GE Energy

Preliminary Report to

NYISO

for

Upstate-Downstate "Superzone" Study

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Foreword

This document was prepared by General Electric International, Inc. It is submitted to the New York Independent System Operator, Inc. Technical and commercial questions and any correspondence concerning this document should be referred to:

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Executive Summary

(to be added later)

1 Objective

The primary objective of this study was to evaluate the reliability of and inter-zonal assistance between two NYCA “superzones” identified as Upstate (Zones A through I) and Downstate (Zones J and K). GE’s Multi-Area Reliability Simulation (MARS) was used to study the years 2006 and 2010.

2 Data

Data for this study was based on the current IRM Base Case for 2006 and consistent with the NYISO Comprehensive Reliability Planning Process (CRPP) Reliability Needs Assessment (RNA) for 2010. Transfer limitations between individual zones, simultaneous interface limits, and the representation of outside control areas were based on the previously mentioned data sources.

3 Methodology

3.1 Reliability Balance

Starting from the base case, firm contracts were modeled between the two superzones such that the calculated indices of the two superzones were nearly balanced in terms of daily LOLE. Because the LOLE index is a measure of whether a system has adequate generation to meet its load, and is thus independent of system size, equitable risk was measured in terms of equal superzonal LOLE without any adjustment for the relative size of the superzones. For this study, the systems were comparable, with the Upstate peak load of 16,502 MW, and the Downstate of 16,793 MW.

3.2 Reserve Sharing

The reserve sharing used to allocate assistance among deficient zones is usually done on a NYCA-wide basis. However, using this approach in this study would result in misleading indices for the superzones. For example, assume that one of the superzones has two zones, one with a shortage of 150 MW and another with a surplus of 200 MW, and the other superzone has a single zone with a shortage of 150 MW. Reserve sharing on a NYCA-wide basis would result in each superzone being short by 50MW, while the first superzone actually has an excess of 50 MW, which should be the limit of the assistance that it provides to the other superzone.

Consequently, for this study the reserve sharing was done first on a superzonal basis, with zones within a superzone assisting other zones within the same superzone. The next level of assistance was then NYCA-wide between the superzones, and then finally assistance to and from outside systems would be modeled. In general, reserve sharing by superzone will not change the overall NYCA LOLE but it will change the relative contribution of the superzones to the NYCA index, which was a key quantity in this study.

3.3 Contracts

Firm contracts were used to transfer perfect capacity between the superzones. Since MARS models contracts between zones and not tied to specific units, a NYCA average forced outage rate of 5.57% was used to convert the perfect capacity to real capacity for calculating reserve margins.

In the original methodology, all of the contracts that were added to achieve reliability balance were to be modeled between Zone I (Upstate) and Zones J and K (Downstate), with the contracts split between Zone J and Zone K in proportion to the transfer limits between Zones I and J (3,700 MW) and Zones I and K (1,270 MW). This would ensure that constraints internal to the superzones would not prevent a contract from being delivered. Because of the reserve sharing within the superzones, it was not necessary to have the contracts originate in the capacity-rich zones.

However, because of the forced outages being modeled on some of the ties, the contracts being modeled from Zone I to Zones J and K could not always be delivered, restricting the ability to balance the reliability between the two superzones. To circumvent this problem and to more closely model the wheel through PJM that exists, the first 1,000 MW of firm contracts from Upstate to Downstate was sent from Zone G to PJM-East to Zone J. Because the PJM wheel is not associated with specific units, it was not adjusted by the average forced outage rate prior to the reserve margin calculations.

4 Modeling Issues Uncovered During Initial Simulations

4.1 Program Versions

The starting point for the 2006 analysis was the 2006 IRM Base Case. For this case capacities had been adjusted so that the state reserve margin was 18% and the locational capacity requirements were 80% for Zone J and 99% for Zone K. When simulated for 1,500 replication with MARS Version 2.69, the resulting NYCA LOLE was 0.096 days/year.

The same case was then modeled with the latest version of MARS, Version 2.80. The major change between Versions 2.69 and 2.80 was a correction to the logic to limit the number of days per month that an emergency operating procedure (EOP) can be implemented. The resulting NYCA LOLE was 0.078 days/year.

To confirm that the problem in the limited EOP logic was the source of the difference between the two versions, the data was revised to remove the limit on the number of days that the EDRP EOP can be implemented. The two versions of the program then produced identical results of 0.075 days/year.

The results from these and the remaining benchmarking cases are shown in Figure 1. With the difference between program versions resolved, all remaining simulations were run with MARS Version 2.80.

4.2 Flow Through Outside Control Areas

To correctly model in this study the reserve sharing between the superzones, NYCA had to be split into two Areas: an Upstate superzone (Zones A through I) and a Downstate superzone (Zones J and K). In theory, whether NYCA is modeled as one Area or two, the overall LOLE for NYCA should be the same. However, because of the way in which MARS models the resource allocation between the zones with excess and those that are deficient, a slight change in the NYCA LOLE resulted.

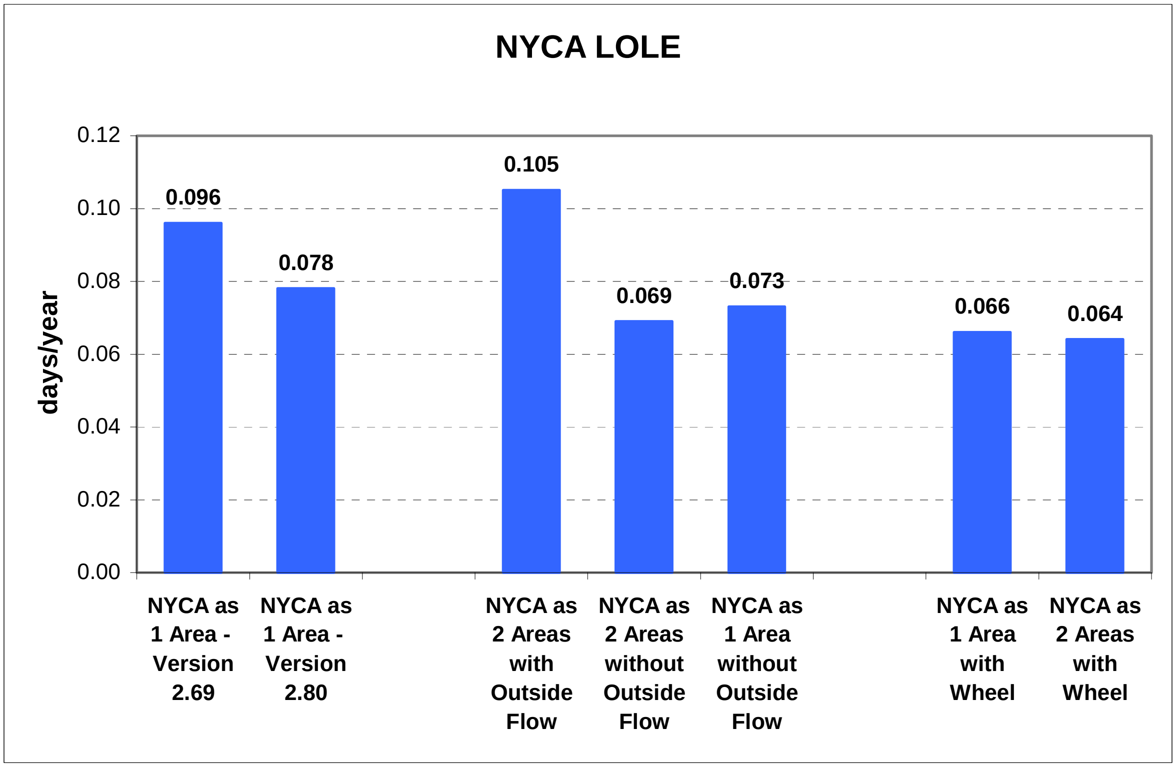

Figure 1 – NYCA LOLE for Benchmarking Cases

The first step in the resource allocation calculations in MARS is for the zones with excess within a given Area to assist the deficient zones within the same Area. The next step is to model the Area-sharing arrangements in which the zones within an Area will provide assistance to zones in other Area(s) according to a predetermined priority order. In the final step, any remaining excess capacity is allocated to the remaining deficient zones on a system-side basis. Throughout this entire process, the excess reserves are always allocated to the deficient zones in proportion to the zones' shortfall, subject to the interface transfer limits.

A key consideration within the resource allocation calculations is whether flow through outside Areas is allowed. When flow through outside Areas is allowed, it's possible for one Area to load up the interfaces within another Area before that Area can use those interfaces to meet the shortfall of its own zones.

With NYCA modeled as two Areas, the assistance between Upstate and Downstate was modeled as the first Area-sharing arrangement, after each Area had first met its internal needs. However, when flows through the outside were allowed in the internal Area pass, PJM was loading up some of the NYCA interfaces while providing assistance to the PJM-East zone. This limited the amount of assistance that Upstate could provide to Downstate, resulting in an increase in the NYCA LOLE from 0.078 days/year for NYCA as one Area to 0.105 days/year with NYCA as two Areas.

The cases with NYCA as one and two Areas were then run with flows not allowed through the outside Areas during the pass in which the zones in each Area provide assistance to other zones in the same Area. The LOLE for NYCA as two Areas improved from 0.105 days/year to 0.069 days/year as Upstate was now able to provide more assistance to Downstate. The reliability for NYCA as one Area also improved slightly as the internal interfaces which had been loaded by PJM were now available to provide assistance to Zones J and K during the Area-sharing arrangements with Ontario and Hydro Quebec.

The contracted wheel of 1,000 MW from Upstate to Downstate was then added as a firm contract from Zone G to PJM-East to Zone J. As shown in Figure 1, this improved the NYCA LOLE to 0.066 days/year in the one-Area case, and 0.064 days/year with NYCA as two Areas. This two-Area case was used as the starting point for subsequent analysis.

4.3 Contracts

As described previously in the discussion on methodology, firm contracts are being used to transfer capacity between Upstate and Downstate in order to balance the reliability of the two superzones. In MARS, a firm contract is defined in terms of the sending and receiving zones and the interfaces over which the contract will be delivered.

The program models the contract by decreasing the margin in the sending zone, increasing the margin in the receiving zone, and adjusting the transfer limits of the specified interfaces to reflect the flow caused by the contract. If a transfer limit is reached, the contract will be curtailed to the amount that can be delivered on the specified path; the program will not attempt to find an alternate delivery route to fulfill the contract.

In this study, the contracts are being modeled as between Zone I and Zones J and K, with the contracts split between Zone J and Zone K in proportion to the transfer limits between Zones I and J (3,700 MW) and Zones I and K (1,270 MW). Whether all of the contracts originate in Zone I or they are distributed among the Upstate zones will have no impact on the reliability of the Upstate superzone, although it may change the LOLE of the individual Upstate zones. Taking all of the contracts from Zone I will make that zone more deficient than if the contracts were spread around, but the other Upstate zones, as the first step in the resource allocation process, will attempt to cover that deficiency with other Upstate resources, subject to the transfer limits between the Upstate zones.

Both methods will produce the same overall reliability for the Upstate zone. The advantage of modeling all of the contracts from Zone I is that it eliminates the need to determine paths over the Upstate interfaces to deliver the capacity to Downstate; the program now automatically does this in its attempt to deliver the additional assistance now required by Zone I.

4.4 Additional Concerns

At the May 2006 meeting of the Installed Capacity Subcommittee (ICS) of the New York State Reliability Council, a number of concerns were discussed that could have an impact the this study. These issues included:

- the inability to simultaneously import into Zone B from Zones A and C (it's either one or the other);
- Oswego bottled capacity;
- revisions to Athens transmission nomogram;
- near term Upstate unit retirements and increased Upstate load growth; and
- possible need for Locational Capacity requirements in Zone B and I due to local transmission constraints.

Additional concerns that have been raised in the past include:

- the modeling of the outside world;
- Downstate retirements or installation slippages; and
- whether the current load forecast uncertainty is sufficiently broad.

We agree with the ICS that all of these issues could have an impact on the Upstate/Downstate study and should be studied at some point in time. We look forward to meeting with the ICS to discuss these issues and how they can be modeled in the current study, along with the impact that the associated changes in assumptions will have on the scope and schedule of the study.