DRAFT ~~— FOR DISCUSSION PURPOSES ONLY~~

MODELING OF EMERGENCY ASSISTANCE FOR THE NEW YORK CONTROL AREA IN NYSRC IRM STUDIES

Preface

The eastern region of the United States and eastern portions of Canada operate as an interconnected Bulk Power System (BPS). In planning for future system operations, it is recognized that during tight operating conditions, Control Area (CA) operators have the ability to purchase emergency power from adjacent CAs. The ability to purchase emergency power is referred to as Emergency Assistance (EA).

For the New York Control Area (NYCA), the 2016 Installed Reserve Margin (IRM) study showed that without EA benefits from its neighbors, New York would need to secure a minimum of 126% of its forecast peak load as capacity resources.[1] Because of the ability to purchase emergency power from neighboring CAs, the total installed capacity requirement for NYCA is reduced to 117.5%. This represents an 8.5 percentage point reduction in needed NYCA capacity resources as a result of EA from neighboring CAs. New England enjoys a similar 6.4 percentage point reduction in its capacity requirements due to EA from its neighbors.

Purpose

The New York State Reliability Council (NYSRC) Policy 5 states: "The primary consideration for developing the final load and capacity models for the external Control Areas is to avoid overdependence on the external Control Areas for emergency capacity support."

The purpose of this study is to analyze the maximum amount of EA that NYCA can reliably depend upon from its neighbors for application in the IRM studies.

Executive Summary

This study examined the amount of emergency assistance that NYCA can reasonably rely upon in establishing its IRM, while maintaining the reliability of the New York State Bulk Power System.

The study found that the levels of EA within the GE MARS model were excessive. These levels were unrealistic from an operation's perspective and are higher than what the amount of total EA that surrounding CAs rely upon in setting their IRM equivalents. For

[1] *See* New York State Reliability Council report titled "New York Control Area Installed Capacity Requirement - For the Period May 2016 to April 2017" (December 4, 2015) at Appendix B, page 50.

example, the study identified GE MARS draws where the 2016 Base Case Simulation relied upon EA as high as 4,900 MW from neighboring CAs.

Looking at NYCA's neighbors, this study saw that their expected EA ranged from 0% of their peak load up to 6.4% of their peak over the last five years. NYCA relied upon EA ranging from 7.7% to 8.9% over the same period. The NYCA value six years ago was over 10%.

This study also found that there was a small amount of EA (referred to as "indirect emergency assistance" for the purposes of this paper) that was obtained by use of the neighboring CAs' transmission systems to deliver power from one part of New York to the load centers in New York, effectively bypassing the New York constraints. Without the indirect emergency assistance, the IRM would have gone from 17.4% to 18.0% (0.6 percentage point increase).

As a result of this study, the New York Independent System Operator, Inc. (NYISO) recommends using the NYCA Total Operating Reserve of 2,620 MW as the maximum level (limit) of EA for setting the NYCA minimum IRM. Understanding that the GE MARS simulation model already exhausts emergency procedures before calling upon EA, the NYISO Operations' perspective is that NYCA should only rely on its neighbors' excess reserves to replenish NYCA operating reserves and not rely on its neighbors' excess reserves to serve NYCA load directly in an emergency. ~~In limited testing during this study,~~ Applying a limit of 2,620 MW of EA increased the IRM from 17.4% to 18.~~2~~8% (an increase of ~~0.8%).~~1.4%) based on a Tan 45 analysis.

Further, the NYISO recommends that the ICS continue to evaluate, monitor, and potentially curtail the indirect emergency assistance that benefits NYCA by delivering power from one area to another area in New York through neighboring transmission systems.

Introduction

For the purposes of this whitepaper, the following terms are defined as:

> Tie Benefits (TB) – the benefits of being interconnected with neighboring Control Areas, is equal to the amount of Emergency Assistance (EA) plus the benefit of Installed Capacity (ICAP) contracted with generation resources outside of a Control Area (CA). This is shown as Equation #1, below.
>
> Equation #1: TB = EA + ICAP
>
> Emergency Assistance (EA) – the amount of unplanned assistance that is sought as a result of a sudden need. EA is made up of two components. Emergency Assistance is equal to the assistance that can be directly supplied from neighboring systems' generation resources (referred to as "Direct Emergency Assistance" (DEA) for the purposes of this study) plus assistance from resources within the requesting CA that

are obtained by utilizing the neighboring transmission system's unused transmission capacity in which the energy is looped from one part of a requesting CA through its neighbor and back to another part of the CA, bypassing constraint(s) in the CA requesting the help (referred to as "Indirect Emergency Assistance" (IEA) for the purposes of this study). This is shown as Equation #2, below.

Equation #2: EA = DEA + IEA

Interconnection Capability – capability that can support both capacity contracts (ICAP) and EA, but only up to their total tie capability (TTC).

For NYCA, the IRM study is conducted without using a forecast of external CA resource capacity contracts (other than those that are grandfathered capacity contracts). In this manner, the model, based on the neighboring system representations, can determine the amount of EA available and determine the minimum IRM while potentially leaving room on the ties for additional capacity contracts. After the completion of developing the minimum IRM, the NYISO then tests various amounts of external CA resource capacity contracts to determine the maximum amount of contracts that can be obtained without interfering with the EA depended upon in setting the IRM. This potential ICAP is then tested to determine if it is deliverable.

Observations

Examination of Emergency Assistance Levels Provided to New York

The NYSRC white paper entitled, "Modeling of Emergency Operating Procedures (EOPs) and Demand Resources (DR) in External Areas in IRM Studies," prepared by a sub-ICS working group, observed:

> As measured as a percent of the peak load, NY derives more LOLE benefit from the use of its EOPs than any of its neighboring control areas. This is especially true for emergency purchases or tie benefits which are significantly greater than any of the other external CAs' systems modeled in the IRM study based on the data compiled.[2]

The NYSRC's observation led the NYISO to also question if the level of EA that the NYCA has relied upon over past IRM studies has increased over time and, if there is a trend, how do those EA levels compare to the neighboring CAs. One measure of EA can be obtained by calculating the difference between the final IRM result of the technical study and a sensitivity case where the New York system is isolated from its neighboring systems.

[2] New York State Reliability Council report entitled, "Modeling of Emergency Operating Procedures (EOPs) and Demand Resources (DR) in External Areas in IRM Studies" (June 27, 2015), at p. 10.

Figure 1 below shows the amount of EA that NYCA has relied upon since the NYISO's start-up.[3]

Figure 1: New York's Emergency Assistance Levels

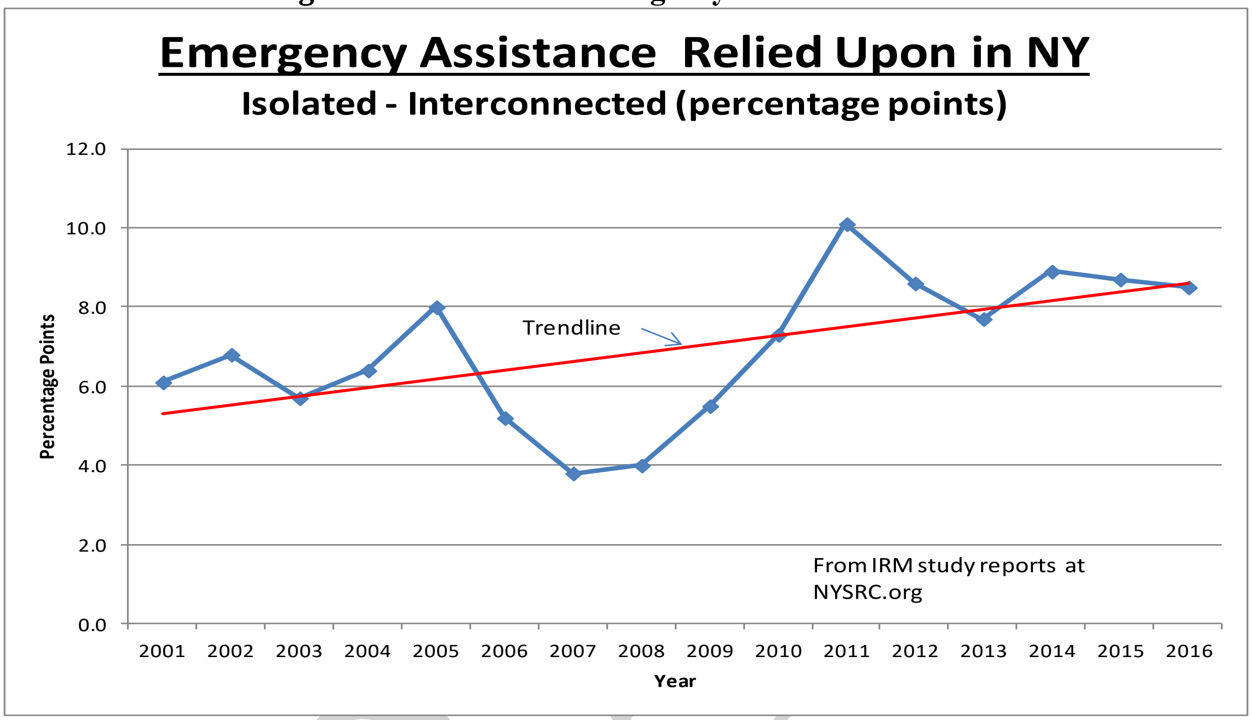
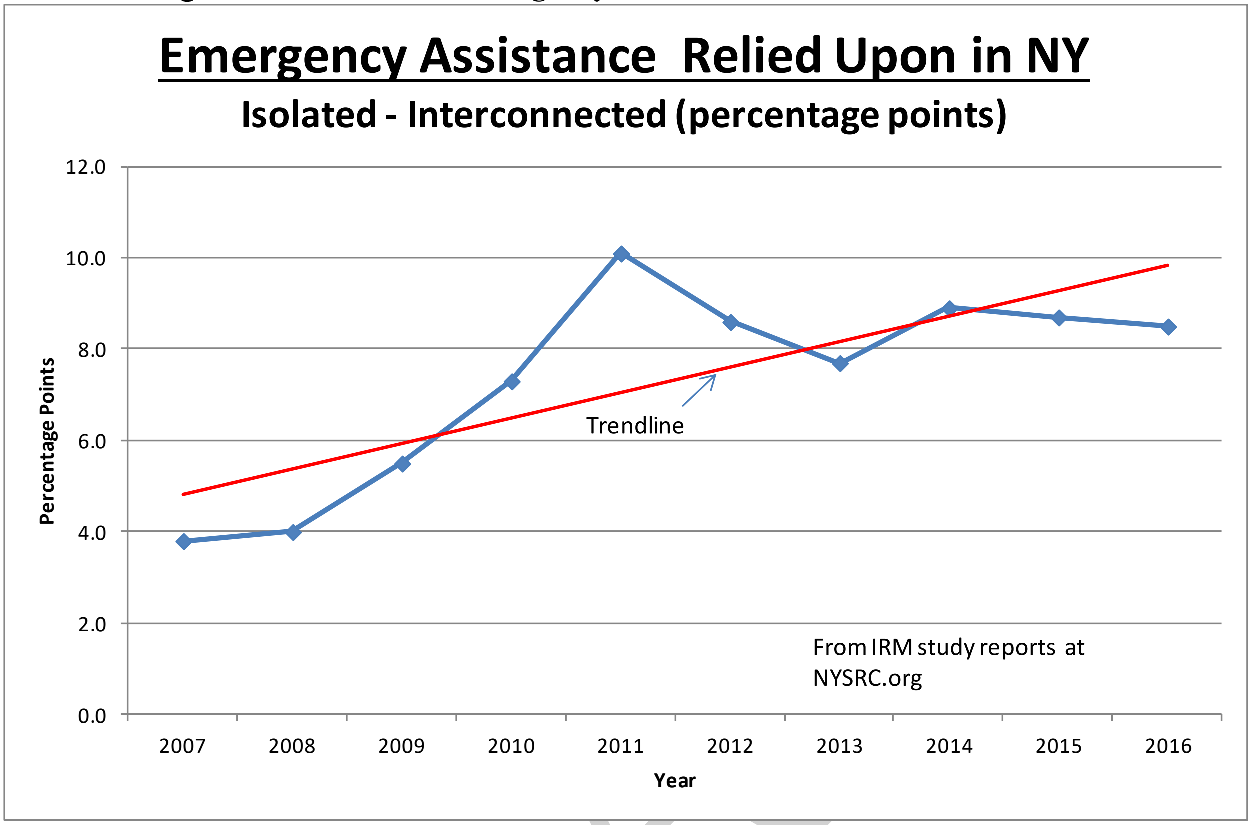


Figure 1 implies that over the period since the start-up of the NYISO, the NYCA has increased the amount of EA relied upon by over 3 percentage points when the New York BPS is isolated. Even over the last ten years, the period in which Policy 5 was in effect, shows an increase in the level of EA for the isolated case. *See* Figure 2 below.

[3] The NYISO's start-up occurred in December 1999 with the first IRM study covering the period beginning in 2000. The results for that IRM study were not conclusive in determining the EA and, therefore, are omitted from Figure 1.

Figure 2: New York's Emergency Assistance Levels - Last Ten Years



Of note, however is the relatively flat period over the last five years with the average EA impact of 8.5 percentage points on the IRM. At a peak load of 33,500 MW, 8.5 percentage points would translate into an expected EA level of about 2,850 MW for the New York isolated case.

The Amounts of Emergency Assistance Relied On By Neighboring Systems

The NYCA's neighboring systems are different from the NYCA and each others,' and each system's interconnection capability is unique. A specific level of relied upon EA in one system does not mean that same level would be appropriate for another, different system. That being said, Table 1 below shows that compared to neighboring systems, the NYCA's reliance is much higher, on a percentage basis, than PJM or ISO-NE based on a similar isolated versus interconnected determination. Ontario and the Maritimes CAs rely on *zero* MWs of EA from their neighbors in designing their systems.[4]

[4] *See* The Northeast Power Coordinating Council's CP-8 Working Group, *Review of Interconnection Assistance Reliability Benefits* (February 12, 2016).

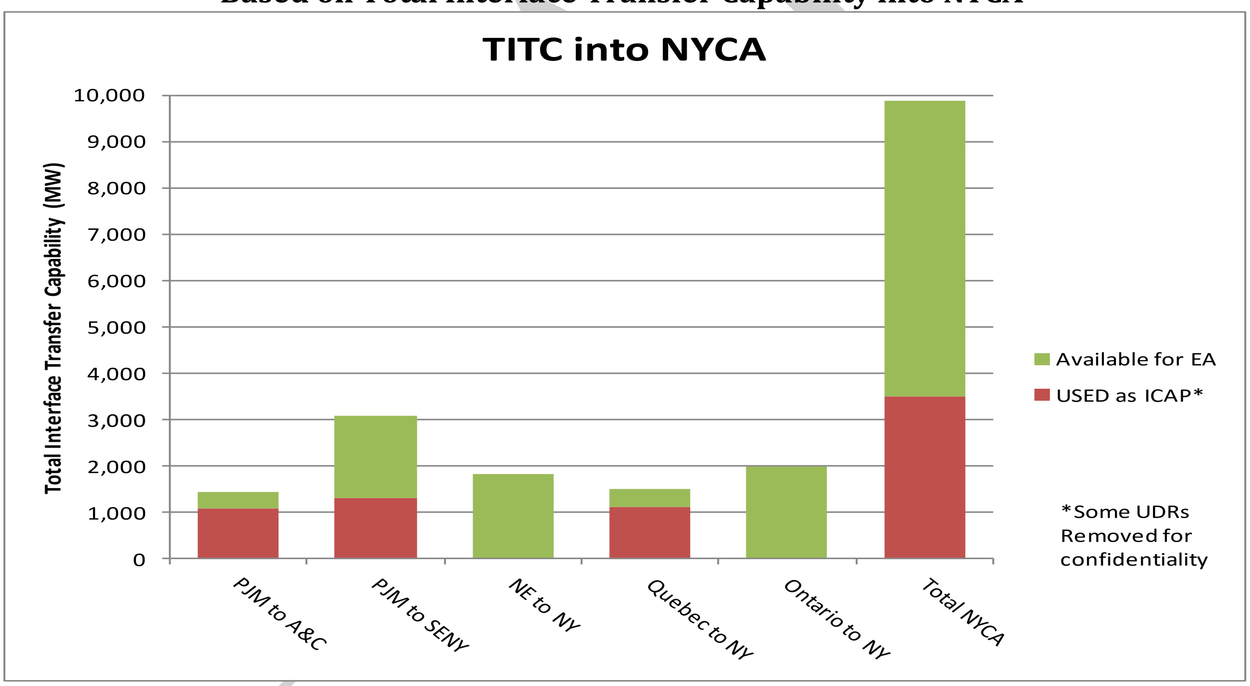
Table 1: Comparison of Emergency Assistance Among NY, ISO-NE, and PJM Control Areas

Comparison of Interconnection Benefits					
	2012/13	2013/14	2014/15	2015/16	2016/17
ISONE (TB)	6.3%	5.8%	5.2%	5.7%	6.4%
PJM (CBOT)	2.6%	4.4%	4.6%	4.7%	4.8%
NYISO	8.6%	7.7%	8.9%	8.7%	8.5%

<u>What the MARS Model Sees</u>

Breaking the Total Interface Transfer Capability (TITC) of New York into two components, this study observed, from Figure 3 below, the headroom available for EA by each neighboring CA interface. As represented in Figure 3, some of the capability shown has already been taken by grandfathered contracts, ETCNL,[5] and some (not all) of the UDRs allocated.[6]

Figure 3: Emergency Assistance Availability Based on Total Interface Transfer Capability into NYCA



It should not be inferred from Figure 3 that the amount of EA that NYCA can get from neighboring systems is almost 6,400 MW, as shown in the total green bar above. Indeed,

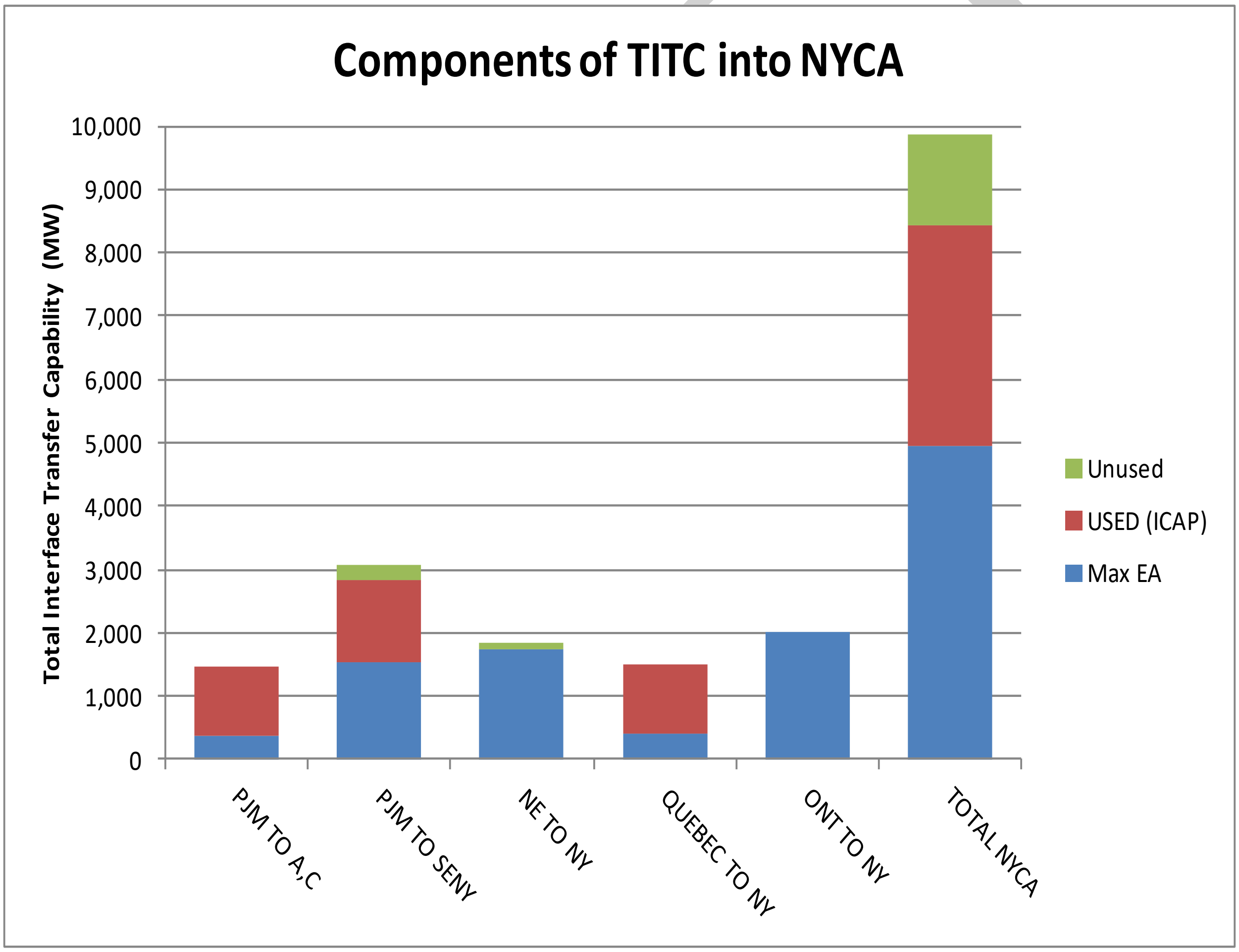
5 Existing Transmission Capacity for Native Load.

6 The total capacity is shown in this way to preserve the confidentiality of UDR contracts.

the amount of help NYCA can get from its neighbors in the MARS model is based on the amount of available tie capability (shown in green above) <u>and</u> to the amount of uncommitted resources that the GE MARS model assumes are available in the neighboring systems. The major thrust of this paper is to evaluate the level of EA assumed available by the MARS model and then determine if that level is reasonable given the actual NYCA system and its operation.

The following figure, Figure 4, is the most critical one concerning that determination. It shows that the maximum amount of EA relied upon in New York in the setting of its Installed Reserve Margin is more than 4,900 MW (shown in blue in Figure 4, below).

Figure 4: New York's Maximum Assistance, Import Capacity, and Unused Capability Versus the Total Interface Transfer Capability



Available Help from Neighboring Systems

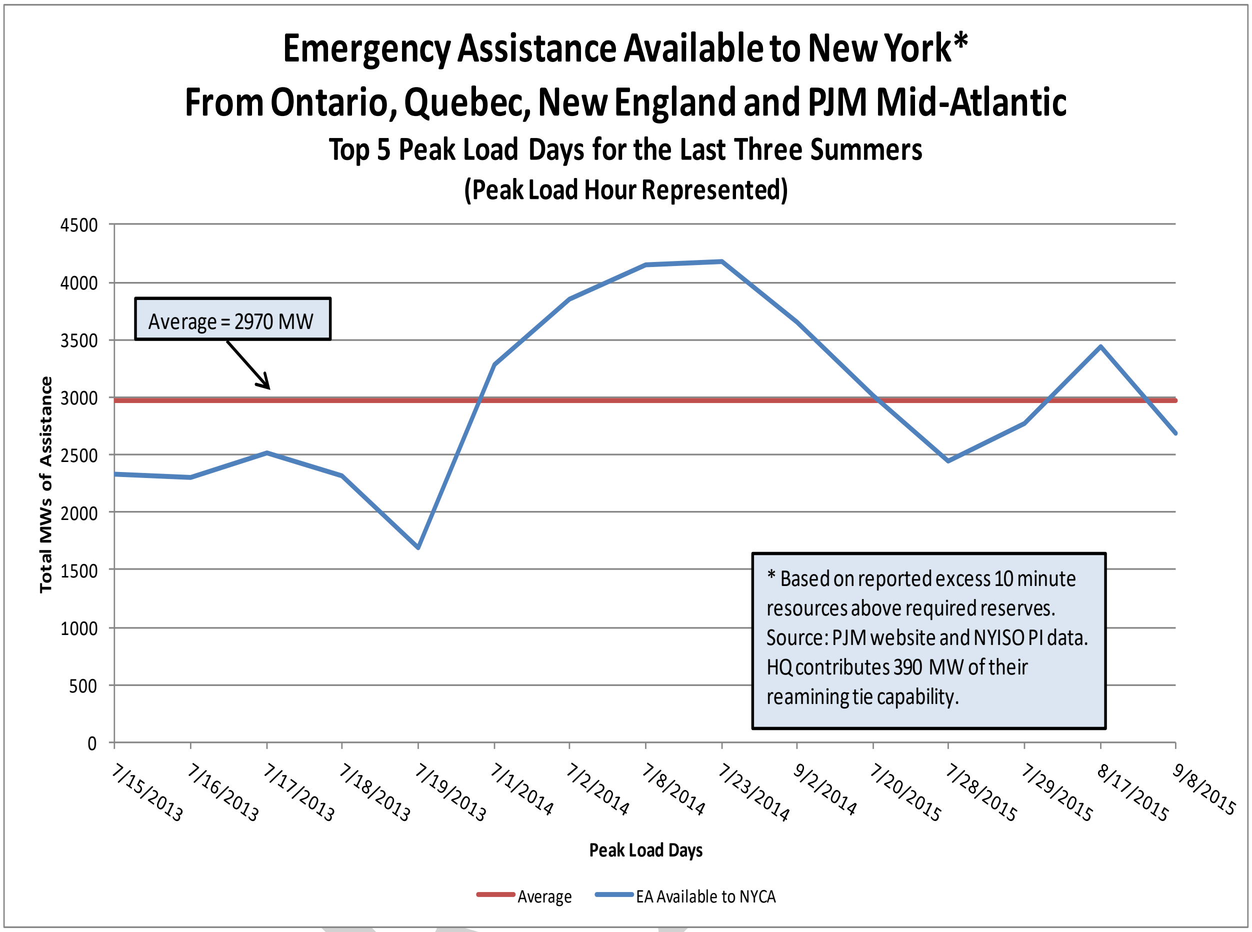
When MARS evaluates EA from neighboring systems during NYCA's hours of capacity shortages, it considers uncommitted resources (which are not New York capacity resources) in those systems as available. In reality, while both internal New York capacity resources that are off-line and capacity resources external to New York that are off-line can be scheduled on-line to meet New York's capacity shortages, external non-capacity resources that are off-line cannot be scheduled on-line to meet New York's capacity shortages. EA modeling should only assume excess energy that happens to be on-line at the time of New York's capacity shortages as EA purchases.

It is also likely that the commitment within NYCA's neighboring service territories on peak days would only be at a level necessary to meet their own load and reserve requirements and any net sales that have been scheduled in their day-ahead planning process. By the time the NYISO determines that emergency support is needed, it is likely to be either late in the day before the peak or during the peak day. Most of NYCA's neighbors have much less quick start capability than the NYISO. By the time the NYISO realizes it needs emergency support, it may be too late to get additional units in the neighboring control area committed to provide that support.

This study used two sources of information to review the resources of neighboring systems during the NYCA's peak hours. The data for PJM came from its website, while the data for New York, Ontario, and New England came from their reporting of excess reserves in our Plant Information (PI) system. Quebec contributes 390 MW's of assistance. It is a winter peaking system and has at least 390 MW of summer tie capability after accounting for their 1,110 MW of contracted ICAP. This value has been reinforced by their historic participation.

Figure 5, below, shows the amount of resources that NYCA's neighbors reported as available, and which is above their required reserves, to assist other CAs, within a 10-minute period, during the NYCA's top five hours for the last three years.

Figure 5: Emergency Assistance from NYCA's Neighbors on Top Three Peak Days



Operations Perspective

In the NYSRC IRM study and in the NYISO's other resource adequacy studies, EA has been evaluated by modeling the neighbors' systems with the data provided to the NYISO and to the same level of detail as the NYCA's representation.[7] The GE MARS program then determines the amount of EA NYCA's neighbors might have on an hourly basis.

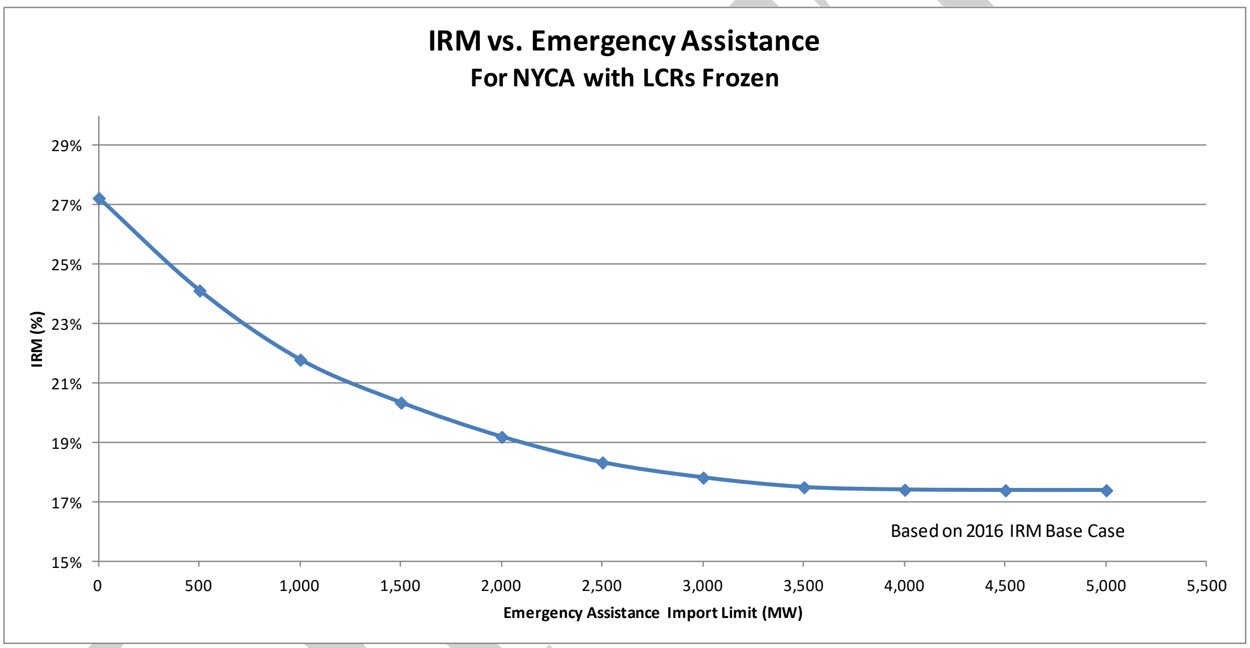
Based on the historical review of EA levels that the NYCA has relied upon over past IRM studies and the increased reliance on EA over time to a level of 4,900 MW as identified in Figure 4, the NYISO is concerned that the NYCA has become overly reliant on EA from neighboring CAs. In order to better understand how reliant the NYCA is on EA when

[7] Some adjustments are generally made to the EA as provided to the NYISO from neighboring CAs. For example, Policy 5 removes the EOPs of the neighbors and adjusts their systems if they appear to be better than 0.1 days/year LOLE.

determining the value of IRM, this study evaluated how different levels of EA impact the IRM determination.

Evaluation of the EA-IRM relationship was accomplished by creating a grouped interface of all the interconnected ties between New York and its neighbors. This grouped interface then acted as a limit to the amount of EA being provided over the ties from its neighbors. Although none of the IRM values are based on a tan 45 analysis, the values are quite indicative of how limiting the maximum value of EA affects the IRM. For the purposes of this analysis, LCRs are frozen at 2016 levels. Figure 6, below, shows the range of IRMs experienced over various amounts of allowed EA.

Figure 6: IRM versus Limits on the Maximum Amount of Emergency Assistance



From an operational perspective, the level of 4,900 MW for maximum EA values (from Figure 4, above) raises a number of concerns. The first concern is that actual EA that can be expected to be available during a regional hot weather event is quite variable and often less than 4,900 MW. As shown in Figure 5, above, recent history indicates that the available EA ranged from 1,600 MW to 4,200 MW. Relying on recent history, however, is arguably not a good indicator of future availability of EA from the NYCA's neighboring CAs given the uncertainties of their generation fleet turnovers and their operational practices as discussed at ICS.

The second concern is that the 4,900 MW level of assumed EA is significantly above what NYCA's neighboring CAs expect for maximum EA levels when determining their IRM equivalent values. NYISO understands that ISO-NE limits its maximum EA dependency to less than 2,000 MW[8] and that PJM limits its maximum EA dependency to less than 3,500 MW. These values are only identified as a reference in considering the reasonableness of setting the maximum EA for the NYCA.

The third concern is that the 4,900 MW level of assumed EA is significantly above the 2,620 MW level of operating reserves that the NYISO is expected to carry. The use of EA by NYISO Operations has historically been used to replenish operating reserves and not to meet firm load. That being said, the NYISO understands that the current IRM process allows for emergency operating procedures, which include operating reserves to be fully diminished to zero. However, the current IRM process indicates that up to 4,900 MW of NYCA firm load is being met by EA from neighboring CAs, as well as assuming that all 2,620 MW of operating reserves are fully depleted. Given the historical IRM approach of meeting firm load through the use of EA, this study recommends that the maximum level of EA be capped at 2,620 MW in order to limit the amount of operational exposure for firm load curtailment in the event that the actual EA is not available in the operational timeframe.

It is meaningful to note that the *maximum* values of EA in Figures 5 and 6 are the primary concerns from an operations perspective.

Each spring the NYISO Operations Department presents a Summer Capacity Assessment to Market Participants. On May 19, 2016, at the NYISO's Operating Committee meeting, Columns 2 and 3 of Table 2, below, were presented to Market Participants, providing projected capacity margins for the projected capacity resources for both 50-50 and 90-10 peak conditions, respectfully. Columns 4 and 5 (which were not presented at the May 19, 2016 Operating Committee meeting) are projected capacity margins "if" the total capacity resources were at Minimum IRM conditions of 117.5% (39,362 MW). Also, Columns 4 and 5 have a minor adjustment to normalize the Assumed Unavailable based on a lower Total Capacity Resources. As shown, the projected capacity margins would be -1,380 MW and -3,703 MW for 50-50 and 90-10 peak conditions, respectfully. The Emergency Operating Procedures presented at the May 19, 2016 Operating Committee meeting list 735 MW of Emergency Demand Response Programs, Voltage Reduction, Voluntary Industrial Curtailments, and General Public Appeals, which would still leave NYISO Operations at projected capacity deficiencies for projected baseline conditions.

[8] ISO-NE's restriction on potential EA is due to earlier study work that examined the number of times that EA would be expected to be called upon within the GE MARS model.

Table 2: Summer Capacity Assessment

	2016	2016	Min IRM	Min IRM
Category	2016 50-50 Peak	2016 90th Peak	2016 50-50 Peak	2016 90th Peak
Total Capacity Resources	41,874	41,874	39,362	39,362
Assumed Unavailable	4,762	4,762	4,476	4,476
Net Capacity Resources	37,112	37,112	34,886	34,886
Peak Load Forecast	33,360	35,683	33,360	35,683
Op Reserve Requirement	2,620	2,620	2,620	2,620
Total Capacity Requirement	35,980	38,303	35,980	38,303
Capacity Margin	**1,132**	**-1,191**	**-1,094**	**-3,417**

Analyses

Using the 2,620 MW level of EA as a sensitivity value for a NYCA assistance import limit, several analyses were conducted. These analyses were based on written and verbal comments received from members of the ICS.

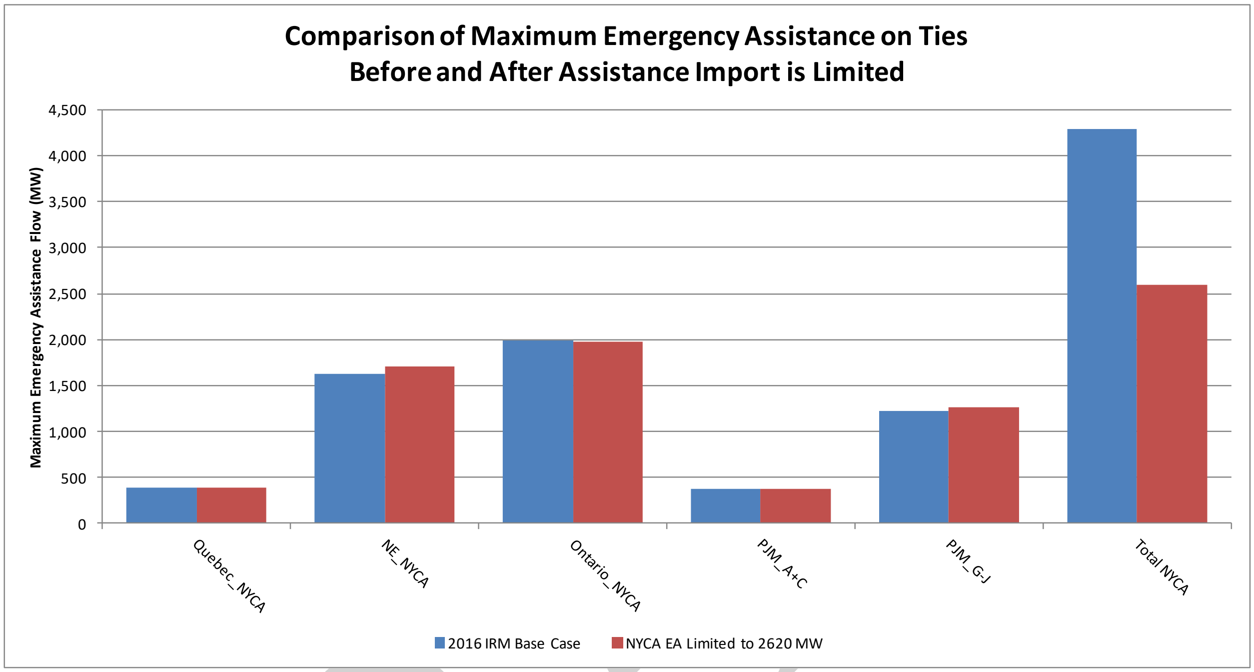
Examination of Assistance Import Flows when the 2,620 MW Limit is Applied

A full tan 45 analysis was performed on the 2016 IRM Base Case after limiting the assistance imports to 2,620 MW. No other topology updates were made to the studied case. The results of the analysis showed an IRM of 18.8%—a 1.4 percentage point increase when compared to the 2016 IRM Base Case value of 17.4%. LCR values dropped to 79.9% for NYC (from 80.8%) and 101.6% for Long Island (from 102.4%). While the increase in IRM was expected, the drop in LCRs was not. Further investigations were conducted to determine why the LCR levels decreased when the assistance imports were limited.

To determine if the GE MARS model was operating correctly after limiting the assistance imports, the change in LOLEs was observed before any of the usual removal or shifting of capacity occurred. The LOLEs of both the Localities and the NYCA increased once the 2,620 MW limit was applied. This means that the change in LCR values was a result of the system's ability to allow more capacity to be shifted away from the Localities to western NYCA without violating the 0.1 LOLE criteria. This finding prompted an examination of the interface flows.

Figure 7, below, shows the differences on import flows before and after the total assistance import is limited to a level of 2,620 MW. While the total flow into the NYCA decreased as expected, the flows from ISO-NE and the flows from PJM into SENY both increased. This explains how the LCRs can decrease when the total NYCA assistance imports are limited. It also indicates a need to examine the components of the EA that our neighbors are providing. Note that these values are the expected maximums and not the actual one time maximums. The expected maximum for total EA into NYCA is 4,284 MW, while the actual maximum level of 4,900 MWs was observed. Similarly, the expected maximum value for TOTAL-NYCA is 2,600 MW with the limit set to 2,620 MW.

Figure 7: Comparing Emergency Assistance on Tie Flows

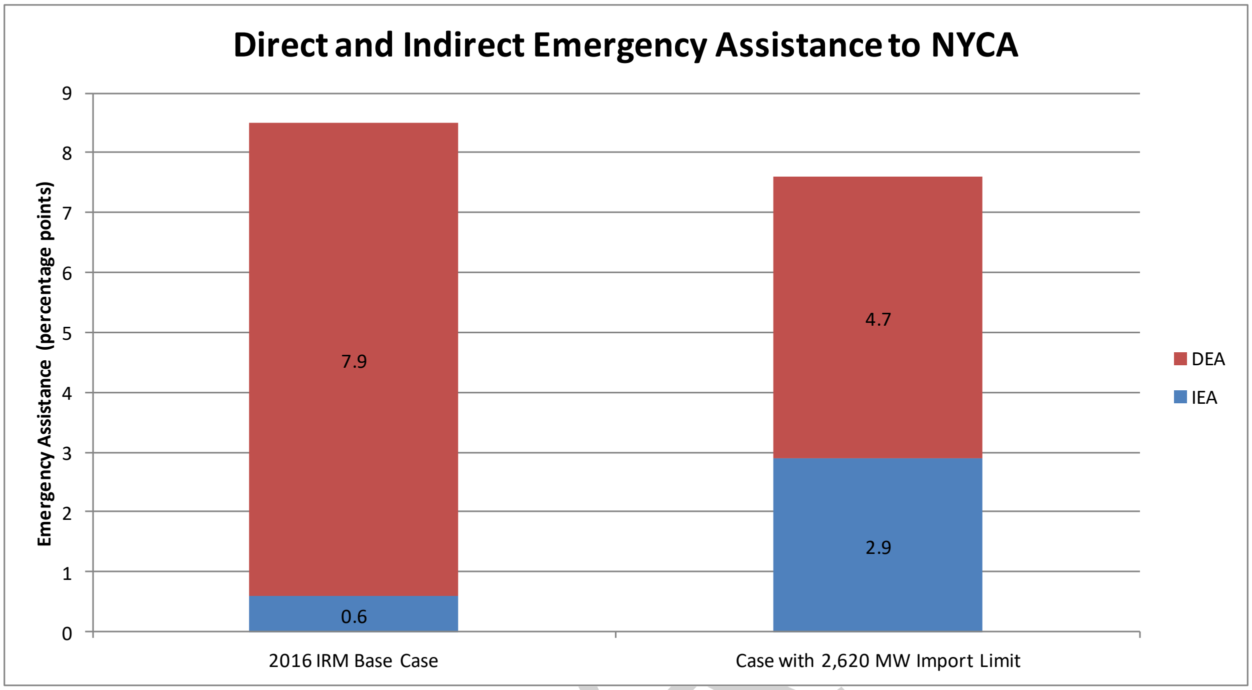


Examination of Both Types of Emergency Assistance in the MARS Model

In the Introduction of this paper, the EA was broken into two components—indirect emergency assistance (IEA) and direct emergency assistance (DEA). Although the total amount of EA was known for the 2016 IRM Base Case—8.5 percentage points, the component pieces were not known. Because of this, this study devised a method to determine the amount of DEA being supplied to the NYCA and, thereby, the IEA by observation. The idea was to cut the ties leaving NYCA and only allow imports of assistance (*i.e.*, DEA). In this manner the IEA is eliminated and the DEA can be determined.

Figure 8, below, shows the base case components of 8.5% total EA. It also shows the change in the levels of IEA and DEA when limiting the total EA into the NYCA to 2,620 MW. Figure 8 shows the total amount of EA falls due to the rise in IRM from 17.4% to 18.8% when the limit is applied.

Figure 8: Components of Direct and Indirect EA in NYCA



This rise in IEA, or use of another CA's transmission system to wheel EA in order to by-pass NYCA constrained interfaces, is concerning.

The GE MARS model employs a pipe-and-bubble transportation model and, as a result, currently allows EA to be wheeled through neighboring systems on the interconnected system. This wheeling of EA is an example of IEA.

Most of the wheeling of IEA is assumed in the GE MARS model to flow over phase-angle regulated interconnections to the Southeast NY (SENY) and New York City (NYC) areas. However, there is arguably no market or operational mechanism under NYISO's tariffs to effectuate this type of wheeling of EA energy. In recognition of this reality, it *may* not be appropriate for the IRM study to use external CA transmission systems to wheel internal NYCA resources to meet NYCA loads using interconnections outside of the internal NYCA transmission system.

Using the assumptions contained in the 2016 IRM study as the base case, the IRM would have been 0.6 percentage points higher had IEA not been permitted.

This study recommends that ICS continue to monitor the impact that the use of IEA has on the IRM process as sensitivity to the base case IRM.

Changes in NYCA Topology Due to Cancellation of PSEG Wheel

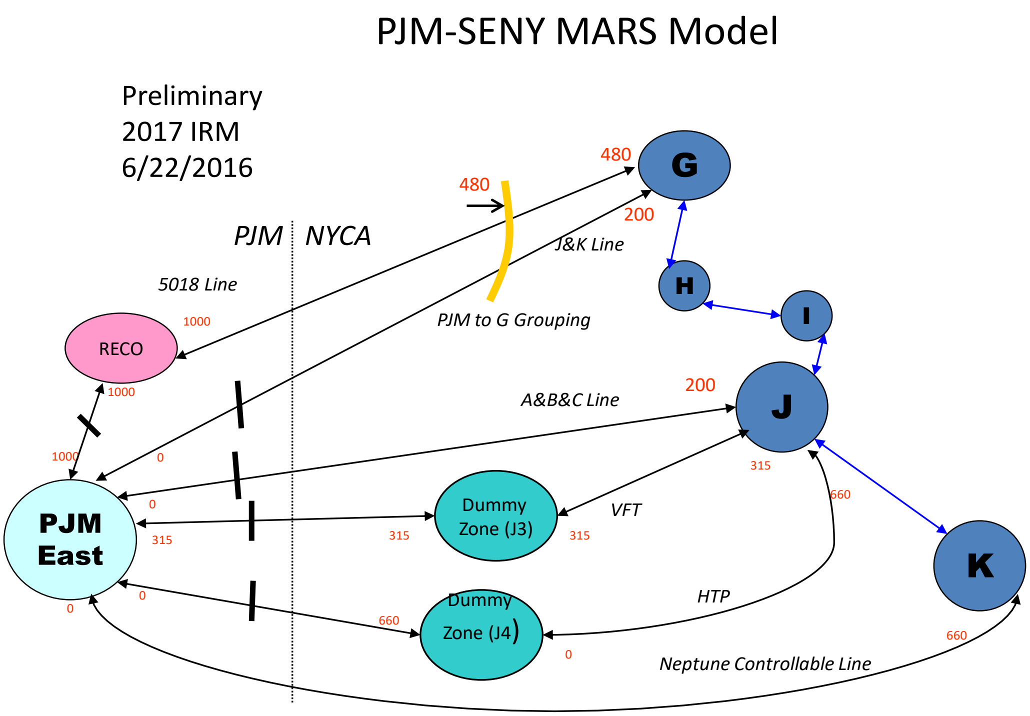
The recent cancellation of the PSEG-Con Edison wheel simplifies the topology between PJM and SENY by removing the need to have one of the separate "dummy" bubbles as explained in the Table 3, below. The following table illustrates the changes as a result of the announcement along with the basis for those changes.

Table 3: Assumption Changes Relating to PSEG Wheel Cancellation

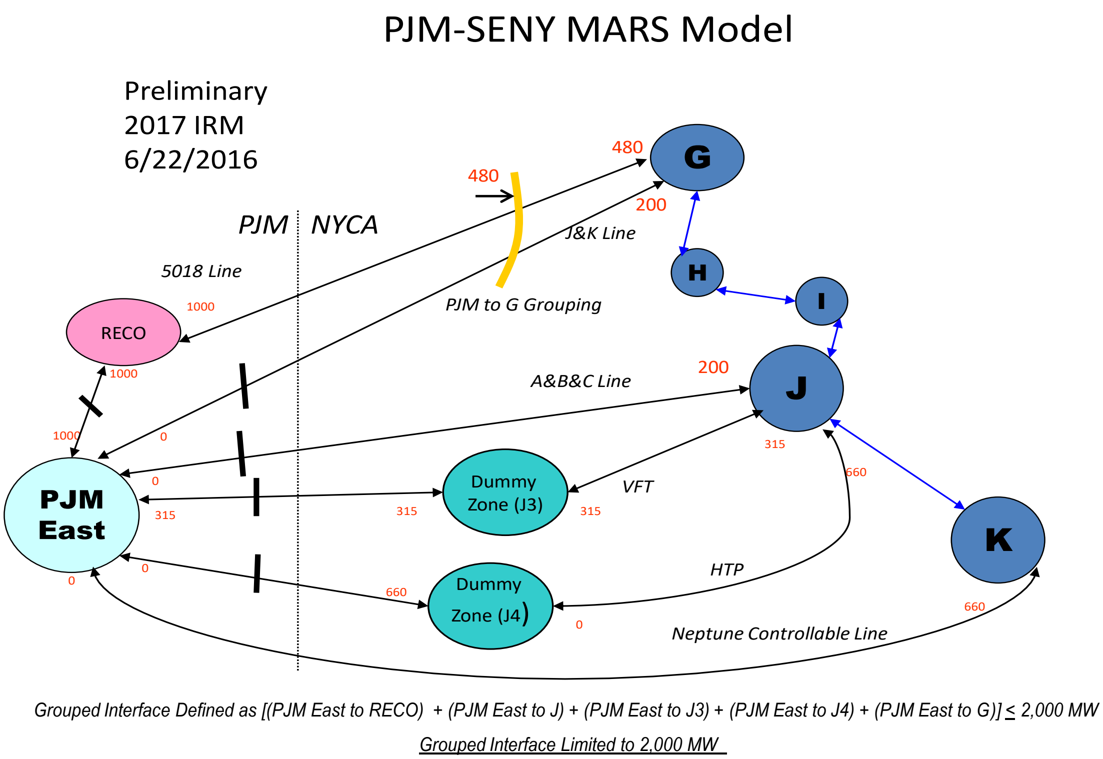
#	Loss of PSEG Wheel Changes	Impact	Basis for Recommendation
1	Removal of J2 Dummy Zone. Combine A, B, and C lines.	Break out A line from VFT. Combine A line with B and C lines.	Loss of wheel removes need for dummy zone (J2) and intermediary paths. No need to combine A line with VFT and lines A, B, and C can be combined.
2	Existing Emergency Assistance continues – on ABC, JK, and 5018 lines	Existing 1,000 MW on these ties are broken out by distribution factors of recent power flow case	No JOA to allow EA scheduling on these specific lines. Roughly 68% of emergency assistance can flow on ABC, JK, and the 5018 paths into NY. Further distribution as shown below.
3	Fixed Emergency Assistance limit of 2000 MW continues on ties from PJM to SENY	No impact on total limit	With removal of dummy zone J2, five interface segments are needed to replace previous 4 segments. Limit stays the same since projects in Northern New Jersey not scheduled for completion until 2018, at the earliest and new limit would need to be studied at that point.

The new topology between PJM and SENY appears in Diagram 1, below.

Diagram 1: Proposed IRM Topology of PJM to SENY Without PSEG Wheel



(PJM East to RECO) + (PJM East to J) + (PJM East to J3) + (PJM East to J4) + (PJM East to G) Grouped Interface Limited to 2,000 MW



Effect of EA Limits on 2016 IRM Study

The 2017 Base Case will have modified topology models that differ from the 2016 IRM Base Case. Although it is too early to determine how the 2016 IRM will change by the modeling updates that will be needed to establish the 2017 IRM, the changes caused by the cancellation of the PSEG/Con Ed wheel and new import limitations were examined as a part of this study through a sensitivity using the 2016 Base Case.

To do this, NYISO started with the 2016 IRM base case and made the changes identified in the above report sections. Tables ~~3~~4 and ~~4~~5 show the impacts of these changes. The values in both Tables 4 and~~3's~~ 5 ~~values~~ are the result of performing an entire IRM-LCR curve, and are indicative of the impacts to both the IRM and LCRs. ~~Table 4 was performed as a normal IRM sensitivity.~~

Table ~~3~~4: Impact of PSEG Wheel Removal on 2016 IRM

Area	2016 IRM Base Case Results	Impact of PSEG Wheel Removal
NYCA IRM	17.4%	17.4%
Zone J LCR	80.8%	80.8%
Zone K LCR	102.4%	102.4%

Table ~~4~~5: Impact of Wheel Removal and 2,620 MW Limit Imposed

Area	2016 IRM Base Case Results	No Wheel and 2620 MW limit
NYCA IRM	17.3%	18.8~~0~~%
Zone J LCR	80.8%	80.5~~1.2~~%
Zone K LCR	102.4%	100.9~~3.0~~%

Conclusion

The total EA that the NYCA has been relying upon from its neighbors in the IRM studies has grown substantially since the start-up of the NYISO. Over the last five years, it appears that the growth has leveled off at a value of 8.5 percentage points, or around 2,850 MW (based on a peak load forecast of 33,500 MW).

For some study years, the EA relied on in the GE MARS model exceeded 4,900 MW, which is far outside an operational and design comfort level and approaches the TTC capability of the interface ties. Several methods were pursued in this study to determine a more reasonable level of EA.

Furthermore, the GE MARS model has no way to account for generation start-up times. Therefore, it is unrealistic to rely on a large portion of neighboring fleets to provide assistance on an emergency basis when by the time those generators start up, NYCA's crisis may have passed or been addressed using other means. For this reason, the study evaluated the excess 10-minute resources of neighboring systems on top of their required reserves. The capability from those 10-minute resources could reasonably be in a position to provide assistance to the NYCA during emergency conditions. The average of this capability over the NYCA's top three peak load days yielded a value of 2,970 MW.

Table 6 shows the potential values of EA from varying perspectives.

Table 6: Total NYCA EA Potential Limits Using Various Methods

Source of Potential Limit	Limit
Last 5 years' expected average	2,850 MW
Operators on Floor	2,200 MW
Neighbor's reported excess reserve margin	2,970 MW
NYISO operation reserves (Use EA to replenish operation reserve margin)	2,620 MW

Figure 6 (page 10) indicates that restricting EA below 3,500 MW would cause the base case IRM to increase. Since t~~T~~he levels of EA shown in Table 6, above, are lower than 3,500 MW the base case IRM would increase, as demonstrated in table 5. ~~knee of the curve shown on Figure 6. This means that there is some potential for the IRM to increase. From the results in Figure 6, it looks like an IRM of slightly over 18% is possible. Since the LCRs are frozen in calculating these results, an 18% IRM due to this potential change would be tempered because Tables 4 and 5, above, indicate a slight increase in LCRs and a smaller increase in the IRM when a full tan 45 curve is generated.~~

The 2,620 MW value, suggested by NYISO Operations and analyzed in this study, represents a reasonable assumption for use in the IRM Study for the following reasons:

1. This value was based on the possibility that NYCA's neighbors could supply to that level of EA as demonstrated by their own submissions;

2. Neighbors' excess resources should be used to only replenish NYCA's loss of operating reserves and not to serve NYCA load;

3. The segregation between excess capacity resources and excess operating reserve resources aligns with how the market operates in that the operating resources do not, nor are expected to, receive capacity payments; and

4. It would not be appropriate to design a BPS that relies on emergency resources that neighboring systems could not bring on-line in time to meet an emergency.

Recommendations

1. For the IRM Study, implement a grouped interface in the GE MARS model to limit the amount of emergency assistance that can be imported into NYCA. Set the import limit for this grouped interface to a value of 2,620 MW, which is based on examination of varying methodologies of import determinations and considerations.

2. The NYISO recommends that the ICS continue to evaluate, monitor, and potentially curtail the indirect emergency assistance that benefits NYCA by delivering power from one area to another area in New York through neighboring transmission systems.

Appendix A

Original Scope of Work for EA Paper

Scope

MODELING OF EMERGENCY ASSISTANCE TO THE NEW YORK CONTROL AREA IN NYSRC IRM STUDIES

Background

NYSRC IRM studies include an Outside World Model representation that consists of four interconnected external control areas contiguous with NYCA: Ontario, Quebec, New England, and the PJM Interconnection (PJM). These interconnections provide emergency assistance (EA[9]) to NYCA for avoiding load shedding, thereby reducing NYCA IRM requirements. Over the past ten years, NYSRC IRM studies (2007 - 2016 IRM Studies) show that the average EA reserve benefit[10] from neighboring control areas has increased from a low of 3.8% in 2007 to a high of 10.1% in 2011[11]. Over the last five years (2012 - 2016 Studies), the EA reserve benefit has averaged **8.5%**. This compares to average EA reserve benefits of **5.8% and 1.7%** for New England and the PJM RTO, respectively, for the same time period (*see* Table-1, below). In consideration of these ranges of EA reserve benefits and the concern as to whether NYSRC studies presently overstate EA reserve benefits, the Executive Committee has requested ICS to conduct an analysis to determine whether the EA levels presently relied upon in NYCA IRM studies may be excessive, considering operating conditions or other system considerations that may not be recognized in the present GE-MARS model, and to recommend an IRM study modeling change if appropriate.

Table-1

Comparison of Average Emergency Assistance (EA) Reserve Benefits (% of the Forecast Peak Load)					
	2012/13	2013/14	2014/15	2015/16	2016/17
ISONE	6.3%	5.8%	5.2%	5.7%	6.4%
PJM RTO	1.2%	1.9%	1.8%	1.8%	1.9%
NYISO	8.6%	7.7%	8.9%	8.7%	8.5%

Present Emergency Assistance Model

The present IRM model in GE-MARS is based upon performing a series of probabilistic Monte Carlo simulations to determine whether, after accounting for unit outages and transmission

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[9] Emergency assistance, as used here, does not include contracted capacity from external control areas.

[10] For the purposes of this scope, "EA reserve benefit" is defined as the NYCA IRM reduction due to emergency assistance from neighboring control areas.

[11] The emergency assistance benefit of 10.1% occurred in 2011 and corresponded with one of the lowest IRM levels of 15.5%. Based on the 2011 observation, a total NYCA imports interface grouping was placed in the model to better monitor and understand emergency assistance reserve benefit.

capability there is sufficient capacity to meet the modeled load. In the Monte Carlo analysis, when the NYCA has insufficient available generation, the GE-MARS model determines whether any of its neighbors has more generation available than is necessary to meet their own loads, and if so, allows that excess generation to meet the remaining NYCA load to the degree that there is available modeled transmission capability to deliver the neighboring area's excess energy.

In performing the analysis, GE-MARS tests all neighboring system generation to determine their availability to provide excess generation (*i.e.*, not projected to be on an outage). Any excess generation from a neighboring system would be committed if called upon by NYCA. However, GE-MARS does not account for the fact that, even though a unit is available to be committed, neighboring systems may not be willing or be able to timely commit their excess generation to supply EA should the NYCA be short of resources. As a result, the GE-MARS model, as presently applied, may overstate EA levels, causing NYSRC IRM studies to determine excessive EA reserve benefits. Given these concerns, it is therefore prudent that ICS evaluate the extent to which NYCA should be dependent on EA reserve benefits from neighboring areas.

<u>Purpose of Study</u>

The purpose of this study is to analyze the maximum amount of EA that NYCA can reliably depend upon from our neighbors for application in IRM studies, considering the above-referenced EA modeling issues and other NYISO operating constraints and considerations not presently considered in the GE-MARS model. Based upon this analysis, ICS will develop modeling changes as appropriate for future IRM studies. The analysis will be completed by September 2016, which will permit a sensitivity case for the 2017-18 IRM Study report. The EA model change, following modifications as appropriate, will be incorporated in the 2018-19 IRM Study. A white paper will be prepared.

<u>Scope</u>

- From the preliminary 2017 IRM Study base case, identify the maximum EA level for a simultaneous NYCA grouped import interface ("NYCA Grouped Import Interface") as well as for individual import interconnection interfaces. Plot the distributions of EA levels for all identified interconnection interfaces.
- Observe the inflection points and confer with NYISO Operations to determine reasonable levels of EA to use as interconnection interface caps (*e.g.*, 90% of the probabilistic draws to avoid the excessive EA draws in the last 10%). These interface caps can be converted to MW values.
- Run cases whereby the maximum EA level of the NYCA Grouped Import Interface is capped at certain MW levels and determine the impact to the NYCA IRM using a Tan 45 analysis. Depending on the above results, run analyses, as warranted, for evaluating the need for additional individual interconnection interface caps. These cases are intended to determine the impact to IRM outcomes of simulating certain limitations in the maximum values of EA reserve benefits.