability Year”, New York Independent System Operator, dated 2/15/01, and the same report covering the 2002-2003 Capability Year, dated 2/28/02

NYISO's assumed interconnection benefit is within the bounds of the previous NPCC tie benefits study<sup>5</sup>.

The above assessments demonstrate that an 18% reserve level is sufficient for NYISO to meet the NPCC resource adequacy design criterion.

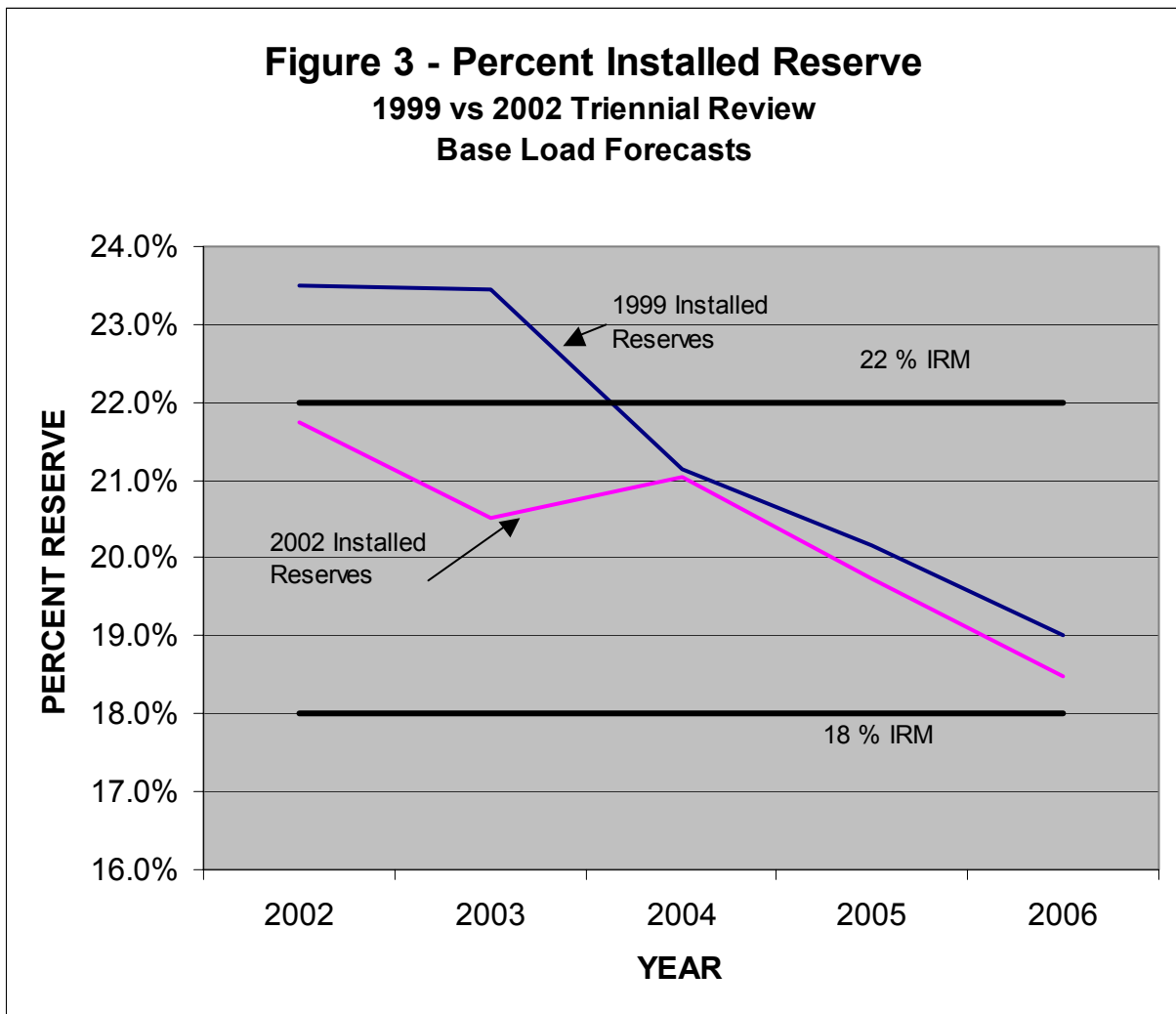
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<sup>5</sup> NPCC CP-5 Working Group report titled, "Review of Interconnection Assistance Reliability Benefits" dated May 12, 1999.

## 5.0 RESOURCE ADEQUACY ASSESSMENT

### 5.1 Planned vs. Required Reserve for Base Case Load Forecast

Figure 3 shows the projected NYPP installed reserve levels for the base load forecast made in 1999 vs the NYISO 2002 forecast along with the 18% required reserve margin for maintaining the NPCC criterion. The 18% requirement for the 2002-2003 capability year is extended, in the figure, for reference purposes. The NYSRC has not set reserves for the years beyond the 2002-2003 capability year. The 22% required reserve margin from the 1999 study is also shown for reference. The base load forecast is based on a 2002 economic forecast that was provided by Economy.com (formerly RFA associates) and is the expected scenario, having 50% probabilities of being exceeded or of not being met.



**TABLE III**

<b>COMPARISON OF PLANNED AND REQUIRED RESERVE BASE LOAD FORECAST</b>							
<b>Year</b>	<b>July Installed Capacity MW<sup>6</sup></b>	<b>System Peak Forecast MW</b>	<b>Planned Reserve</b>		<b>Required Reserve<sup>7</sup></b>		<b>LOLE</b>
			<b>MW</b>	<b>%</b>	<b>MW</b>	<b>%</b>	
2002	37100	30475	6625	21.7	5486	18.0	0.006
2003	37420	31053	6367	20.5	5590	18.0	0.004
2004	38020	31408	6612	21.1	5653	18.0	0.003
2005	38020	31755	6265	19.7	5716	18.0	0.008
2006	38020	32086	5934	18.5	5775	18.0	0.017

Table III shows the planned vs. required reserves over the study period and compares them against the NYISO base load forecast. Although over 3400 MW of capacity has been approved under New York's Article X process, only 920 MW of projects are represented in this analysis. While this approach is conservative, it should be noted that the majority of these selected resources are located in the zones within the NYCA that exhibit the highest LOLE in the MARS model output. The selection of these units was based on the ability of developers to recently site and build projects. These units have been built in the areas that have exhibited the highest energy prices in New York.

As a sensitivity analysis, a portion of the projected 920 MW of capacity was added in the NYCA zones where the LOLE was low. This was done in a manner to maintain the minimum locality requirements in the high LOLE zones. The results indicated that even if the majority of projected additions were installed in low LOLE zones, adequate installed capacity would exist to meet criterion.

Figure 3 and Table III show that NYISO is expected to have adequate installed capacity under the present 18% reserve requirement.

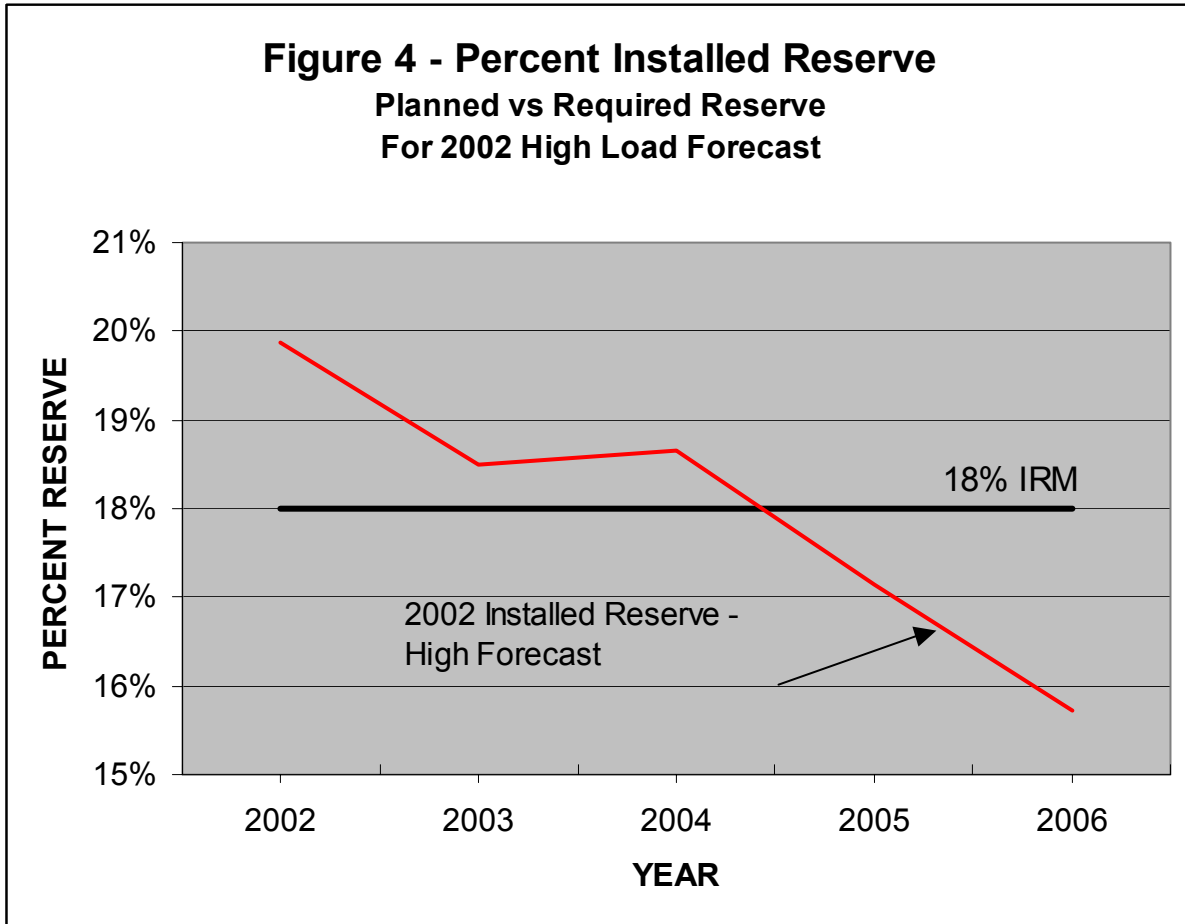
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<sup>6</sup> Includes 515 MW of Special Case Resources (see Appendix A, section A 1.1.4)

<sup>7</sup> Required reserves are set annually. The 18% requirement is for the period May 2002 through April 2003. This table shows 18% requirement in other years for reference purposes only.

## 5.2 Planned vs. Required Reserve for High Load Forecast

Figure 4 shows the NYISO 2002 high load forecast along with the 18% required reserve for maintaining the NPCC and NYSRC criterion. The 18% requirement for the 2002-2003 capability year is extended, in the figure, for reference purposes. The 2002 high load forecast reflects a more robust economy than the base case. This level of economic growth is estimated to have approximately a 20% probability of occurring.





**TABLE IV**

<b>COMPARISION OF PLANNED AND REQUIRED RESERVE HIGH LOAD FORECAST</b>							
<b>Year</b>	<b>July Installed Capacity MW<sup>8</sup></b>	<b>System Peak Forecast MW</b>	<b>Planned Reserve</b>		<b>Required Reserve<sup>9</sup></b>		<b>LOLE</b>
			<b>MW</b>	<b>%</b>	<b>MW</b>	<b>%</b>	
2002	37100	30950	6150	19.9	5571	18.0	0.010
2003	37420	31581	5839	18.5	5685	18.0	0.009
2004	38020	32042	5978	18.7	5768	18.0	0.010
2005	38020	32458	5562	17.1	5842	18.0	0.021
2006	38020	32857	5163	15.7	5914	18.0	0.043

Table IV shows the planned vs. required reserves over the study period and compares them against the NYISO high load forecast. Although the planned reserve falls below the currently established IRM of 18% for the years 2005 and 2006, the LOLE for these is below the NPCC criterion of once in ten years (expressed above on an average basis of 0.100 days/year). Two immediate factors that explain these LOLE results are the placement of capacity into the high LOLE zone (see sec. 5.1) and the inclusion of the 330 MW DC tie from Connecticut to Long Island that is currently under construction.

### **5.3 Contingency Plans**

The establishment of an open market for ICAP along with the imposition of locational ICAP requirements<sup>10</sup> has led to target capacity additions in the NYCA. In New York City, for example, shortfalls in ICAP of 300 MW and 296 MW for 2000 and 2001, respectively, have changed to a surplus of 175 MW<sup>11</sup> in 2002. Similarly, shortfalls of 270 MW and 131 MW for Long Island in 2000, and 2001 have turned into a surplus of 103 MW. The addition of capacity has occurred in zones where market prices have been high. In addition, over 3,400

<sup>8</sup> Includes 515 MW of Special Case Resources (see Appendix A, section A 1.1.4)

<sup>9</sup> Required reserves are set annually. The 18% requirement is for the period May 2002 through April 2003. This table shows 18% requirement in other years for reference purposes only.

<sup>10</sup> **Locational Installed Capacity Requirement (“Locational ICAP Requirement”)** – Due to transmission constraints, that portion of the NYCA ICAP requirement that must be electrically located within a zone, in order to ensure that sufficient energy and capacity are available in that zone and that NYSRC Reliability Rules are met. Definition from “NYSRC RELIABILITY RULES For Planning And Operating the New York State Power System”, Revision 2, February 1, 2002.

<sup>11</sup>“ Locational Installed Requirements Study, Covering the New York Control Area, For the 2001-2002 Capability Year”, New York Independent System Operator, dated 2/15/01, and the same report covering the 2002-2003 Capability Year, dated 2/28/02

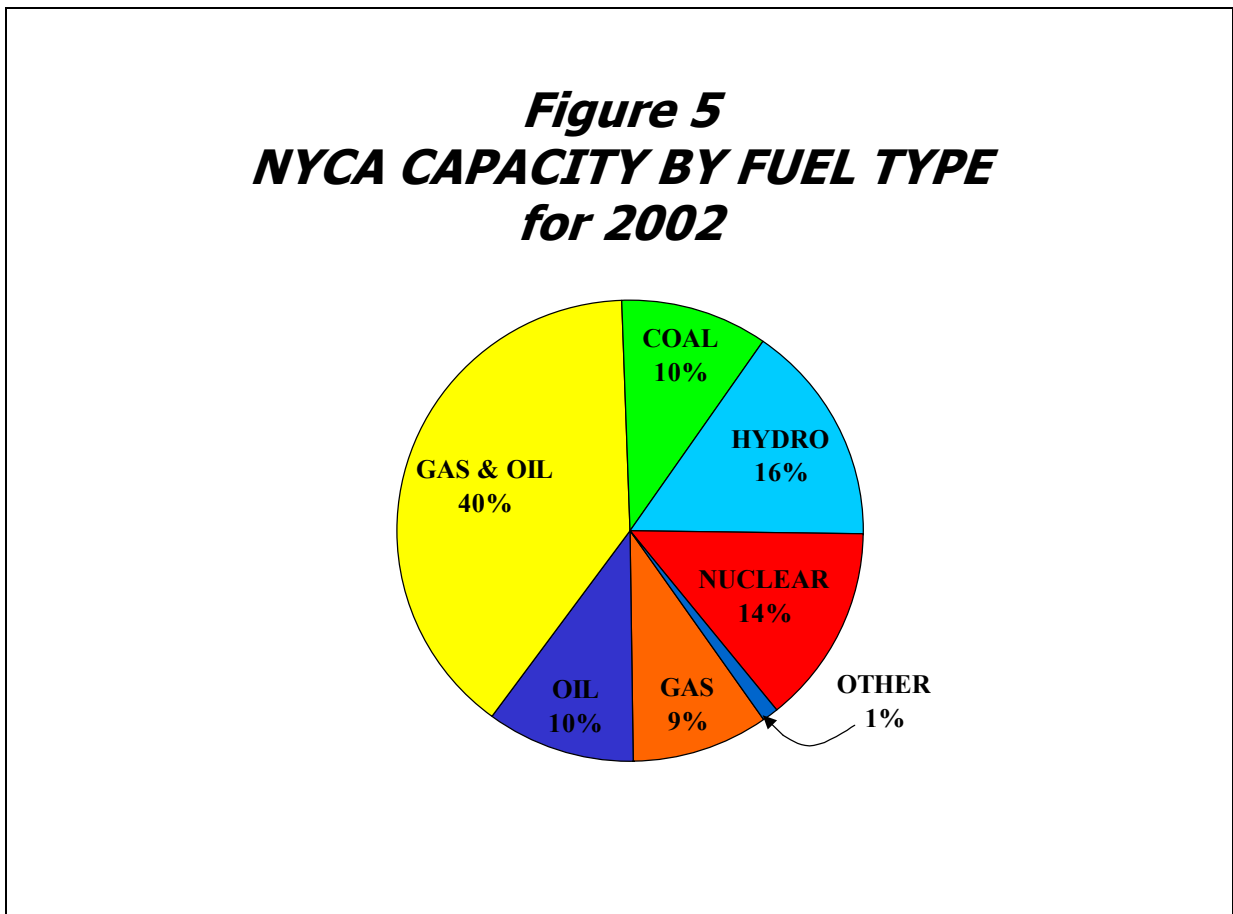
MW of capacity has been approved for construction under New York State's Article X citing process. If these facilities are built, as planned, resources will be sufficient to meet both expected and high load forecast assumptions.

In the event of higher than modeled load growth and cessation of capacity additions, several options would be considered. These options include additional purchases of regional excess installed capacity and the accelerated promotion of Special Case Resources and Emergency Demand Relief Program measures. The NYISO has already had a great deal of success with these programs, attracting over 600 MW of measures in 2001, with over 700 MW signed up to date for the summer of 2002.

## 6.0 PLANNED RESOURCE CAPACITY MIX

### 6.1 Planned Resource Capacity Mix

Figure 5 depicts NYISO's resource capacity mix by fuel type for the year 2002 on an installed capacity basis.



<b>TABLE V</b>							
<b>Planned Resource Capacity Mix By Year</b>							
<b>Month Of July</b>	<b>Coal %</b>	<b>Gas &amp; Oil %</b>	<b>Gas Only %</b>	<b>Hydro %</b>	<b>Nuclear %</b>	<b>Oil Only %</b>	<b>Other %</b>
<b>2002</b>	10.5	39.3	9.5	15.6	13.9	10.3	1.0
<b>2003</b>	10.4	39.0	10.3	15.5	13.8	10.2	1.0
<b>2004</b>	10.2	38.4	11.7	15.2	13.5	10.0	1.0
<b>2005</b>	10.2	38.4	11.7	15.2	13.5	10.0	1.0
<b>2006</b>	10.2	38.4	11.7	15.2	13.5	10.0	1.0

Table V shows the projected installed capacity resource mix from 2002 through 2006. The “other” category includes wind power, resource recovery, wood burning, and other fuels.

## **6.2 Reliability Impact of Resource Diversification Strategy**

The deregulation of the electric infrastructure and the opening of the wholesale electric markets have caused a lapse in the movement to develop diversely fuelled resources. Although this is beginning to be addressed in the U.S. on a federal level through a national energy plan, the short-term implication is that new capacity additions will be driven only by current economic considerations.

For the duration of this study period in New York, resources fueled by natural gas will meet all of the growth in projected energy consumption. No new resources employing other fuels are expected to be added in the planning period. The growth in gas is due to the new resources referred to in Section 5.1.

In response to the increasing dependence of the electric system on gas-fired generation, the NYISO is participating in two studies addressing the issue of gas deliverability. The first study is being co-sponsored with the New York Research and Development Agency and focuses on New York State. This study has examined whether there is sufficient natural gas infrastructure (i.e., pipelines) to supply the needs of core natural gas customers and gas-fired electric generation, and whether any such constraints in natural gas deliverability impair the electric system’s ability to serve load. The study is examining system operations under steady state and contingency conditions. The final report for this study should be available in June 2002. The second study is being conducted jointly with the IMO, PJM, and ISO-NE, and is examining gas deliverability issues from a regional perspective, particularly the impact of gas contingencies in one control area on gas availability in other control areas. This study was initiated in May 2002 and should be completed in 2003.

In terms of operational strategy, the NYSRC has adopted the following local reliability rule:

**I-R3. Loss of Generator Gas Supply (New York City & Long Island)<sup>12</sup>**

**The NYS Bulk Power System shall be operated so that the loss of a single gas facility does not result in the loss of electric load within the New York City and Long Island zones.**

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<sup>12</sup> “NYSRC RELIABILITY RULES For Planning And Operating the New York State Power System”, Revision 2, February 1, 2002

## APPENDIX A

### A. DESCRIPTION OF RESOURCE RELIABILITY MODEL<sup>13</sup>

#### A 1.1 LOAD MODEL

##### *A 1.1.1 Description of Load Model*

MARS employs an 8760-hour chronological zonal load model. The load model currently used relies on an actual year of historical loads that has been demonstrated to give conservative results. Over the last several years, the 1995 load shape has consistently exhibited this characteristic when compared to current and past years. This model is then scaled up to the summer peak for the future year being analyzed.

##### *A 1.1.2 Load Forecast Uncertainty*

Load forecast uncertainty was determined by analyzing NYISO's actual vs. predicted loads for 1979 through 2001. The standard deviation resultant from this analysis is 1.07%.

##### *A 1.1.3 Loads of Other Areas*

These are based on each Area's load model used in the summer 2001 CP8 study<sup>14</sup>. The load models are scaled so the projected peaks for 2002 are obtained. Those control areas, external to NYCA, whose isolated LOLE's were below that of the NYCA were further adjusted to match the NYCA isolated LOLE.

##### *A 1.1.4 Demand Side Management*

The NYISO Demand Side Management program consists of the Special Case Resources (SCR's) program, the Emergency Demand Response Program (EDRP), and the Day-Ahead Demand Response Program (DADRP). These programs consist of loads that are capable of being interrupted and distributed generation that are activated on demand, and which are not metered directly by the NYISO. SCR's receive payment as ICAP providers for their capacity contribution. EDRP and DADRP participants receive incentives based on their energy contribution. SCR and EDRP programs are available as resources to operators in order to mitigate operating reserve deficiencies. The DADRP program is a bid-based economic resource.

SCRs are used to supplement other NYCA ICAP resources for meeting peak loads during July and August. This study assumed 515 MW of SCR capacity will be available during the

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<sup>13</sup> More detailed descriptions of the model can be found in the NYSRC Report titled, "New York Control Area Installed Capacity Requirements for the Period May 2002 Through April 2003"

<sup>14</sup> "NPCC Summer 2001 Multi-Area Probabilistic Reliability Assessment", conducted by the NPCC CP-8 Working Group, May 1, 2001.

summer periods. EDRP providers that also participate in SCR program are captured in the model as part of the 515 MW reference above. Those who do not participate as SCR's, as well as DADRP participants, are captured under the EOPs described in section 4.2 of this report.

## **A 1.2 RESOUCUE UNIT REPRESENTATION**

### ***A 1.2.1 Unit Ratings***

#### ***A 1.2.1.1 Definitions***

The unit ratings in reliability calculations, referred to as Dependable Maximum Net Capability (DMNC), are based on seasonal certification that establishes each unit's sustained maximum net output. Combustion turbines are tested for a one-hour period and all other units, for a four-hour period.

#### ***A 1.2.1.2 Procedure for Verifying Ratings***

The document that describes the procedure for verifying unit ratings through DMNC testing is in section 4.2 of the "NYISO Installed Capacity Manual".

### ***A 1.2.2 Unit Unavailability Factors***

#### ***A 1.2.2.1 Unavailability Factors Represented***

NYISO represents forced outage rates, planned outages, maintenance outages, and partial outage rates.

#### ***A 1.2.2.2 Source of Outage Factors***

Unit outage data is based on actual history. Unit forced and partial outage rates are calculated from NERC-GADS (North American Electric Reliability Council Generation Availability Data System) event data for the years 1991 – 2000.

Units that do not have a complete 10-year history for unscheduled outages are augmented with class average ratings from the NERC Generating Unit Statistical Brochure for the years 1995-1999.

Approved schedules for planned outages are compared to historical duration averages and may be adjusted before being input. Units that do not supply schedules are automatically scheduled by the program for durations based on historical averages from 10-year NERC-GADS data.

Historical hydro generation from the small units has been found to vary significantly by season. An analysis of the on-line data at the NYISO control center resulted in a monthly adjustment to the model.

*A 1.2.2.3 Maturity Considerations*

No separate immature/mature unavailability factors are used in NYISO reliability studies.

*A 1.2.2.4 Tabulation of Unavailability Factors*

Table A-1 presents the average availability factors used in the NYISO reliability study compared to NERC averages.

**Table A-1 Average Availability Factors**

Unit Type	MW Nameplate	EAF		FOR		EFORd	
		NERC	NYISO	NERC	NYISO	NERC	NYISO
<b>Coal - Primary</b>	<b>All Sizes</b>	83.98	80.41	4.80	4.10	6.58	6.83
<b>Gas - Primary</b>	<b>All Sizes</b>	84.16	83.21	7.49	3.38	7.06	4.98
<b>Oil - Primary</b>	<b>All Sizes</b>	83.69	77.56	8.46	8.71	7.82	12.52
<b>Nuclear - All Types</b>	<b>All Sizes</b>	75.87	73.74	10.39	17.66	12.33	18.68
<b>Jet Engine</b>	<b>All Sizes</b>	86.59	91.69	51.84	14.36	9.37	2.40
<b>Gas Turbine</b>	<b>All Sizes</b>	85.58	78.24	50.47	22.77	9.48	11.80
<b>Combined Cycle</b>	<b>All Sizes</b>	84.49	86.22	3.12	0.28	4.43	0.63
<b>Hydro</b>	<b>All Sizes</b>	89.95	61.73	4.86	1.60	4.04	1.31

*EAF- Equivalent Availability Factor*

*FOR - Forced Outage Rate*

*EOFRd - Equivalent Force Outage Rate during Demand*

### *A 1.2.3 Purchase and Sale Representation*

The following purchases of ICAP from other control areas and sales of ICAP to other control areas were modeled for the study years.

**TABLE A2**  
**ANNUAL EXTERNAL ICAP PURCHASES AND SALES – 2002-2006**

	Installed Capacity Purchases (MW)		Installed Capacity Sales (MW)	
	<u>Summer</u>	<u>Winter</u>	<u>Summer</u>	<u>Winter</u>
Hydro-Quebec	1200	0	0	0
ISO-New England	355	390	125	127
PJM	117	117	94	94
IMO	0	81	2	3
<u>ECAR</u>	<u>0</u>	<u>0</u>	<u>82</u>	<u>82</u>
TOTAL	1672	588	303	306

### *A 1.2.4 Retirements*

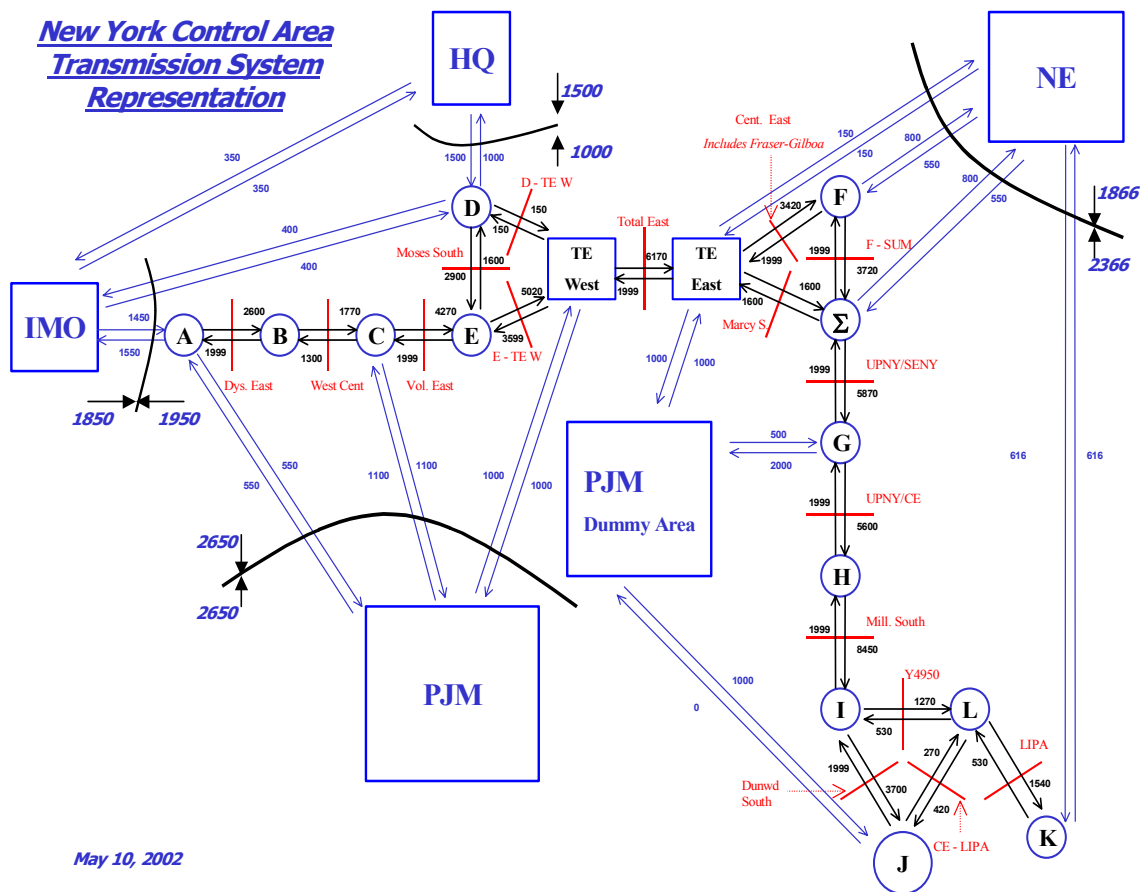
There were no retirements considered in the study.



### A 1.3 INTERCONNECTED SYSTEMS

The Independent Electricity Market Operator (IMO), ISO-New England, Hydro-Quebec, and PJM's interconnections were modeled as shown in Figure A1 below.

**Figure A1**  
**New York Control Area Transmission System Representation**



## **A 1.4 MODELING OF LIMITED ENERGY RESOURCES**

The Gilboa pumped storage facility is considered available for all hours in which the unit is not on forced or scheduled outage.

Seasonal variation in small hydro units is accounted for and is described in Section A 1.2.2.2 above.

The Robert Moses – Niagara hydroelectric project is modeled with a probability capacity model that is based on historical data.

## **A 1.5 MODELING OF DEMAND SIDE MANAGEMENT (DSM)**

A description of the DSM program is given in section A1.1.4. 515 MW of DSM Special Case Resources are modeled in the study. This amount is less than the total registered for the program and reflects actual operating history of these resources.

## **A 1.6 MODELING OF RESOURCES**

Modeling of resources is described in the above sections. Greater detail can be found in the IRM study<sup>15</sup>

## **A 1.7 OTHER ASSUMPTIONS**

Internal ties were modeled at emergency limits and can be seen on the previous figure A-1. Maintenance over-runs and environmental constraints were not modeled in this study. Derates on Gas Turbines were introduced due to lower output at higher than tested temperatures. These derates equate to 640 MW at a temperature of 100 Degrees F, or 80 MW per degree over the design test temperature of 92° F.

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<sup>15</sup> NYSRC Report titled, “New York Control Area Installed Capacity Requirements for the Period May 2002 Through April 2003”

## **APPENDIX B**

### **B. DESCRIPTION OF RELIABILITY PROGRAM**

NYISO uses the GE MARS model to perform its reliability studies. MARS can model multi-pool power systems and each pool can be modeled as several zones. MARS uses sequential Monte Carlo simulation to model the availability of generating units over the time period of the study. The study period is one year, with each day modeled sequentially. For each unit, the model generates a random operating profile based on its forced and partial outage rates. Units can be fully available, forced out, or in one of several partial availability states. The availability profiles for each unit change from replication to replication. Scheduled maintenance is developed externally based on history.

Total resource capacities are developed from these profiles for each area. These are compared to the daily peak loads. If an area's resource capacity is not enough to meet its load, emergency purchases are made to the extent excess capacity is available elsewhere and transmission constraints allow the excess capacity to be transmitted to the deficient area. If emergency purchases are not sufficient for the area to meet its load, then additional emergency operating procedures are initiated. If more than one area is deficient, excess reserves from other areas are shared between the deficient ones proportionately.

If an area is still deficient after all these steps, the program records that it has experienced a loss of load for that day at that load level. These resources are compared to various load levels that simulate load forecast uncertainty. The resultant loss of loads, when weighted by the probability of being at each load level, produces an expected value for that replication. These expected values are accumulated over the number of replications and the LOLE, and other measures of reliability, are calculated and reported.