New York Control Area
Installed Capacity
Requirements

Draft Report Body

October 31 , 2012

New York State Reliability Council, LLC

Installed Capacity Subcommittee

NYSRC

This Page Left Intentionally Blank

Table of Contents

This Page Left Intentionally Blank

Executive Summary

A New York Control Area (NYCA) Installed Reserve Margin (IRM) Study is conducted annually by the New York State Reliability Council (NYSRC) Installed Capacity Subcommittee to provide parameters for establishing NYCA IRM requirements for the following capability year. This year's report covers the period May 2013 to April 2014 (2013 Capability Year).

Results of the NYSRC technical study show that the required NYCA IRM for the 2013 Capability Year is 17.3% under base case conditions.

This study also determined Minimum Locational Capacity Requirements (MLCRs) of 85% and 101% for New York City (NYC) and Long Island (LI), respectively. In its role of setting the appropriate locational capacity requirements (LCRs), the New York Independent System Operator (NYISO) will consider these MLCRs.

These study results satisfy and are consistent with NYSRC Reliability Rules, Northeast Power Coordinating Council (NPCC) reliability criteria, and North American Electric Reliability Corporation (NERC) reliability standards.

The 17.3% IRM base case for 2013 represents a 1.2*% increase* from the 2012 base case IRM of 16.1%. Table 6-1 shows the IRM impacts of individual study parameters that result in this change. The principal drivers that increased the required IRM are:

- An updated Special Case Resource (SCR) model
- An updated load forecast uncertainty model
- An updated Outside World model

The above IRM drivers together accounted for an IRM increase of 1.2% from the 2012 base case value.

In addition, the principle driver that reduced the IRM is a new model that better represents generator performance. This method calculates an "EFORd" which is presently used by the NYISO market. The new EFORd model reduced the IRM by 0.8%.

There are presently five environmental initiatives driven by the State and/or Federal regulators, either in place or are pending, that will affect the operation of most thermal generators in the NYCA, and have the potential to impact future IRM requirements. Compliance with these initiatives could lead to multiple unplanned plant retirements. However, these regulations will not by themselves require retirements and impact IRM requirements in 2013.

This study also evaluated IRM impacts of several sensitivity cases. These results are summarized in Table 7-1 and in greater detail in Appendix Table B-1. In addition, a confidence interval analysis was conducted to demonstrate that there is a high confidence that the base case 17.3% IRM will fully meet NYSRC and the NPCC resource adequacy criteria.

The base case and sensitivity case IRM results, along with other relevant factors, will be considered in a separate NYSRC Executive Committee process in which the Final NYCA IRM requirement for the 2013 Capability Year is adopted. The 2013 IRM Study also evaluated Unforced Capacity (UCAP) trends. This analysis shows that UCAP margins have steadily decreased over the past five years despite variations in IRM requirements and increases in low capacity factor wind generation.

1. Introduction

This report describes a technical study, conducted by the NYSRC Installed Capacity Subcommittee (ICS), for establishing the NYCA IRM for the period of May 1, 2013 through April 30, 2014 (2013 Capability Year). This study is conducted each year in compliance with Section 3.03 of the NYSRC Agreement which states that the NYSRC shall establish the annual statewide Installed Capacity Requirement (ICR) for the NYCA. The ICR relates to the IRM through the following equation:

ICR = (1 + %IRM Requirement/100) x Forecasted NYCA Peak Load

The base case and sensitivity case study results, along with other relevant factors, will be considered by the NYSRC Executive Committee for its adoption of the Final NYCA IRM requirement for the 2013 Capability Year.

The NYISO will implement the final NYCA IRM as determined by the NYSRC, in accordance with the NYSRC Reliability Rules[1] and the NYISO Installed Capacity (ICAP) Manual.[2] The NYISO translates the required IRM to an Unforced Capacity (UCAP) basis. These values are also used in a Spot Market Auction based on FERC-approved Demand Curves. These UCAP and Demand Curve concepts are described later in the report. The schedule for conducting the 2013 IRM Study was based on meeting the NYISO's timetable for these actions.

The study criteria, procedures, and types of assumptions used for this 2013 IRM Study are in accordance with NYSRC Policy 5-6[3], *Procedure for Establishing New York Control Area Installed Capacity Requirement*. The primary reliability criterion used in the IRM study requires a Loss of Load Expectation (LOLE) of no greater than 0.1 days/year for the NYCA. This NYSRC resource adequacy criterion is consistent with NPCC reliability criteria and NERC reliability standards. IRM study procedures include the use of two study methodologies, the *Unified* and the *IRM Anchoring Methodologies.* The above reliability criterion and methodologies are discussed in more detail later in the report. In addition to calculating the NYCA IRM requirement, these methodologies identify corresponding MLCRs for NYC and LI. In its role of setting the appropriate LCRs, the NYISO will utilize the same study methodologies and procedures as in the 2012 IRM Study, and will consider the MLCR values determined in this study.

A major modeling change was implemented in the 2013 IRM Study. During 2011 and 2012, an improved model for representing generator outage rates was developed. This

[1] http://www.nysrc.org/NYSRCReliabilityRulesComplianceMonitoring.asp
[2] http://www.nyiso.com/public/markets_operations/market_data/icap/index.jsp
[3] http://www.nysrc.org/policies.asp

model calculates an "EFORd," which is a better measure of generator performance for reliability studies than previously represented. This study improvement is described in the report.

Previous NYCA 2000 to 2012 IRM Study reports can be found on the NYSRC website.[4] Table C-1 in Appendix C provides a comparison of previous NYCA base case and final IRMs for the 2000 through 2012 Capability Years. This table and Figure 8-1 shows UCAP reserve margin trends over previous years. Definitions of certain terms in this report can be found in the Glossary (Appendix D).

2. NYSRC Resource Adequacy Reliability Criterion

The acceptable LOLE reliability level used for establishing NYCA IRM Requirements is dictated by the NYSRC Reliability Rule A-R1, *Statewide Installed Reserve Margin Requirements,* which 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 emergency transfer capability, and capacity and/or load relief from available operating procedures.*

This NYSRC Reliability Rule is consistent with NPCC Resource Adequacy Design Criteria in Section 5.2 of NPCC Directory 1, *Design and Operation of the Bulk Power System*.

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.

3. IRM Study Procedures

The study procedures used for the 2013 IRM Study are described in detail in NYSRC Policy 5-6, *Procedure for Establishing New York Control Area Installed Capacity Requirements*.

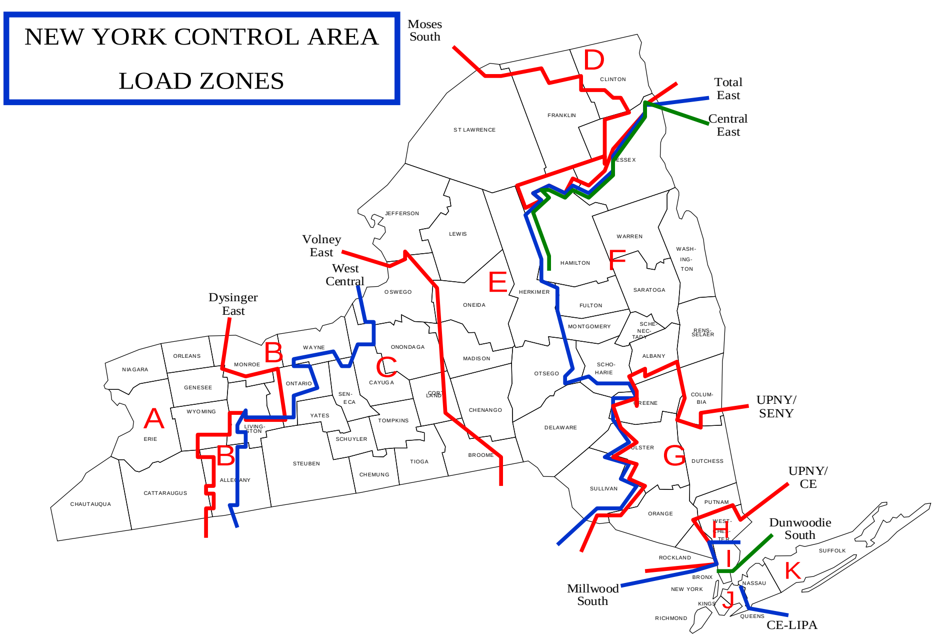
[4] http://www.nysrc.org/reports3.asp

Policy 5-6 also describes the computer program used for reliability calculations and the types of input data and models used for the IRM Study.

This study utilizes a *probabilistic approach* for determining NYCA IRM requirements. This technique calculates the probabilities of generator unit outages, in conjunction with load and transmission representations, to determine the days per year of expected resource capacity shortages.

General Electric's Multi-Area Reliability Simulation (GE-MARS) is the primary computer program used for this probabilistic analysis. This program includes detailed load, generation, and transmission representation for eleven NYCA zones — plus four external Control Areas (Outside World Areas) directly interconnected to the NYCA. The external Control Areas are: Ontario, New England, Quebec, and the PJM Interconnection. The eleven NYCA zones are depicted in Figure 3-1 below. GE-MARS calculates LOLE, expressed in days per year, to provide a consistent measure of system reliability. The GE-MARS program is described in detail in Appendix A.

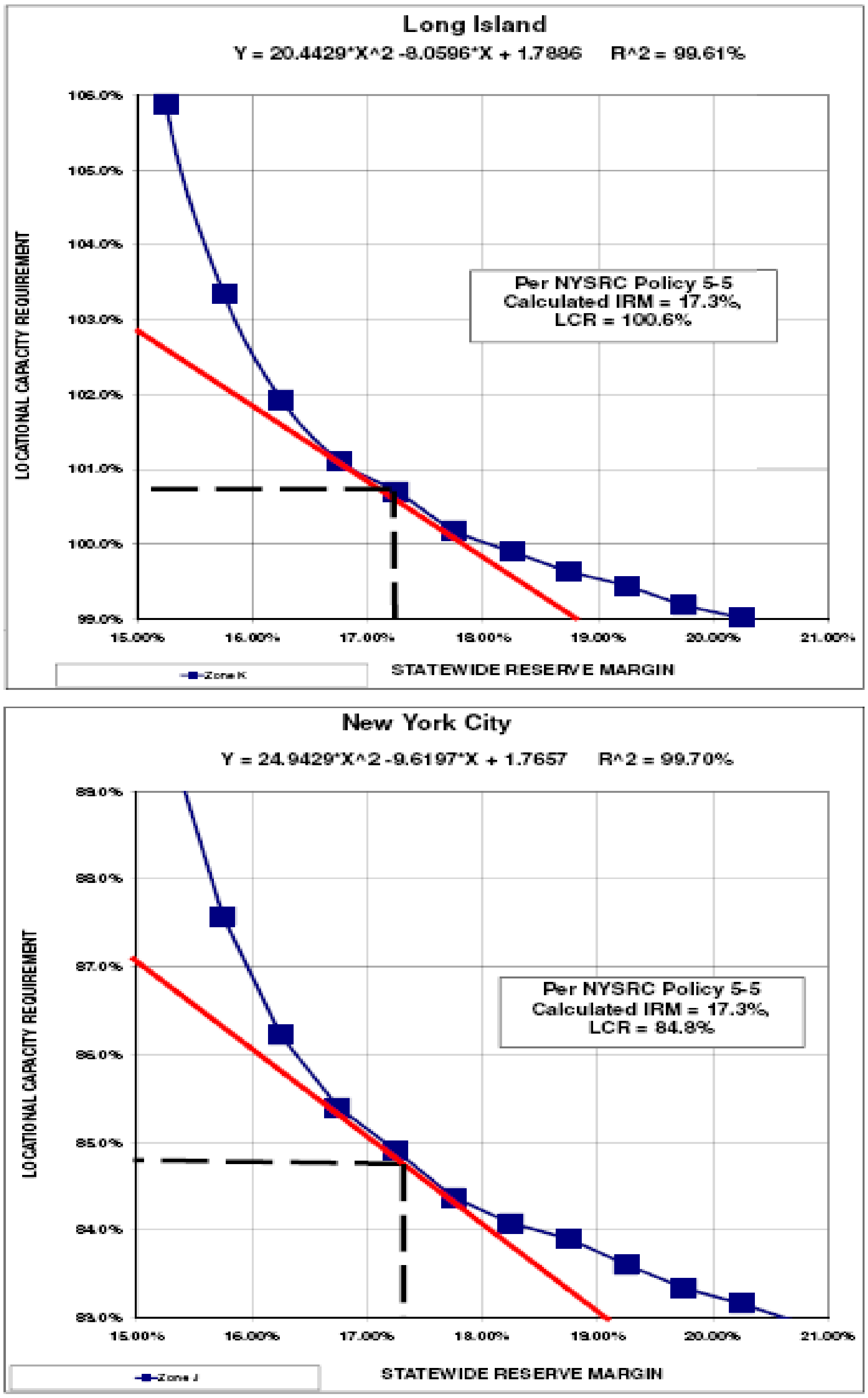
Figure 3-1: NYCA Load Zones



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 MLCRs, as illustrated in Figure 4-1. All points on these curves meet the NYSRC 0.1 days/year LOLE reliability criterion described above.

Note that all points above the curve are more reliable than criteria, and vice versa. This methodology develops a pair of curves, one for NYC (Zone J) and one for LI (Zone K). Appendix A of Policy 5-6 provides a more detailed description of the Unified Methodology.

Figure 3-2
NYCA Locational ICAP Requirements vs. Statewide ICAP Requirements



Base case NYCA IRM requirements and related MLCRs are established by a supplemental procedure (termed the *IRM Anchoring Methodology*) which is used to define an *inflection point* on each of these curves. These inflection points are selected by applying a tangent of 45 degrees (Tan 45) analysis at the bend (or "knee") of each curve. Mathematically, each curve is fitted using a second order polynomial regression analysis. Setting the derivative of the resulting set of equations to minus one yields the points at which the curves achieve the Tan 45 degree inflection point. Appendix B of Policy 5-6 provides a more detailed description of the methodology for computing the Tan 45 inflection point.

4. Study Results – Base Case

Results of the NYSRC technical study show that the required NYCA IRM is 17.3% for the 2013 Capability Year under base case conditions. As described above, Figure 3-2 depicts the relationship between NYCA IRM requirements and resource capacity in NYC and LI.

The tangent points on these curves were evaluated using the Tan 45 analysis. Accordingly, it can be concluded that maintaining a NYCA installed reserve of 17.3% for the 2013 Capability Year, together with MLCRs of 85% and 101% for NYC and LI, respectively, will achieve applicable NYSRC and NPCC reliability criteria for the base case study assumptions shown in Appendix A.

Comparing these results to the 2012 IRM Study, the 83% NYC MLCR increased 2%, while the LI MLCR decreased 0.5%. The NYISO will consider these MLCRs when developing the final NYC and LI LCR values for the 2013 Capability Year.

A Monte Carlo simulation error analysis shows that there is a 95% probability that the above base case result is within a range of 17.0% and 17.6% (see Appendix A) when targeting a standard error of 0.025 per unit. This analysis demonstrates that there is a high level of confidence that the base case IRM value of 17.3% is in full compliance with NYSRC and NPCC reliability rules and criteria.

5. Models and Key Input Assumptions

This section describes the models and related input assumptions for the 2013 IRM Study. The models represented in the GE-MARS analysis include a *Load Model, Capacity Model, Transmission System Model, and Outside World Model*. Potential IRM impacts of pending environmental initiatives are also addressed. The input assumptions for the base case were based on information available prior to October 2012. Appendix A provides more details of these models and assumptions. Table A-4 compares key assumptions with those used for the 2012 IRM Study.

5.1 Load Model

5.1.1 Peak Load Forecast

A 2013 NYCA summer peak load forecast of 33278 MW was assumed in the study, a decrease of 57 MW from the 2012 summer peak forecast used in the 2012 IRM Study. The 2013 load forecast, completed by the NYISO staff in collaboration with the NYISO Load Forecasting Task Force, was presented to ICS on October 3, 2012, and considers actual 2012 summer load conditions. Use of this 2013 peak load forecast in the 2013 IRM study had no impact on IRM requirements compared to the 2012 Study (Table 6-1). The NYISO will prepare a final 2013 summer forecast in early 2013 for use in the NYISO 2013 Locational Capacity Requirement Study. It is expected that the NYISO's October 2012 summer peak load forecast for 2013 and the final 2013 forecast will be similar.

5.1.2 Load Shape Model

The 2013 IRM Study was performed using a load shape based on 2002 actual values. This same load shape was used in the six previous IRM studies and is consistent with the load shape assumption used by adjacent NPCC Control Areas. The 2002 load shape has a comparatively larger number of daily peak hours that are close to or nearly equal to the summer peak demand than for other years during the 1999-2011 period. As a result, there are a higher number of LOLE events using the 2002 load shape than if the load shape based on an average or typical load shape was instead represented. As a result, all else being equal, the resulting IRM will tend to be higher using the 2002 load shape, and therefore represents a conservative IRM load shape representation. To demonstrate this, a sensitivity analysis comparing the 2002 load shape with a typical load shape (determined to be 2007) results in a 2.6 % lower IRM if the 2007 typical load shape was represented instead of the 2002 load shape (Table 7-1).

Because of the conservative nature of the 2002 load shape, the NYSRC is exploring alternate load shape methodologies for future IRM studies. One methodology under consideration assigns load shapes to load uncertainty bins. The method develops an index for each year of the available hourly load data for the period 1999 to 2011. The index is developed by taking the 30 highest daily peaks for each year and dividing by the weather adjusted or normalized peak that year to create a per unit value. These 30 per unit values are averaged together to create a single index for each year. The higher the index the more daily peak days there were generally above or closer to the weather adjusted or normalized peak load that year. The index is used to rank order the years and determine their probability of occurrence.

5.1.3 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 base case model by using a load forecast probability distribution that is sensitive to different weather conditions. Recognizing the unique LFU of individual NYCA areas, separate LFU models are prepared for four areas: New York City (Zone J), Long Island (Zone K), Westchester (Zones H and I), and the rest of New York State (Zones A-G).

The load forecast uncertainty models and data used for the 2013 IRM Study were updated by Consolidated Edison for Zones H, I, and J; Long Island Power Authority (LIPA) for Zone K; and the NYISO. Appendix Section A-3.1 describes these models in more detail. Recognition of load forecast uncertainty in the 2013 IRM Study has an effect of increasing IRM requirements by 9.3%. Use of updated LFU models for the 2013 IRM Study increased IRM requirements by 0.5% from the 2012 IRM Study (Table 6-1).

5.2 Capacity Model

5.2.1 Planned Non-Wind Facilities, Retirements and Reratings

Planned non-wind facilities and retirements that are represented in the 2012 IRM Study are shown in Appendix A. The rating for each existing and planned resource facility in the capacity model is based on its Dependable Maximum Net Capability (DMNC). In circumstances where the ability to deliver power to the grid is restricted, the value of the resource is limited to it Capacity Resource Interconnection Service (CRIS) value. The source of DMNC ratings for existing facilities is seasonal tests required by procedures in the NYISO Installed Capacity Manual. Planned non-wind facilities, retirements and reratings had no impact on IRM compared to the 2012 IRM Study. Appendix A shows the ratings of all resource facilities that are included in the 2013 IRM Study capacity model.

5.2.2 Wind Generation

It is projected that by the end of the 2013 summer period there will be a total wind capacity of 1,584 MW participating in the capacity market in New York

State. All wind farms are located in upstate New York, in Zones A-E. See Appendix A for details. The 2013 summer period wind capacity projection is 64 MW lower than the forecast 2012 wind capacity assumed for the 2012 IRM Study.

The 2013 IRM Study base case assumes that the projected 1,584 MW of wind capacity will operate at an 11.0% capacity factor during the summer peak period. This assumed capacity factor is based on an analysis of actual hourly wind generation data collected for wind facilities in New York State during the June through August period, between the hours of 2:00 p.m. and 5:00 p.m. This test period was chosen because it covers the time when virtually all of the annual NYCA LOLE is distributed.

The decrease in projected wind capacity from the value of 1,648 MW used in the 2012 IRM Study, to 1,584 MW forecast used for this study, results in a 0.1% decrease to the IRM (Table 6-1).

Overall, inclusion of the projected 1,584 MW of wind capacity in the 2013 Study accounts for 4.4% of the 2013 IRM requirement (Table 7-1). This relatively high IRM impact is a direct result of the very low capacity factor of wind facilities during the summer peak period. The impact of wind capacity on *unforced capacity* is discussed in Appendix C, Section C.3, "Wind Resource Impact on the NYCA IRM and UCAP Markets." A detailed summary of existing and planned wind resources is shown in Figure A-6.

5.2.3 Generating Unit 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 during demand periods (EFORd) for each unit represented. Outage data used to determine the EFORd is received by the NYISO from generator owners based on outage data reporting requirements established by the NYISO. Capacity unavailability is modeled by considering the average forced and partial outages for each generating unit that have occurred over the most recent five-year time period – the time span considered for the 2013 IRM Study covered the 2007-2011 period. The five-year EFORd calculated for this period slightly exceeded the 2006-2010 average value used for the 2012 IRM Study, causing the IRM to increase by 0.3% (Table 6-1). Figure A-3 depicts NYCA 2002 to 2011 EFORd trends.

In past NYSRC IRM studies, the model used for calculating loss-of-load-expectation (LOLE) simulated the random outage of generating using transition rates developed from the generating availability data system or GADS. GADS is the system that generators use to report their performance. The transition rates calculated from the GADS data have been consistent with NERC's EFORd definition. The EFORd in practice determines the probability of a generating unit being in a forced outage state during periods of demand. The NYISO capacity market uses the EFORd to determine a generating unit unforced capacity value or UCAP, which determines its overall capacity. The better a generating unit performs, the higher its UCAP.

During 2010, ICS concluded that the EFORd would provide an improved and more accurate measure of generator performance, as well as provide a metric that was aligned with what is used in the capacity markets. An independent consulting firm, Associated Power Analysts (APA), was retained in 2011 by the NYISO to help develop this method. APA proposed and developed two alternative methodologies which would provide transition rate matrices that were consistent with EFORd or probabilities conditioned on demand. After review, ICS selected one of these methodologies to implement for IRM studies. The APA/EFORd methodology was fully developed and successfully validated following extensive testing. ICS then concluded that the new methodology should be implemented for the 2013 IRM Study.

The IRM impact of implementing the APA/EFORd methodology is shown in Table 6-1 – use of the new model results in a 0.8% lower IRM than use of the previous EFOR model used to represent generator outage rates.

5.2.4 Capacity Availability of Firm Purchases and Sales

The availability of the resources participating in the New York market changes as firm sales and purchases change. Highly available resources acquired through capacity purchases reduce IRM requirements. Similarly, firm sales of highly available resources increase the IRM. There is no IRM change from 2012 using updated purchase and sale capacity projections.

5.2.5 Emergency Operating Procedures (EOPs)

(1) <u>Special Case Resources (SCRs)</u>

SCRs are ICAP resources that include loads that are capable of being interrupted on demand and distributed generators that may be activated on demand. This study assumes a SCR base case value of 1,767 MW in July

2013 with varying amounts during other months based on historical experience.

The SCR performance model is based on an analysis of historical SCR load reduction performance which is described in Section A-3.7 of Appendix A. Due to the possibility that some of the potential SCR program capacity may not be available during peak periods, projections are discounted for the base case based on previous experience with these programs, as well as any operating limitations. The updated SCR values and performance used for the 2013 IRM Study resulted in no IRM change from the 2012 IRM Study (Table 6-1).

The SCR model was changed for the 2013 IRM Study. Previously, the effective value of the program was tied to the individual zonal peaks. To the extent that these peaks were increased to account for load forecast uncertainty, the available amount of SCRs was amplified. SCRs are represented in the 2013 Study by a fixed MW value and are not subject to the model's amplification for load forecast uncertainty. This model change resulted in an increase of 0.7% from the 2012 IRM study (Table 6-1).

(2) 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. The 2013 Study assumes 144 MW of EDRP capacity resources will be registered in 2013, a reduction from 2012. This EDRP capacity was discounted to a base case value of 14 MW reflecting past performance, and is implemented in the study in July and August (differing amounts during other months), while being limited to a maximum of five EDRP calls per month. Both SCRs and EDRP are included in the Emergency Operating Procedure (EOP) model. Unlike SCRs, EDRP are not ICAP suppliers and therefore are not required to respond when called upon to operate. The updated EDRP model used for the 2013 IRM Study resulted in an IRM increase of 0.1% from the 2012 IRM Study (Table 6-1).

(3) Other Emergency Operating Procedures (EOPs)

In accordance with NYSRC criteria, the NYISO will implement EOPs as required to minimize customer disconnections. Projected 2013 EOP capacity values are based on recent actual data and NYISO forecasts. (Refer to Appendix B, Table B-3, for the expected use of SCRs, EDRP, voltage reductions, and other types of EOPs during 2013.). The updated EOP model, excluding the SCR impact noted above, increased the IRM from the 2012 IRM study by 0.2% (Table 6-1).

5.2.6 Unforced Capacity Deliverability Rights (UDRs)

The capacity model includes UDRs which are capacity rights that allow the owner of an incremental controllable transmission project to extract the locational capacity benefit derived by the NYCA from the project. Non-locational capacity, when coupled with a UDR, can be used to satisfy locational capacity requirements. The owner of UDR facility rights designates how they will be treated by the NYSRC and NYISO for resource adequacy studies. The NYISO calculates the actual UDR award based on the performance characteristics of the facility and other data.

LIPA's 330 MW High Voltage Direct Current (HVDC) Cross Sound Cable, 660 MW HVDC Neptune Cable, 300 MW Linden Variable Frequency Transformer (VFT), and the projected 660 MW Hudson Transmission Project (HTP) are facilities that are represented in the 2013 IRM Study as having UDR capacity rights. The owners of these facilities have the option, on an annual basis, of selecting the MW quantity of UDRs (ICAP) it plans on utilizing for capacity contracts over these facilities. Any remaining capability on the cable can be used to support emergency assistance which may reduce locational and IRM requirements. The 2013 IRM study incorporates the elections that these facility owners made for the 2013 Capability Year.

5.3 Transmission Model

5.3.1 Internal Transmission Model

A detailed transmission system model is represented in the GE-MARS topology. The transmission system topology, which includes eleven NYCA zones and four Outside World Areas, along with transfer limits, is shown in Figures A-11, 12, and 13. The transfer limits employed for the 2013 IRM Study were developed from emergency transfer limit analysis included in various studies performed by the NYISO, and from input from Transmission Owners and neighboring regions. The transfer limits are further refined by additional assessments conducted specifically for this cycle of the development of the topology. The assumptions for the transmission model included in the 2013 IRM study are listed in Table A-7.

Forced transmission outages are included in the GE-MARS model for the underground cables that connect New York City and Long Island to surrounding zones. The GE-MARS model uses transition rates between operating states for each interface, which are calculated based on the probability of occurrence from the failure rate and the time to repair. Transition rates into the different operating states for each interface are calculated based on the circuits comprising each interface, which includes failure rates and repair times for the individual cables, and for any transformer and/or phase angle regulator associated with that particular cable.

The interface transfer limits were updated for the 2013 IRM Study based on transfer limit analysis performed for the NYISO 2012 Comprehensive System Planning Process. Transmission Owners and the NYISO performed several analyzes to update several transfer limits. These analyzes are described in detail in section A.3.3 of Appendix A.

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 LCRs. The most recent NYISO study[5] determined that for the 2012 Capability Year, the required LCRs for NYC and LI were 83% and 99%, respectively. A LCR Study for the 2013 Capability Year is scheduled to be completed by the NYISO in January 2013.

Results from 2013 IRM Study illustrate the impact on the IRM requirement for changes of the base case NYC and LI LCR levels of 83% and 99%, respectively. Observations from these results include:

1) Unconstrained NYCA Case
   If internal transmission constraints were entirely eliminated the NYCA IRM requirement could be reduced to 15.4%, 1.9% less than the base case IRM requirement (Table 7-1.) As a result, relieving NYCA transmission constraints would make it possible to reduce the 2013 NYCA installed capacity requirement by approximately 630 MW.

2) Downstate New York Capacity Levels
   If the NYC and LI LCR levels were *increased* from the base case results to 87% and 102.5%, respectively, the 2013 IRM requirement could be

[5] *Locational Installed Capacity Requirements Study, http://www.nyiso.com/public/markets_operations/services/planning/planning_studies*

reduced by 1.3%, to 16%. Similarly, if the NYC and LI locational installed capacity levels were *decreased* to 84.2% and 100%, respectively, the IRM requirement must increase by 0.7%, to 18% (Figure 4-1).

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

5.4 External Control Area Model

The Outside World Model consists of those Control Areas contiguous with NYCA: Ontario, Quebec, New England, and the PJM Interconnection. NYCA reliability can be improved and IRM requirements can be reduced by recognizing available emergency capacity assistance support from these neighboring interconnected control areas - in accordance with control area agreements during emergency conditions. Representing such interconnection support arrangements in the 2013 IRM Study base case reduces the NYCA IRM requirements by 7.7% (Table 7-1). A model for representing neighboring control areas, similar to previous IRM studies, was utilized in his study.

The primary consideration for developing the base case load and capacity assumptions for the Outside World Areas is to avoid overdependence on these Areas for emergency assistance support. For this purpose, from Policy 5-6, a rule is applied whereby an Outside World Area's LOLE cannot be lower than its own LOLE criterion, its isolated LOLE cannot be lower than that of the NYCA, and its IRM can be no higher than that Area's minimum requirement. In addition, EOPs are not represented in Outside World Area models.

Another consideration for developing models for the Outside World Areas is to recognize internal transmission constraints within those Areas that may limit emergency assistance into the NYCA. This recognition is considered either explicitly, or through direct multi-area modeling providing there is adequate data available to accurately model transmission interfaces and load areas within these Outside World Areas. For this study, two Outside World Areas – New England and the PJM Interconnection – are each represented as multi-areas, i.e., 13 zones for New England and four zones for the PJM Interconnection. Such granularity better captures the impacts of transmission constraints within these areas, particularly on their ability to provide emergency assistance to the NYCA.

The major changes to the NYCA 2013 IRM Study topology from the 2012 Study are:

1) Volney East up 800 MW to 5675,
2) UPNY/CE fixed at 5150 MW, a 450 MW drop from the previous top dynamic rating of 5600 MW.
3) Ontario to NY increasing by 100 MW
4) A drop in the UPNY/SENY interface of 100 MW to a limit of 5150 MW
5) The Central East interface group increase by 250 MW to a limit of 4800 MW
6) Dunwoodie South interface decreasing by 80 MW to a limit of 5210 MW

These changes and other lesser changes are summarized in Table A-8.

Base case assumptions considered the full capacity of transfer capability from external Control Areas (adjusted for grandfathered contracts) in determining the level of external emergency assistance.

Updated Outside World Area load, capacity, and transmission representations in the 2013 IRM Study results in an IRM increase from the 2012 IRM Study by 0.5%.

5.5 Environmental Initiatives

Various environmental initiatives driven by the State and/or Federal regulators are either in place or are pending that will affect the operation of the existing fleet. The United States Environmental Protection Agency (USEPA) has promulgated several regulations that will affect most of the thermal generation fleet of generators in NYCA. Similarly, the New York State Department of Environmental Conservation (NYSDEC) has undertaken the development of several regulations that will apply to most of the thermal fleet in New York.

The control technology retrofit requirements of five environmental initiatives are sufficiently broad in application that certain generator owners may need to address the retirement versus retrofit question. These environmental initiatives are: (i) NYSDEC's Reasonably Available Control Technology for Oxides of Nitrogen (NOx RACT); (ii) Best Available Retrofit Technology (BART) to address regional haze; (iii) Best Technology Available (BTA) for cooling water intake structures; (iv) the USEPA's Mercury and Air Toxics Standards (MATS); and (v) either the Cross State Air Pollution Rule (CSAPR) or its predecessor the Clean Air Interstate Rule (CAIR) addressing interstate transport of criteria air pollutants. Although all but CSAPR are currently in effect, none of these environmental regulations will, by themselves, require retirements and impact IRM requirements in 2013.

Beyond 2013 as many as 34,000 MW in the existing NYCA generator fleet will have some level of exposure to the new regulations, as further discussed in Appendix B. The magnitude of the combined investments required to comply with the five initiatives could lead to multiple unplanned plant retirements.

5.6 Database Quality Assurance Reviews

It is critical that the data base used for IRM studies undergo sufficient review in order to verify its accuracy. To accomplish this objective, this year the NYSRC significantly improved its process for reviewing the accuracy of the study's data base, while continuing to respect confidentiality issues.

The NYISO, General Electric (GE), and the New York Transmission Owners (TOs) conducted independent data quality assurance reviews after the base case assumptions were developed and prior to preparation of the final base case. Masked and encrypted input data was provided by the NYISO to the transmission owners for their reviews. The NYISO, GE, and TO reviews found several minor data errors, none of which affected IRM requirements in the preliminary base case. The data found to be in error by these reviews were corrected before being used in the final base case studies. A summary of these quality assurance reviews is shown in Appendix A.

6. Comparison with 2012 IRM Study Results

The results of this 2013 IRM Study show that the base case IRM result represents a 1.2% increase from the 2012 IRM Study base case value. Table 6-1 compares the estimated IRM impacts of updating several key study assumptions and revising models from those used in the 2012 Study. The estimated percent IRM change for each parameter in was calculated from the results of a parametric analysis in which a series of IRM studies were conducted to test the IRM impact of individual parameters. The results of this analysis were normalized such that the net sum of the -/+ % parameter changes totals the 1.2 % IRM increase from the 2012 Study. Table 6-1 also summarizes the reason for the IRM change for each study parameter from the 2012 Study.

The principal drivers shown in Table 6-1 that increased the required IRM from the 2012 IRM base case are: an updated SCR, load forecast model, and outside world models, which together, increased the 2012 IRM by 1.7%. The principle driver the decreased the required IRM from the 2012 IRM base case is the new EFORd model, which decreased the 2012 IRM by 0.8%.

The parameters in Table 6-1 are discussed under *Models and Key Input Assumptions*. A more detailed description of these changes and their IRM impacts can be found in Appendix A.

Table 6-1: Parametric IRM Impact Comparison
2013 IRM Study vs. 2012 IRM Study

Parameter	Estimated IRM Change (%)	IRM (%)	Reasons for IRM Changes
2012 IRM Study – Final Base Case IRM		**16.1**	
2013 Updated Parameters that increased the IRM:			
SCR Modeling Change	+0.7		Model changed from a percent of load to a fixed value representation.
Updated Load Forecast Uncertainty Model	+0.5		MWs in the higher bands for Zone J & ROS increased, which increased load forecast uncertainty.
Updated Outside World Model	+0.5		Less emergency assistance from PJM.
Updated Cable Outage Rates	+0.4		FORs for two cables increased recently.
Updated Generating Unit EFORd's	+0.3		Higher fleet EFORd in 2011.
Updated Non-SCR/EDRP EOPs	+0.2		83 MW EOP reduction in Downstate.
Updated EDRP Capacity	+0.1		Reduced EDRP capacity.
Total IRM Increase	**+2.7**		
2013 Updated Parameters that decreased the IRM:			
New EFORd Model	-0.8		Conversion from EFOR to EFORd lowers IRM.
Hudson Transmission Project	-0.3		Permits additional assistance from PJM.
Updated Load Forecast	-0.3		Load growth mostly in Upstate.
New Generating Unit and Wind Capacity	-0.1		Wind capacity is 64 MW less than assumed in 2012 IRM Study.
Total IRM Decrease	**-1.5**		
2013 Updated Parameters that did not change the IRM:			
Updated SCR Capacity	0		
Updated Maintenance	0		
Updated Existing Generating Unit Capacities	0		
Updated Purchases & Sales	0		
Retirements	0		
Total IRM Change	**0**		
Net Change From 2012 Study		**+1.2**	
2013 IRM Study – Preliminary Base Case IRM		**17.3**	

7. 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 7-1 shows IRM requirement results and related NYC and LI locational capacities for three groups of selected sensitivity cases. Many of these sensitivity case results are important considerations when the NYSRC Executive Committee develops the Final NYCA IRM for 2013. A complete summary of the 17 sensitivity case results shown in Table 7-1 is depicted in Appendix B, Table B-2. Table B-2 also includes a description and explanation of each sensitivity case. A preliminary base case was used as the basis for developing the sensitivity case values except for Case 10. This case, because of its interest, used the final base case model. Table 7-1 reflects adjustments made to the preliminary base case sensitivity study results to reflect the final base case IRM. Further, there was no attempt to develop sensitivity results utilizing the Tan 45 "inflection point" method, with the exception of Case 10, which replaces the base case 2002 load shape model with a 2007 load shape model. The basis for the 2007 load shape model is described in Section 5.1.2.

Table 7-1: Sensitivity Cases
NYCA 2013 IRM and Related NYC and LI Locational Capacity Impacts

Case	Case Description	IRM (%)	% Change From Base Case	NYC LCR (%)	LI LCR (%)
0	Base Case	17.3%	--	85%	101%

Impacts of Major MARS Parameters

1	NYCA isolated	25.0%	+7.7	91	107
2	No internal NYCA transmission constraints	15.4%	-1.9	0 [1]	0 [1]
3	No load forecast uncertainty	8.0%	-9.3	79	94
4	No wind capacity (1,585 MW)	12.9%	-4.4	85	101
5	No SCRs and EDRPs	16.8%	-0.5	85	103

Impacts of Base Case Assumption and Model Changes

6	Higher Outside World reserve margins	11.1%	-6.2	81	96
7	Lower Outside World reserve margins	23.4%	+6.1	90	106
8	Higher EFORds	18.8%	+1.5	87	102
9	Lower EFORds	16.6%	-0.7	85	100
10	2007 Load Shape [2]	14.6%	-2.7	80	96
11	Retire Indian Point Units 2 and 3	22.3%	+5.0	93	110
12	300 MW wheel from Quebec to New England	17.7%	+0.4	86	101
13	Limit SCRs to five calls per month per zone	20.4%	+3.1	88	104
14	Coal unit retirement scenario [3]	18.0%	+0.7	85	101
15	HTP provides emergency assistance only [4]	17.7%	+0.4	84	102
16	Unit retirements after the base case assumptions were finalized [5]	16.9%	-0.4	85	101
17	Updated Outside World load forecasts after the base case assumptions were finalized				

[1] There would be no need to establish locational capacity requirements if there were no internal NYCA transmission constraints.
[2] The IRM anchoring (Tan 45) methodology was used for this case.
[3] This case assumes the retirement of all coal units (as in the NYISO RNA) due to economic and environmental impacts.
[4] The Hudson Transmission Project (HTP) base case representation includes a contract. This sensitivity case removes this contract and allows the tie to be fully available (660 MW) for emergency assistance. Removal of the contracted amount reduces the capacity in Zone J and therefore raises the LOLE. When capacity is added back to all zones, per the Policy 5 sensitivity methodology, it raises the margins in all zones; however, since Zone J was at a lower starting point, its end point is lower than the NYC 85% LCR base case result.
[5] These are units that have been actually retired (i.e., Dunkirk), or have announced retirement (i.e., Cayuga) since the 2013 IRM study base case assumptions were approved.

8. NYISO IMPLEMENTATION OF NYCA CAPACITY REQUIREMENT

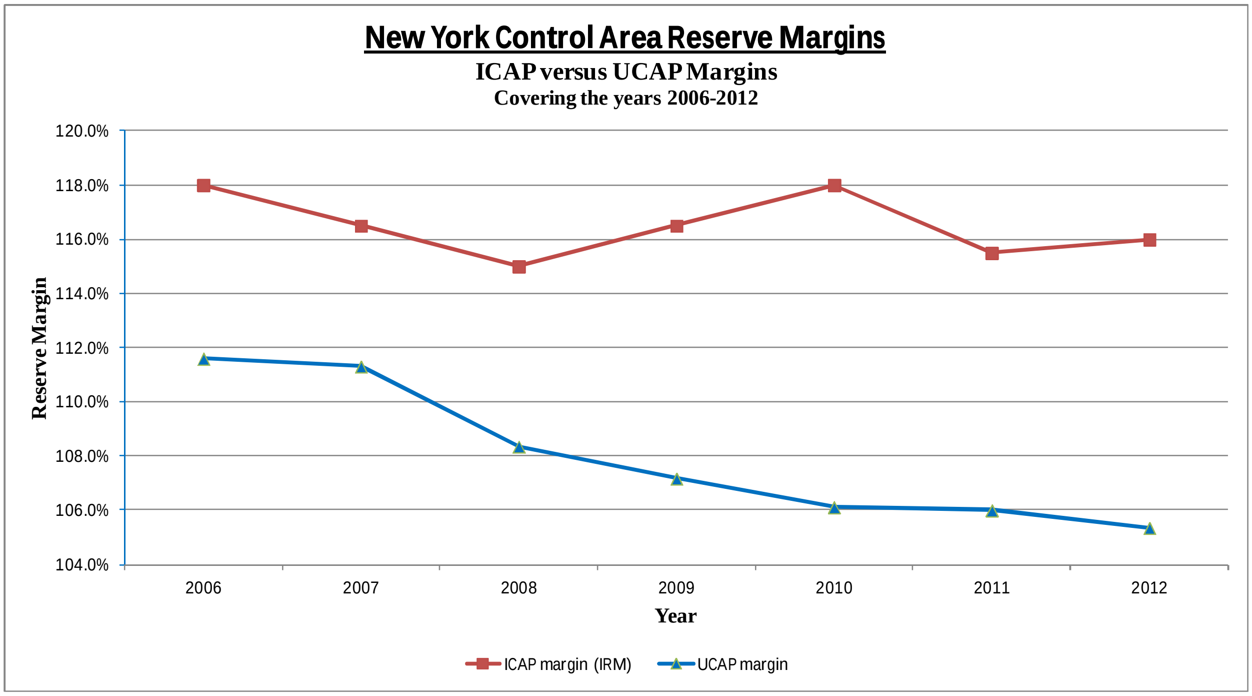
8.1 NYISO Translation of NYCA ICAP Requirements to UCAP Requirements

The NYISO values capacity sold and purchased in the market in a manner that considers the forced outage ratings of individual units — Unforced Capacity (UCAP). To maintain consistency between the rating of a unit translated to 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 LCRs in place are also translated to equivalent UCAP values during these periods. The conversion to UCAP essentially translates from one index to another; it is not a reduction of actual installed resources. Therefore, no degradation in reliability is expected. The NYISO employs a translation methodology that converts ICAP requirements to UCAP in a manner that ensures compliance with NYSRC Resource Adequacy Rule A-R1. The conversion to UCAP provides financial incentives to decrease the forced outage rates while improving reliability.

The increase in wind resources increases the IRM because wind capacity has a much lower peak period capacity factor than traditional resources. On the other hand, there is a negligible impact on the need for UCAP. Figure 8-1 below illustrates that UCAP reserve margins have steadily decreased over the 2006-2011 period, despite variations of UCAP requirements. This indicates a lower burden on New York loads over time. Appendix C offers a more detailed explanation.

Figure 8-1: NYCA Reserve Margins



8.2 NYISO Implementation of a Spot Market Auction based on 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 Zone J (New York City), Zone K (Long Island), and the NYCA. The existence of Demand Curves does not impact the determination of IRM requirements by the NYSRC.