Draft #1 – October 27, 2006

NEW YORK CONTROL AREA INSTALLED CAPACITY REQUIREMENTS FOR THE PERIOD MAY 2007 THROUGH APRIL 2008

TECHNICAL STUDY REPORT

December __, 2006
New York State Reliability Council, LLC
Installed Capacity Subcommittee

To be Revised

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INTRODUCTION

Section 3.03 of the New York State Reliability Council (NYSRC) Agreement states that the NYSRC shall establish the annual statewide Installed Capacity Requirements (ICR) for the New York Control Area (NYCA) consistent with North American Electric Reliability Council (NERC) and Northeast Power Coordinating Council (NPCC) standards. This report describes a technical study conducted by the NYSRC Installed Capacity Subcommittee (ICS) for establishing the NYCA required installed reserve margin (IRM) for the period of May 2007 through April 2008 (Year 2007) in compliance with the NYSRC Agreement. The NYSRC Executive Committee will consider these study results. along with other factors, to establish the Final NYCA IRM Requirement for 2007-08.

The ICR relates to the IRM through the following equation:

$$ICR = (1 + IRM\% / 100) \times \text{Forecasted NYCA Peak Load}$$

The New York Independent System Operator (NYISO) will implement the statewide ICR as determined by the NYSRC — in accordance with the NYSRC Reliability Rules and the "NYISO Installed Capacity" manual. The NYISO translates the required IRM to an "Unforced Capacity" (UCAP) basis, in accordance with a 2001 NYISO filing to FERC. Also, in June 2003 the NYISO replaced its monthly Deficiency Auction with a Spot Market Auction based on FERC approved "Demand Curves." These Unforced Capacity and Demand Curve concepts are described later in the report.

This Year 2007 IRM Requirement Study continued to implement two study methodologies that were utilized for the first time in 2005 for the 2006-07 IRM Study, the *Unified* and the *IRM Anchoring Methodologies.* These methodologies are discussed in detail under "Study Procedure". In addition to calculating NYCA IRM requirements, these methodologies also identify corresponding Minimum Locational Capacity Requirements (MLCR). In its role of setting the appropriate Locational Capacity Requirements (LCR), the NYISO considers the MLCR determined in this study. (Note: Consider adding words from the EC's "IRM-NYSRC Resolution" about the NYISO responsibility to determine LCRs.)

Definitions of certain terms in this report can be found in the NYSRC Glossary in the *NYSRC Reliability Rules for Planning and Operating the New York State Power System*, http://www.nysrc.org/documents.html.

EXECUTIVE SUMMARY

The base case for 2007 IRM Study calculated that **NYCA IRM requirement for the period May 2007 through April 2008 to be ___%.** For this base case the study also determined MLCRs of __% and __% for New York City and Long Island, respectively.

For the first time the NYISO's final peak load forecast for the following summer period, based on the most recent actual summer load conditions, was used for this study which allows both the IRM and NYISO LCR studies to nominally use the same model.

The study also evaluated IRM requirement impacts caused by the updating of key study assumptions and various sensitivity cases. These results are depicted in Tables 1 and 2 and in Appendix B-1. The sensitivity case results and other relevant factors provide the basis for a NYSRC Executive Committee establishment of the Final NYCA IRM Requirement for Year 2007.

NYSRC RESOURCE ADEQUACY RELIABILITY CRITERION

The acceptable LOLE reliability level used for establishing NYCA IRM Requirements is dictated by the NYSRC Reliability Rules, wherein Rule A-R1, *Statewide Installed Reserve Margin Requirements,* states:

> *The NYSRC shall establish the IRM requirement for the NYCA such that the probability (or risk) of disconnecting any firm load due to resource deficiencies shall be, on average, not more than once in ten years. Compliance with this criterion shall be evaluated probabilistically, such that the loss of load expectation (LOLE) of disconnecting firm load due to resource deficiencies shall be, on average, no more than 0.1 day per year. This evaluation shall make due allowance for demand uncertainty, scheduled outages and deratings, forced outages and deratings, assistance over interconnections with neighboring control areas, NYS Transmission System transfer capability, and capacity and/or load relief from available operating procedures.*

This NYSRC Reliability Rule is consistent with the NPCC Resource Adequacy Standard in NPCC Document A-2.

In accordance with NYSRC Rule A-R2, *Load Serving Entity (LSE) Installed Capacity Requirements*, the NYISO is required to establish LSE installed capacity requirements, including locational capacity requirements, in order to meet the statewide IRM requirements established by the NYSRC for maintaining NYSRC Rule A-R1 above.

The NYSRC Reliability Rules can be found on the NYSRC Web site, www.nysrc.org.

IRM STUDY PROCEDURES

The study procedures used for the 2007 IRM study are described in detail in NYSRC Policy 5-1, *Procedure for Establishing New York Control Area Installed Capacity Requirements*. Policy 5-1 describes the computer program used for the reliability calculation in addition to the procedures and types of input data and models used for the IRM Study. Policy 5-1 can be found on the NYSRC Web site, www.nysrc.org.

This study utilizes a *probabilistic* approach for determining the NYCA IRM requirements. This technique calculates the probabilities of generating unit outages, in conjunction with

load and transmission representations, to determine the days per year of expected capacity shortages.

GE-MARS is the primary analytical tool used for this probabilistic analysis. This program includes detailed load, generation, and transmission representation for the eleven NYCA Zones — plus four external Control Areas (Outside World Areas) directly interconnected to the NYCA. GE-MARS calculates "Loss of Load Expectation" (LOLE, expressed in days per year), to provide a consistent measure of system reliability.

Using the GE-MARS program, a procedure is utilized for establishing NYCA IRM requirements (termed the *Unified Methodology)* which establishes a graphical relationship between NYCA IRM and the LCRs. All points on these curves meet the NYSRC 0.1 days/year LOLE reliability criterion described above. This methodology develops two pairs of curves, one for NYC and one for LI. From these curves, base case NYCA IRM requirements and related MLCRs are established by a supplemental procedure (termed the *IRM Anchoring Methodology*) which is used to define *anchor points* on these curves. These anchor points are selected by applying a tangent of 45 degrees ("Tan 45") analysis at the bend (or "knee") of each curve. NYSRC Policy 5-1 provides detailed descriptions of these two methodologies.

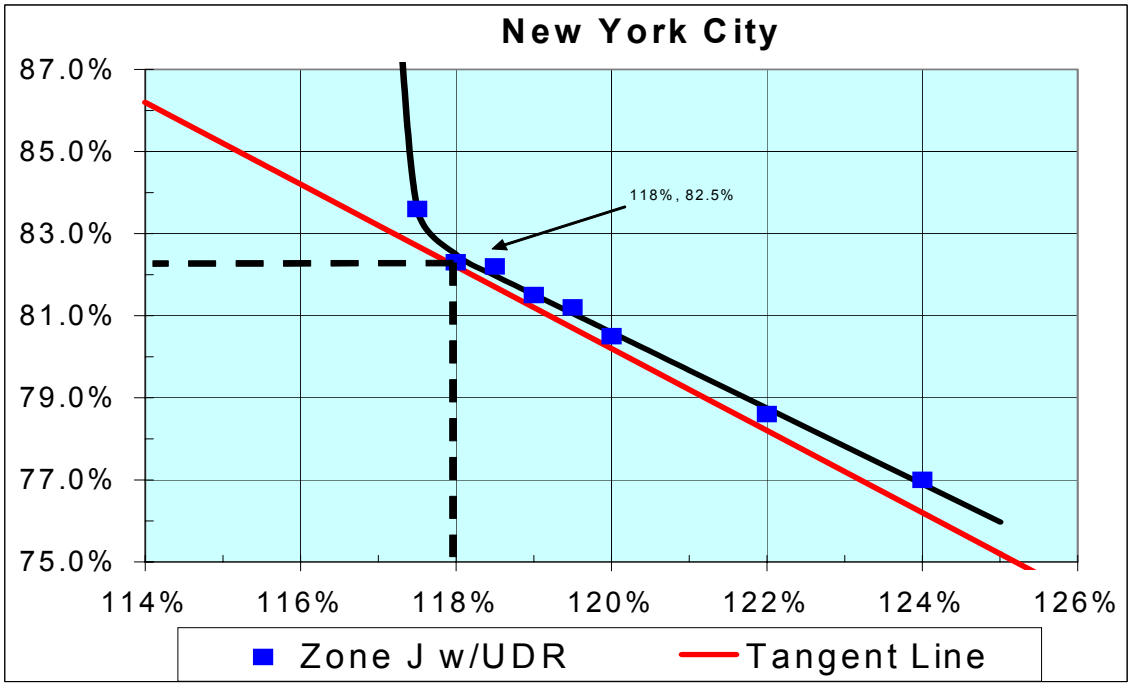
BASE CASE STUDY RESULTS

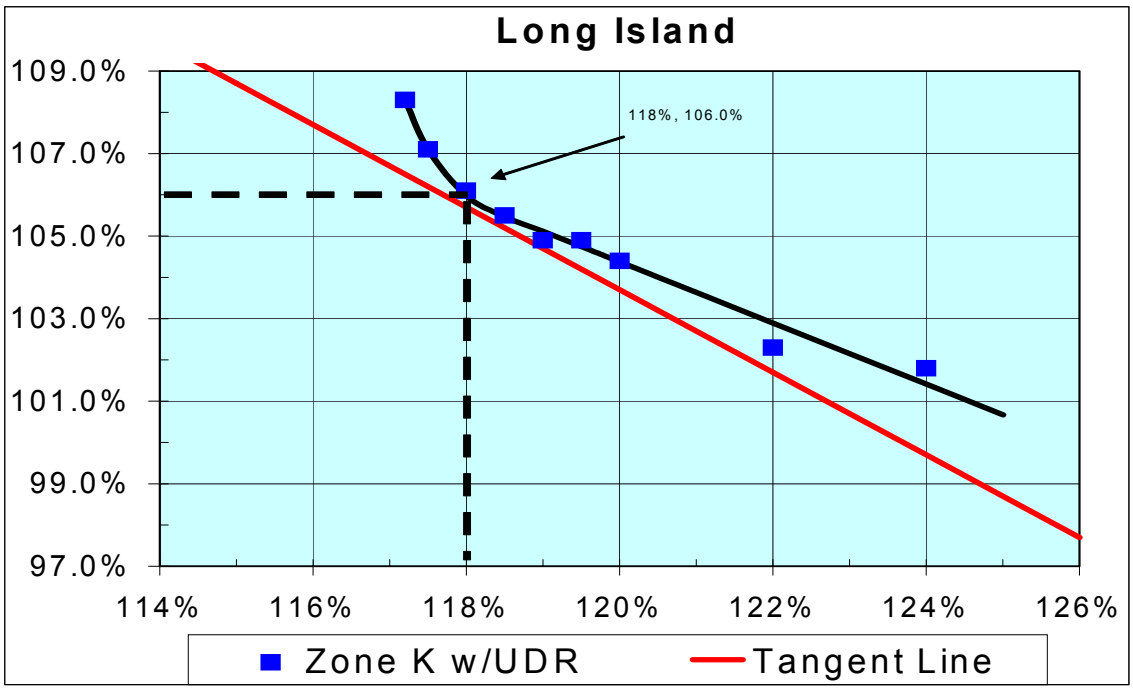
Year 2007 IRM Base Case study results show a required NYCA IRM of __%. Accordingly, we conclude that maintaining the NYCA installed reserve of ___% over the forecasted NYCA 2007 summer peak season will achieve applicable NYSRC and NPCC reliability criteria for Base Case study assumptions. The base case the study further corresponding MLCRs for NYC and LI of ___% and ___%, respectively.

Figure 1 depicts the relationship between NYCA IRM Requirements and resource capacity in NYC and LI. The anchor points on these curves, from which these study results are based, were evaluated using the "Tan 45" analysis described under "Study Procedures". Accordingly, we conclude that maintaining the NYCA installed reserve of ___% over the forecasted NYCA 2006 summer peak season, together with MLCR of ___% and ___% for NYC and LI, respectively, will achieve applicable NYSRC and NPCC reliability criteria for the Base Case study assumptions shown in Appendix A.

Figure 1
(Will be similar to the 2006-07 IRM Report's curves shown below)

NYCA Locational ICAP Requirements vs. Statewide ICAP Requirements UDR Base Case





Major parameter and modeling enhancements that influenced the 2007 NYCA IRM study results include:

- ***Interconnection Support during Emergencies.*** NYCA reliability can be improved by receiving emergency assistance support from other interconnected Control Areas — in accordance with control area reserve sharing agreements during emergency conditions. Assuming such arrangements in the Base Case permits the NYCA IRM to be approximately __ percentage points lower than is otherwise required (see Table 1). A model for representing the neighboring Control Area, similar to that applied in the 2006 IRM Study, was utilized for this study. In this model two of the Outside World Areas, ISO-NE and PJM, are each represented as multi-areas. This level of granularity better captures the impacts of transmission constraints within these Areas, particularly on their ability to provide emergency assistance to the NYCA.

  Limitations across the Northport-Norwalk Harbor cable were modeled as a function of the availability of Norwalk Harbor generation. Limitations from Eastern PJM system across the Con Edison Hudson-Farragut, Linden-Gothels interconnections, and LIPA's new Neptune intertie, were modeled as a function of the availability of Northern New Jersey generation including Linden, Hudson, and Bergen.

- ***Peak Load Forecast.*** The Base Case peak load forecast has a direct impact on IRM Requirements with respect to the relationship between Upstate NY and Downstate NY loads. (Note: Revise the following as necessary): The load forecast used for the Year 2006 Study projected a 51.9% share of the NYCA load for Downstate NY; the Year 2007 Study reflects an increased Downstate NY share of load at ___%. The larger load share for Downstate NY has an impact on the Year 2006 IRM Requirement (see NYCA "Transmission Constraints".)

  For the first time the NYISO's final peak load forecast for the following summer period, based on the most recent actual summer load conditions, was used for this study. Previous studies used preliminary forecasts.

- ***Resource Capacity Availability.*** Generating unit forced and partial outages are modeled in GE-MARS by inputting a multi-state outage model that represents an "equivalent forced outage rate on demand" (EFORd) for each unit represented. Outage data is received by the NYISO from generator owners based on specific reporting requirements established by the NYISO. Capacity unavailability is modeled by considering forced and partial outages that occur over the most recent 5-year time period. The time span considered for the 2007 Study covered the 2001 – 2005 period. During this period average capacity availability improved from 2000 – 2004 performance, the period considered for the 2006 Study. Incorporation of this improvement in generating unit availability in the 2007 Study model had a direct impact of reducing IRM requirements from 2006 Study results.

  The 2005 and 2006 IRM Studies incorporated statewide DMNC reductions to offset overstatements of the capacity availability of certain resources reported to the NYISO. These studies incorporated DMNC reduction adjustments of 711 MW and 125 MW,

respectively. The NYISO took steps to mitigate these capacity availability overstatements by improving generating unit availability reporting requirements. These initiatives included the modification of outage data collection software, requirements for the reporting of generation unavailability caused by transmission outages, education efforts, and expanding the number of NYISO audits. Because of the success of this program the NYISO reported to the NYSRC that capacity availability overstatements vertually no longer exist, and that therefore a DMNC adjustment was not needed for the 2007 Study.

Incorporation of generating unit outage rates from the most recent 5-year time period, combined with the reduction of the DMNC adjustment to zero, has resulted in an IRM requirement decrease of approximately __ percentage points from last year's study (see Table 2).

- ***NYCA Transmission Constraints.*** GE-MARS is capable of determining the impact of transmission constraints on the NYCA LOLE. This study, as with previous GE-MARS studies, consistently reveals that the transmission system into NYC and LI is constrained and can impede the delivery of emergency capacity assistance required to meet load within these zones. The NYSRC has two reliability planning criteria that recognize transmission constraints: 1) the NYCA IRM requirement considers transmission constraints into NYC and LI, and 2) minimum LCRs must be maintained for both NYC and LI (See NYSRC Resource Adequacy Reliability Criteria section).

  The impact of transmission constraints on NYCA IRM requirements depends on the level of resource capacity in NYC and LI. In accordance with NYSRC Reliability Rule A-R2, *Load Serving Entity ICAP Requirements,* the NYISO is required to calculate and establish appropriate LCR. The most recent NYISO study (*Locational Installed Capacity Requirements Study,* dated March 28, 2006) determined that for 2006 the LCR for NYC and LI were 80**%** and 99**%**, respectively.

  As previously discussed, Figure 1 depicts the relationship between NYCA IRM requirements and resource capacity in NYC and LI for the Base Case. This figure shows that the IRM requirement can be impacted significantly depending on the level of capacity within these zones, particularly to the right of the "anchor point" of the curve where the IRM requirement rises much faster than the locational installed capacity level can be reduced. For Base Case assumptions, the anchor point in Figure 1 results in the Base Case IRM Requirement of ___**%** and NYC and LI MLCR levels of ___**%** and ___**%**, respectively.

  Results from this study illustrate IRM requirement impacts for changes of locational installed capacity level assumptions from the UDR Base Case. Observations from these results include:

  - **Unconstrained NYCA Case** - If internal transmission constraints were entirely eliminated the NYCA IRM requirement could be reduced to ___%, __ percentage points less than the Base Case IRM Requirement. (See Table 1.)

- **Downstate NY Capacity Levels** - If the NYC and LI locational installed capacity levels were *increased* from the UDR Base Case results to ___% and ___%, respectively, the IRM requirement would be reduced by __ percentage points to about ___%. Similarly, if the NYC and LI locational installed capacity levels were *decreased* to ___% and ___%, respectively, the IRM Requirement would increase __ percentage point to about __%. (See Figure 1.)

These results illustrate the significant impact on IRM caused by transmission constraints and implementing different locational installed capacity levels, assuming all other factors being equal.

Other important factors that impact IRM studies include:

- ***Load Forecast Uncertainty (LFU).*** It is recognized that some uncertainty exists relative to forecasting NYCA loads for any given year. This uncertainty is incorporated in the model by using a load forecast probability distribution that is sensitive to different weather and economic conditions. Recognizing the unique LFU of individual NYCA areas, the LFU model is subdivided into four areas: NYC (Zones I and J), LI, and the rest of New York State.

- ***Special Case Resources (SCRs)***. SCRs are ICAP resources that include loads that are capable of being interrupted — and distributed generation that may be activated on demand. This study assumes 994 MW of SCR capacity resource capacity in July and August (and lesser amounts during other months), limited to a maximum of four SCR calls per month in July and August for DEC-limited generation.

- ***Emergency Demand Response Programs (EDRP).*** EDRP allows registered interruptible loads and standby generators to participate on a voluntary basis - and be paid for their ability to restore operating reserves. This study assumes 228 MW of EDRP capacity resources in July and August (and less in other months), limited to a maximum of five EDRP calls per month. Both SCRs and EDRP are included in the Emergency Operating Procedure (EOP) model.

- ***Other Emergency Operating Procedures.*** The NYISO will implement EOPs as required to minimize customer disconnections. If a ___% IRM is maintained, firm load disconnections due to inadequate resources will not occur more than once in every ten years on average — in accordance with NYSRC and NPCC criteria. (Refer to Appendix B, Table B-2, for the expected use during 2006 of SCRs, EDRP, voltage reductions, and other EOPs.)

SENSITIVITY CASE STUDY RESULTS

Determining the appropriate IRM Requirement to meet NYSRC reliability criteria depends upon many factors. Variations from the base case will, of course, yield different results. Table 1 shows IRM requirement results and related NYC and LI locational capacities for

several sensitivity cases. (Sensitivity case results are also listed in Appendix B, Table B-1.) Due primarily to time and resource constraints, there was no attempt to re-evaluate the "anchor point" or to fix the MLCRs for each case, or to fix the MLCRs to make them consistent with the Base Case MLCR results.

Table 1

(Note: The sensitivity cases and the results below are from the 2006 IRM report's Table 1 and are shown for illustrative purposes.)

Sensitivity Case Results

NYCA IRM Requirements and Related NYC & LI Locational Capacities

Case	Case Description	IRM (%)	% Change from Base Case	NYC (%)	LI (%)
1	NYCA Isolated	23.2	+5.7	86	104
2	No SCRs & EDRP	22.7	+5.2	86	104
3	No Voltage Reductions	19.6	+2.1	83.5	101
4	No NYS Transmission System Constraints	15.5*	-2.0*	*	*
5	External Control Area IRMs: -10%	18.6	+1.1	84	100.5
6	External Control Area IRMs: +10%	11.1	-6.4	77.5	95
7	GADf Derate: 0 MW	17.2	-.3	82	99
8	GADf Derate: 250 MW	17.8	+.3	82	100

* Locational capacities are not relevant for this case.

NYISO IMPLEMENTATION OF THE NYCA IRM REQUIREMENT

NYISO Translation of NYCA Capacity Requirements to Unforced Capacity:

The NYISO values capacity sold and purchased in the market in a manner that considers the forced outage ratings of individual units — Unforced Capacity or "UCAP". To maintain consistency between the rating of a unit (UCAP) and the statewide ICR, the ICR must also be translated to an unforced capacity basis. In the NYCA, these translations occur twice during the course of each capability year, prior to the start of the summer and winter Capability Periods.

Additionally, any LCR in place are also translated to equivalent UCAP values during these periods. The conversion to UCAP essentially translates from one index to another, and is not a reduction of actual installed resources. Therefore, no degradation in reliability is expected. The NYISO employs a translation methodology that converts UCAP requirements to ICAP in a manner that assures compliance with NYSRC Resource Adequacy Rule A-R1. The conversion to UCAP provides financial

incentives to decrease the forced outage rates while improving reliability.

NYISO Implementation of a Spot Market Auction based on a Demand Curves:

Effective June 1, 2003 the NYISO replaced its monthly Capacity Deficiency Auction with a monthly Spot Market Auction based on three FERC-approved Demand Curves. Demand Curves are developed for zones J, K, and the rest of NYCA.

The existence of Demand Curves does not impact the determination of IRM requirements by the NYSRC.

COMPARISON WITH 2006 IRM STUDY RESULTS

The results of the Year 2007 IRM study show that the IRM requirement has decreased __ percentage points compared to the Year 2006 IRM Study. Table 2 below compares the approximate IRM impacts of changing certain several key study assumptions from the 2006 Study. The primary drivers that changed the IRM Requirement from 2006 include _____.

Table 2
Parametric IRM Impact Comparison with 2006 Study*
(Note: The parameters below are taken from the 2006 IRM Report's Table 2 and are shown for illustrative purposes.)

Parameter	Approximate IRM Req. Change (%)	IRM Req. (%)
Previous 2006 Study – Base Case IRM Result		**18.0**
Updated Peak Load Forecast		
Updated EFORs and Reduced DMNC Adjustment, from 711 to 125 MW		
Updated LFU Representation		
New Generating Units & Retirements		
Updated SCR and EDRP Capacity & Other EOPs		
Updated NYS Transmission System Limits		
New Outside World Multi-Area Representation		
Net Change from 2006 Study		
2007 IRM Study Result		**xx.x**

*This table reconciles assumption changes between the 2006 and 2007 studies.