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New York Control Area Installed Capacity Requirements For the Period May 2012 through April 2013

Technical Study Report

December __, 2011

New York State Reliability Council, LLC
Installed Capacity Subcommittee

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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 2012 to April 2013 (2012 Capability Year).

Results of the NYSRC technical study show that the required NYCA IRM for the 2012 Capability Year is 16.1% under base case conditions.

For this base case, the study also determined Minimum Locational Capacity Requirements (MLCRs) of 83.9% and 99.2% 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 above 2012 base case IRM study value of 16.1% represents a *0.6% increase* from the base case 15.5% IRM requirement determined by the 2011 IRM Study. Table 1 shows the IRM impacts of individual study parameters that result in this change. The principal drivers that increased the required IRM are:

- A 337 MW increase in wind-powered generation
- Updated NYCA purchase and sale capacity projections
- Reduced availability of NYPA generating units

The above IRM drivers together accounted for an IRM increase of 1.3% from the 2011 base case value. There were several updated study parameters that reduced the IRM.

There are several state and federal environmental regulations that will affect owners of generation resources in New York over the next decade. The only regulation that could affect generation operations in the 2012 capability year, however, is the newly enacted Cross State Air Pollution Rule (CSAPR). Overall, CSAPR will affect 167 generating units representing 23,275 MW of capacity in New York. Although the regulation requirements will start in 2012, a NYISO analysis showed that the NYCA can operate reliably with the program in 2012, and have no impact on IRM requirements.

The study also evaluated IRM impacts of several sensitivity cases. These results are summarized in Table 2 and in greater detail in Appendix Table B-2. In addition, a confidence interval analysis was conducted to demonstrate that there is a high confidence that the base case 16.1% 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 2012 Capability Year is adopted.

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, 2012 through April 30, 2013 (2012 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 2012 Capability Year.

The NYISO will implement the final NYCA IRM 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. These values are also used in a Spot Market Auction based on FERC-approved Demand Curves. These Unforced Capacity and Demand Curve concepts are described later in the report. The schedule for conducting the 2012 IRM Study was based on meeting the NYISO's timetable for these actions.

The study criteria, procedures, and types of assumptions used for this 2012 IRM Study are in accordance with NYSRC Policy 5-5, *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.

Two improvements in the IRM study process were implemented in the 2012 IRM Study. First, the process for reviewing input data accuracy was improved. Second, a preliminary base case was prepared, which was used as the basis for conducting sensitivity studies and data accuracy review. These study improvements are described in the report.

Previous NYCA 2000 to 2011 IRM Study reports can be found at www.nysrc.org/reports.asp. Table B-1 in Appendix B provides a comparison of previous NYCA base case and final IRMs for the 2000 through 2011 Capability Years. 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 Manual,* at www.nysrc.org/NYSRCReliabilityRulesComplianceMonitoring.asp.

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. The full NYSRC Reliability Rule A-R2 can be found in the NYSRC Reliability Rules Manual on the NYSRC Web site, at
www.nysrc.org/NYSRCReliabilityRulesComplianceMonitoring.asp.

IRM STUDY PROCEDURES

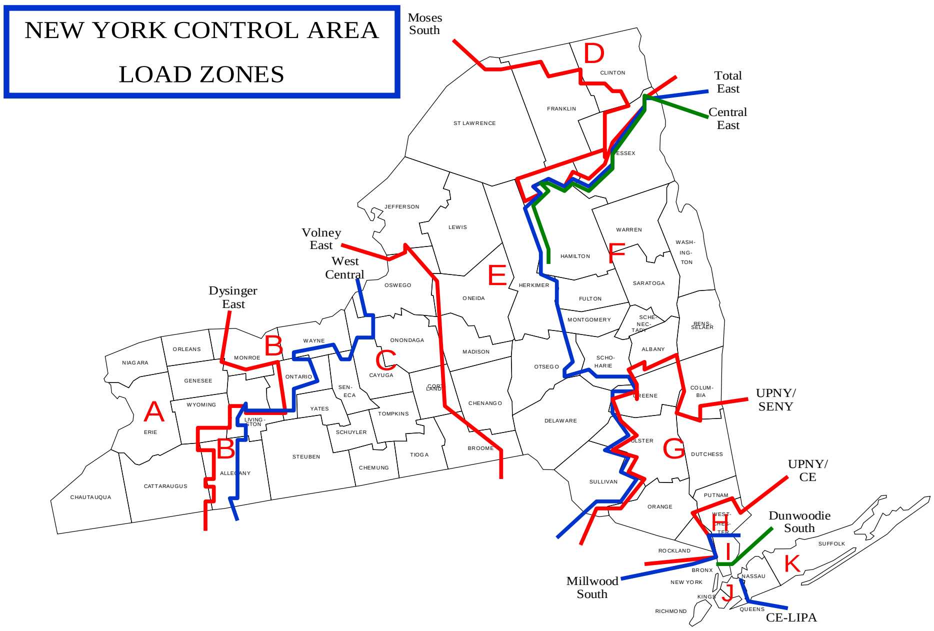
The study procedures used for the 2012 IRM Study are described in detail in NYSRC Policy 5-5, *Procedure for Establishing New York Control Area Installed Capacity Requirements*. Policy 5-5 also describes the computer program used for reliability calculations and the types of input data and models used for the IRM Study. Policy 5-5 can be found on the NYSRC Web site at, www.nysrc.org/policies.asp.

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 eleven

NYCA zones are depicted in Figure 1 below. GE-MARS calculates LOLE, expressed in days per year, to provide a consistent measure of system reliability.

Figure 1: NYCA Load Zones



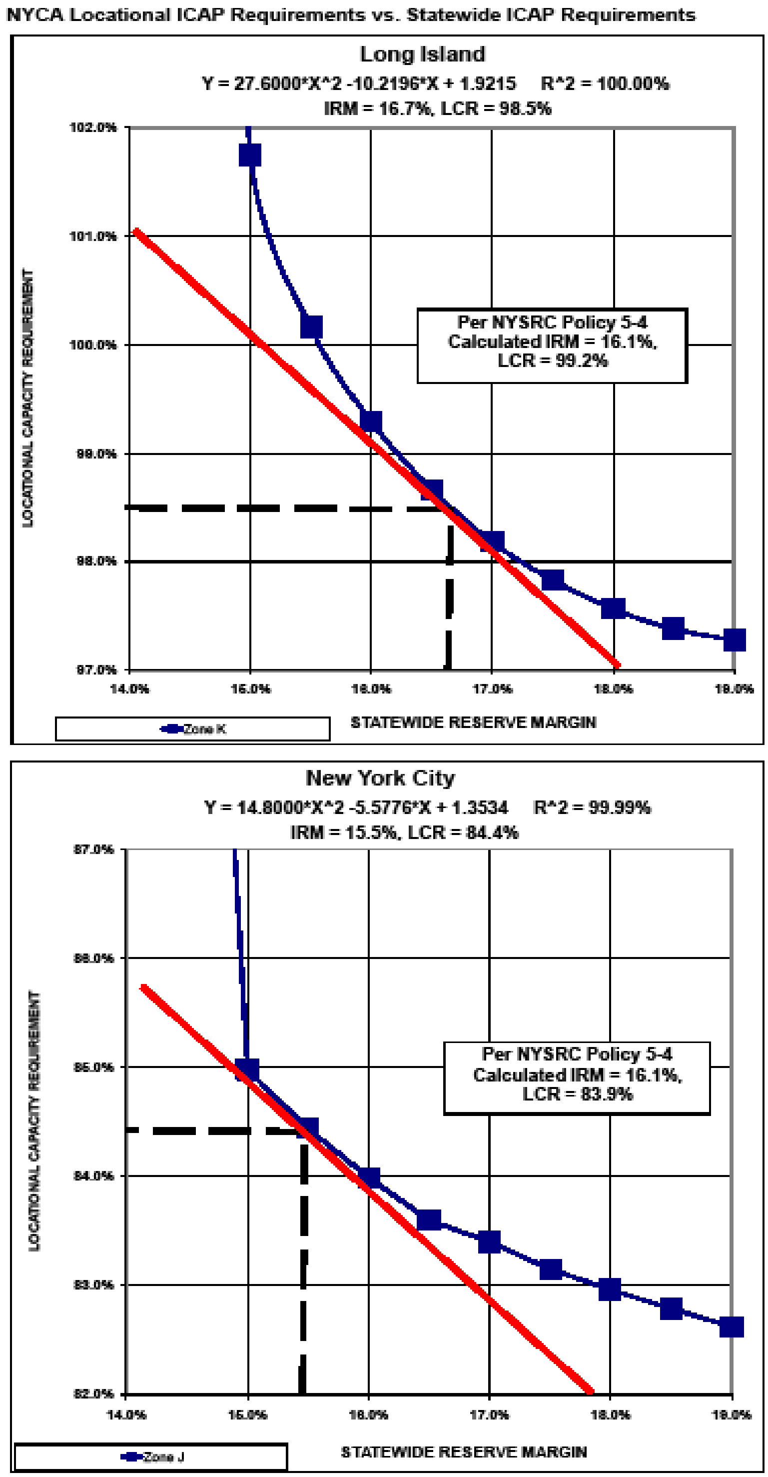
Using the GE-MARS program, a procedure is utilized for establishing NYCA IRM requirements (termed the *Unified Methodology)* which establishes a graphical relationship between NYCA IRM and MLCRs, as illustrated in Figure 2. All points on these curves meet the NYSRC 0.1 days/year LOLE reliability criterion 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 5-5 provides a more detailed description of the Unified Methodology.

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 5-4 provides a more detailed description of the methodology for computing the Tan 45 inflection point.

BASE CASE STUDY RESULTS

Results of the NYSRC technical study show that the required NYCA IRM is 16.1% for the 2012 Capability Year under base case conditions. Figure 2 depicts the relationship between NYCA IRM requirements and resource capacity in NYC and LI.

Figure 2: NYCA Locational ICAP Requirements vs. Statewide ICAP Requirements



The tangent points on these curves from which the above base case study results are based were evaluated using the Tan 45 analysis, also previously described. Accordingly, we conclude that maintaining a NYCA installed reserve of 16.1% for the 2012 Capability Year, together with MLCRs of 83.9% and 99.2% for NYC and LI, respectively, will achieve applicable NYSRC and NPCC reliability criteria for the base case study assumptions shown in Appendix A. The 83.9% MLCR for NYC represents an increase of 2.9 percentage points from that calculated in the 2011 IRM Study, while the 99.2% MLCR for LI represents a decrease of 2.1 percentage points from that calculated in the 2011 Study. The NYISO will consider these MLCRs when developing the final NYC and LI LCR values for the 2012 Capability Year.

A Monte Carlo simulation error analysis shows that there is a __% probability that the above base case result is within a range of __% and __% (see Appendix A). Within this range the statistical significance of the __%, __%, and __% numbers are a __%, 50%, and __% probability of meeting the one day in ten LOLE, assuming perfect accuracy of all parameters and using a standard error of 0.05. If a standard error of 0.025 were used, the band would tighten from __% to __%. This analysis demonstrates that there is a high level of confidence that the base case IRM value of __% is in full compliance with NYSRC and NPCC reliability rules and criteria.

MODELS AND KEY INPUT ASSUMPTIONS

This section describes the models and related input assumptions for the 2012 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 1, 2011. Appendix A provides more details of these models and assumptions. Table A-4 compares key assumptions with those used for the 2011 IRM Study.

Load Model

- ***Peak Load Forecast:*** A 2012 NYCA summer peak load forecast of 33,335 MW was assumed in the study. This forecast is an increase of 463 MW from the 2011 summer peak forecast used in the 2011 IRM Study. The above 2012 load forecast was completed by the NYISO staff in collaboration with the NYISO Load Forecasting Task Force on October 3, 2011, and considers actual 2011 summer load conditions. Use of this 2012 peak load forecast in the 2012 IRM study had no impact on IRM requirements compared to the 2011 Study (see Table 1). The NYISO will prepare a final 2012 summer forecast in early 2012 for use in the NYISO 2012 Locational Capacity Requirement Study. It is expected that the NYISO's October 2011 summer peak load forecast for 2012 and the final 2012 forecast will be similar.

- ***Load Shape Model:*** The 2012 IRM Study was performed using a load shape based on 2002 actual values. The same 2002 load shape was used in the five previous

IRM studies and is consistent with the load shape assumption used by adjacent NPCC Control Areas. An analysis comparing the 2002 load shape to actual load shapes from 1999 through 2010 concluded that the 2002 load shape continues to be the best suited for the 2012 IRM Study.

- ***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 and economic 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 2012 IRM Study were updated by Consolidated Edison (Zones H, I, and J), LIPA (Zone K), and the NYISO. Appendix Section A-5.2.1 describes these models in more detail. Recognition of load forecast uncertainty in the 2012 IRM Study has an effect of increasing IRM requirements by 6.3%. Use of updated LFU models for the 2012 IRM Study decreased IRM requirements by 0.2% from the 2011 IRM Study.

Capacity Model

The capacity model in MARS incorporates several considerations, as discussed below:

- ***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. This includes the addition of 22.5 MW of solar capacity located on Long Island. The rating for each existing and planned resource facility in the capacity model is based on its Dependable Maximum Net Capability (DMNC). 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 the overall effect of decreasing the IRM by 0.3% from the 2011 IRM Study. Appendix A shows the ratings of all resource facilities that are included in the 2011 IRM Study capacity model.

- ***Wind Generation:*** It is projected that by the end of the 2012 summer period there will be a total wind capacity of 1,648 MW in New York. All wind farms are located in upstate New York, in Zones A-E. See Appendix A for details. The 2012 summer period wind capacity projection is 337 MW higher than the forecast 2011 wind capacity assumed for the 2011 IRM Study.

  The 2012 IRM Study base case assumes that the projected 1,648 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.

Overall, inclusion of the projected 1,648 MW of wind capacity in the 2012 IRM base case accounts for 4.7% of the 2011 IRM requirement (see Table 2). This relatively high IRM impact is a direct result of the very low capacity factor of wind facilities during the summer peak period, as noted above. The impact of wind capacity on *unforced capacity* is discussed in Appendix B, Section B-3, "The Effect of Wind Resources on the NYCA IRM & UCAP Markets" A detailed summary of existing and planned wind resources is shown in Appendix A, Section A-5.8.

- ***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 (EFOR) for each unit represented. Outage data used to determine the EFOR 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 2012 IRM Study covered the 2006–2010 period. The five-year EFOR calculated for this period slightly exceeded the 2005-2009 average value used for the 2011 IRM Study, causing the IRM to increase by 0.4% (see Table 1). Figure A-5 depicts NYCA 2001 to 2010 EFOR trends.

In past NYSRC IRM studies, the model used to represent thermal generator outage rates has been based on the calculation of an EFOR, irrespective of the demand. However, the NYISO uses the concept of Unforced Capacity (UCAP) to establish both the LSE obligation to buy, and the amount each generator can sell into the capacity market. UCAP values are derived from the Equivalent Forced Outage Rate during demand periods (EFORd). Since EFORs are the same or lower than EFORds, the model's representation in past IRM studies has been considered conservative in that it calculates an IRM that is higher than would be calculated if EFORd was used as the basis.

Over the last year, the ICS has been investigating a method in which transition rates (used as the model input to represent forced outage rates) can be developed to better match the market's EFORd values. Associated Power Analysts (APA) was retained by the NYISO to help develop this method. Although the APA/EFORd method has not been fully developed, tested and reviewed by ICS as of November 2011, a sensitivity case was prepared to demonstrate the approximate IRM impact of implementing the APA method. The IRM impact of this sensitivity case is shown in Table 2 (see Case13). As expected, use of the new EFORd model would result in a lower IRM, although the magnitude of an IRM reduction when the model is fully developed is presently uncertain. It is expected that the new EFORd model will be implemented in the 2013 IRM base case after it is fully developed and approved by ICS.

- ***Emergency Operating Procedures (EOPs):***

  -- Special Case Resources (SCRs). 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 2,192 MW in August 2012 with lesser 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-5.3 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. An updated SCR model used for the 2012 IRM Study resulted in an IRM decrease of 0.3% from the 2011 IRM Study (see Table 1). This was primarily due to an improvement in overall performance of SCRs. SCRs, because of their obligatory nature, are considered capacity resources in setting the IRM.

  -- **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 2012 Study assumes 148 MW of EDRP capacity resources will be registered in 2012, a reduction from 2011. This EDRP capacity was discounted to a base case value of 95 MW reflecting past performance, and is implemented in the study in July and August (lesser 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 considered capacity resources because they are not required to respond when called upon to operate.

  -- Other Emergency Operating Procedures. In accordance with NYSRC criteria, the NYISO will implement EOPs as required to minimize customer disconnections. Projected 2012 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 2012). The updated EOP model, excluding the SCR impact noted above, slightly decreased the IRM from the 2011.

- ***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 HVDC Cross Sound Cable, 660 MW HVDC Neptune Cable, and the 300 MW Linden VFT project are facilities that are represented in the 2011 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 2012 IRM study incorporates the elections that the facility owners have made for the 2012 Capability Year.

Transmission System Topology

A detailed transmission system model is represented in the GE-MARS study. The transmission system topology, which includes eleven NYCA zones and four Outside World Areas, along with transfer limits, is shown in Figure A-13 in Appendix A. The transfer limits employed for the 2012 IRM Study were developed from emergency transfer limits calculated from various transfer limit studies performed at the NYISO and from input from Transmission Owners and neighboring regions. The transfer limits are further refined by additional analysis conducted specifically for the GE-MARS representation.

Failure rates for overhead lines and underground cables are similar, but the repair time for an underground cable is much longer. Therefore, forced transmission outages are included in the GE-MARS model for the underground cable system from surrounding zones entering into New York City and Long Island. 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 individual make-up of each interface, which includes failure rates and repair times for the cable, and for any transformer and/or phase angle regulator on that particular cable. A recent extended cable outage caused an increase in the average cable FOR, resulting in a slight IRM increase.

[This paragraph to be revised.] The interface limit of Dunwoodie-South (Zones I to J) was increased from 4,000 MW, assumed in the 2010 IRM Study, to 4,350 MW based on recent studies performed by Con Edison and the NYISO. The increase in the Dunwoodie-South limit was primarily due to the expected operation of the new M29 line. There were also several transfer limit increases made for the PJM to NYCA interfaces and Northport Tie for the 2011 Study. Appendix A describes the basis for these changes in more detail.

GE-MARS is capable of determining the impact of transmission constraints on NYCA LOLE. The 2012 IRM study, as with previous GE-MARS studies, 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 LCRs. The most recent NYISO study (*Locational Installed Capacity Requirements Study*, dated January 14, 2011, at
http://www.nyiso.com/public/markets_operations/services/planning/planning_studies/inde

x.jsp, determined that for the 2011 Capability Year, the required LCRs for NYC and LI were 81.0% and 101.5%, respectively. A LCR Study for the 2012 Capability Year is scheduled to be completed by the NYISO in January 2012.

Results from 2012 IRM Study illustrate the impact on the IRM requirement for changes of the base case NYC and LI LCR levels of 83.9% and 99.2%, respectively. Observations from these results include:

- **Unconstrained NYCA Case –** If internal transmission constraints were entirely eliminated the NYCA IRM requirement could be reduced to 13.8%, 2.3 percentage points less than the base case IRM requirement. (See Table 2.) As a result, relieving NYCA transmission constraints would make it possible to reduce the 2012 NYCA installed capacity requirement by approximately 770 MW.

- **Downstate NY Capacity Levels –** If the NYC and LI LCR levels were *increased* from the base case results to 85% and 102%, respectively, the 2012 IRM requirement could be reduced by 1.1 percentage points, to 15.0%. Similarly, if the NYC and LI locational installed capacity levels were *decreased* to 83.0% and 97.5%, respectively, the IRM requirement must increase by 1.9 percentage points, to 18.0%. (See Figure 2.)

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

Outside World Model

The Outside World Model consists of those control areas contiguous with NYCA: Ontario, Quebec, New England, and PJM. 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 2012 IRM Study base case reduces the NYCA IRM requirements by 8.6 percentage points (see Table 2). A model for representing neighboring control areas, similar to that applied in 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 5-5, 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 the Outside World Areas that may limit emergency assistance to 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 of the Outside World Areas – New England and PJM – are each represented as multiareas, i.e., 13 zones for New England and four zones for PJM. 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.

[This paragraph to be replaced.] For the 2012 IRM Study the Quebec to Ontario interface was increased to 1,850 MW, from 900 MW used in the 2010 Study. The addition of Highgate Phase 2 facility in Vermont increased the Quebec-New England interface capability. In addition, the transfer limits for two PJM interfaces – Central-East and West-Central – were increased. These changes had the collective effect of improving emergency assistance capability to NYCA from the Outside World in the 2011 IRM Study. The 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.

The updated Outside World Area load, capacity, and transmission representations in the 2012 IRM Study, plus an increase in the number of zones represented for New England and PJM described above, results in an IRM reduction from the 2011 study by __ percentage points.

Environmental Initiatives

There are several state and federal environmental regulations that will affect owners of generation resources in New York over the next decade. Appendix A, section A-3(?) discusses these regulations. The only regulation that could affect generation operations in the 2012 Capability Year, however, is the newly enacted (July 2011) Cross State Air Pollution Rule (CSAPR). As a result of this new regulation, affected generators will need one allowance for each ton of SO_2 or NOx emitted in a year. Overall, CSAPR will affect 167 generating units representing 23,275 MW of capacity in New York. The first reduction starts in 2012 with additional reductions required in 2014. A NYISO analysis examined multiple scenarios which all showed that the NYCA can operate reliably with the program in 2012 (phase one) with no effect on IRM requirements.

Compliance actions for the second phase that begins in 2014 will likely include emission control retrofits, fuel switching, and new clean efficient generation. Although the NYISO analysis indicates that phase one will not result in any immediate reliability impacts, phase two coupled with the forecasted impacts of the four programs discussed in the Appendix (NOx RACT, BART, MACT, and BTA), and the current economic realities (low capacity payments and less expensive natural gas) could lead to plant retirements potentially affecting reliability and IRM requirements in New York as early as 2014.

Data Base 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, and the transmission owners 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, General Electric, and transmission owner 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 __.

COMPARISON WITH 2011 IRM STUDY RESULTS

The results of this 2012 IRM Study show that the base case IRM result represents a 0.6 percentage point increase from the 2011 IRM Study base case value. Table 1 compares the estimated IRM impacts of updating several key study assumptions and revising models from those used in the 2011 Study. The estimated percent IRM change for each parameter in Table 1 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 0.6 percentage point IRM increase from the 2011 Study. Table 1 also summarizes the reason for the IRM change for each study parameter from the 2011 Study.

The principal drivers shown in Table 1 that increased the required IRM from the 2011 IRM base case are: increased wind capacity, updated purchases and sales assumptions, and updated generating unit EFORs, which together, increased the 2011 IRM by 1.3 percentage points.

The parameters in Table 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 C.

Table 1: Parametric IRM Impact Comparison – 2012 IRM Study vs. 2011 IRM Study

Parameter	Estimated IRM Change (%)	IRM (%)	Reasons for IRM Changes
2011 IRM Study – Base Case IRM		**15.5**	
2012 Updated Parameters that Increase the IRM:			
New Wind Capacity (337 MW)	+0.5		Wind has low availability performance.
Updated Purchases and Sales	+0.4		Loss of sales contracts resulted in poor performing units remaining in NY.
Updated Generating Unit EFORs	+0.4		FOR increases in Downstate units higher relative to Upstate units.
Updated Cable Outage Rates	+0.1		Increase in cable FORs due to recent extended outage.
Updated Outside World Model	+0.1		Higher New England load growth relative to capacity increase results in reduced emergency assistance available to NYCA.
Updated EDRPs	0		
Updated Maintenance	0		
New Solar Capacity	0		
Updated Load Forecast	0		
Total IRM Increase	**+1.5**		
2012 Updated Parameters that Decrease the IRM:			
Updated SCRs	-0.3		Improvement in overall SCR performance.
New Generating Capacity	-0.2		New generating capacity has higher availability relative to existing fleet.
Updated Load Forecast Uncertainty Model	-0.2		Recent historical data shows less load uncertainty in Zones J&K.
Updated Non-SCR/EDRP EOPs	-0.1		Increase in EOP capability in Downstate relative to Upstate.
Retirements	-0.1		Retirement of poorer performing generating units.
Updated Existing Generating Unit Capacities	0		
Total IRM Decrease	**-0.9**		
Net Change From 2011 Study		**+0.6**	
2012 IRM Study – Final Base Case IRM		**16.1**	

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 2 shows IRM requirement results and related NYC and LI locational capacities for three groups of selected sensitivity cases. Certain of these sensitivity cases – particularly those included under the "Base Case Assumption Uncertainties" group – are important input when the NYSRC Executive Committee develops the final NYCA 2011 IRM. A complete summary of all sensitivity case results is shown 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 in Table 2. This table 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.

Table 2: Sensitivity Cases
NYCA 2012 IRM and Related NYC and LI Locational Capacity Impacts

Case	Case Description	IRM (%)	% Change From Base Case	NYC LCR (%)	LI LCR (%)
0	Base Case	16.1	--	84	99

2012 IRM Impacts of Major MARS Parameters

1	NYCA isolated	24.7	+8.6	90	105
2	No internal NYCA transmission constraints	13.8	-2.3	N/A	N/A
3	No load forecast uncertainty	8.8	-8.8	79	93
4	No wind capacity (1,648 MW)	11.4	-4.7	84	99
5	No EDRPs	16.3	+0.2	84	99
6	No SCRs and EDRPs	15.5	-0.6	84	101

2012 IRM Impacts of Base Case Assumption and Modeling Changes

7	Higher Outside World reserve margins	11.9	-4.2	81	96
8	Lower Outside World reserve margins	22.6	+6.5	89	104
9	Higher EFORd's	18.7	+2.6	86	101
10	Lower EFORd's	13.6	-2.5	81	101
11	Alternate load shape model	13.7	-2.4	82	97
12	Alternate wind shape model				
13	Use of a new EFORd model now under development	15.1	1.0	83	98
14	Limited SCR use (15 peak days)				
15	Retire Indian Point 2&3	21.6	+5.5	92	107
16	300 MW wheel from HQ to NE	16.2	+0.1	84	99
17	One in two Con Edison load forecast				
18	Updated PJM representation				

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 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, 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 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 unforced capacity. See Appendix B for a more detailed explanation.

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