Upstate-Downstate Study
Findings and Recommendations
For Discussion Purposes Only
Draft 6/07/07

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Background

In a complaint filed on September 30, 2005 with the Federal Energy Regulatory Commission ("FERC" or the "Commission") under section 206 of the Federal Power Act, Niagara Mohawk Power Corporation, d/b/a National Grid ("National Grid") alleged that current practices of the New York State Reliability Council ("NYSRC") and the New York Independent System Operator ("NYISO") pertaining to the setting of the statewide installed capacity reserve margin ("IRM") and locational capacity requirements ("LCRs") resulted in electricity consumers in upstate New York subsidizing the costs of maintaining reliability in the downstate regions.[1] National Grid requested FERC to direct the NYSRC and the NYISO to implement a lower statewide installed capacity requirement to eliminate the claimed subsidy. The National Grid complaint also alleged that the current NYSRC and NYISO procedures for setting the IRM and LCRs were inconsistent with Commission orders and policy underlying locational markets and depressed price signals for increasing capacity in the downstate zones.[2] FERC dismissed the National Grid complaint, without prejudice, and required that National Grid first try to resolve this dispute within the NYSRC and the NYISO stakeholder processes before filing a complaint with the Commission.

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[1] *Niagara Mohawk Power Corporation, a National Grid Company v. New York State Reliability Council and New York Independent System Operator, Inc.*, 114 FERC ¶ 61,098, paragraph 1 (2006) (hereinafter cited as "FERC Order" with paragraph references).

[2] FERC Order, paragraph 10.

A key element of the stakeholder process was the development of an Upstate-Downstate (U-D) Study. The primary purpose of the U-D study was to determine if an assessment of the reliability balance between the Upstate and Downstate Regions[3] of the State could provide insight into the primary issue of the complaint – *i.e.*, does the Upstate Region of the New York Control Area (NYCA) result in a reliability subsidy to Downstate Region of the NYCA. The U-D Study defined a subsidy as one region of the NYCA having a implicitly lower reserve margin than the other, compared to the statewide IRM, when both regions are at equal risk from a Loss-Of-Load-Expectation (LOLE) perspective. General Electric Energy Consulting (GE) was retained to conduct the study and the GE report is attached as Appendix A. Also, attached in Appendix B are two cost of capacity studies that were compiled and presented by Upstate and Downstate stakeholders.

This report begins with an identification and overview of the characteristics of the NYCA power system which are important factors in determining the level of the installed reserves required to meet reliability criteria. This is followed by a summary of the key findings of the GE study. Finally, the report ends with the findings that can be drawn from the information included in this report regarding the subsidy issue as well as a recommendation for bringing this issue to a resolution.

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[3] Upstate is defined as NYCA Load Zones A through I and is identified as the Upstate Super Zone while Downstate is defined as NYCA Load Zones J and K and is identified as the Downstate Super Zone

The New York Power System in Context

The reliability of a power system is a function of both its design characteristics and operating environment. Power system reliability consists of adequacy and security. Adequacy, which encompasses both capacity resources and transmission adequacy, refers to the ability of the bulk power system to supply the aggregate requirements of consumers at all times, accounting for scheduled and unscheduled outages of system components. Security refers to the ability of the bulk power system to withstand disturbances such as electric short circuits or unanticipated loss of system components.

Adequacy is a planning and probability concept. A system is adequate if the probability of not having sufficient transmission and capacity resources to meet expected demand are equal to or less than the system's reliability standard, which is expressed as a LOLE. The New York State Power System is designed such that an involuntary load disconnection event shall not occur on average more than once in every 10 years. This resource adequacy criterion is defined probabilistically as an LOLE that can be no more than 0.1 days per year and forms the basis of the NYCA installed capacity or installed reserve margin requirements.

The level of installed reserves required to meet the criterion is a function of many system characteristics or risk factors. They include the availability or equivalent forced outage rate (EFOR) of the system resources, the number of high load hours or its load shape, size of generating units, transmission system capability and availability, load uncertainty, emergency operating procedures and emergency assistance from neighboring control areas. As a result, systems with differing characteristics will have differing levels of installed reserve margin to meet the criterion of 0.1 days per year. This is why it is important to compare and contrast some of the key characteristics for the upstate and downstate SuperZones.

Table 1 below focuses on the characteristics of EFOR, load shape, and generating unit size for upstate and downstate based on the five year average derived from the study database.

Table 1

	EFOR[4]	Load Shape		System Avg.	Unit Size Information number of units by size (MW)			Avg. of Units > 300
		Sum/Win Ratio	Load Factor	MW	300-700	701-1000	>1000	MW
Upstate	6.19% / 6.97%	1.2	62%	173	11	5	3	675
Downstate	5.88%	1.5	51%	78	13	3	0	490

In general, the system with a higher EFOR will require a higher installed reserve margin (IRM) to meet the criterion than a system with a lower EFOR. The same is true for a system with a flatter load shape vis-à-vis one that is more peaked. A flatter load shape which is identified by a lower summer/winter peak ratio and higher load factor results in more hours closer to the peak hour (when measured as percentage or per unit of the peak hour) than a more peaked load shape. The result is a higher IRM because of more hours

[4] The EFOR number for Upstate is shown with and without the inclusion of the Niagara and St. Lawrence Hydro projects - the first being with and the second being without. These are resources that are made available for a specific set of public uses.

at risk and less opportunity to conduct maintenance. Also, a system with larger unit sizes will generally require a higher IRM to meet the same criterion than a system with smaller unit sizes. The primary inference that can be drawn from the statistics presented in Table I is that system characteristics for the downstate system imply that the IRM or the amount of resources the downstate SuperZone would require as a percentage of its peak load to meet the 0.1 days per year criterion would be less than that required for the Upstate system if they were operated as separate control areas. However, there are other factors that must be considered.

Another key factor is that NY explicitly models the transmission system for the purpose of establishing its IRM requirements. This not only includes the transfer capability of key interfaces connecting the Load Zones but also the availability of the cables connecting the downstate SuperZone with the upstate SuperZone. Figure I below identifies the Upstate and Downstate SuperZones in NY and shows the juxtaposition of the Load Zones along with the neighboring Areas and transmission interconnections as well as key interfaces.

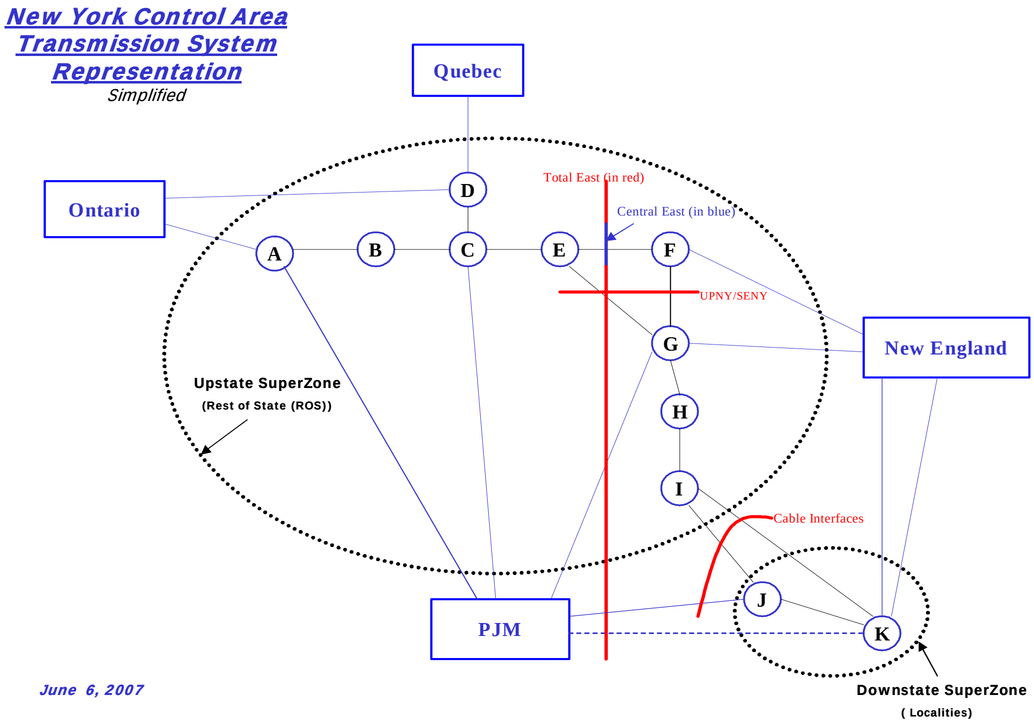

Figure I

The boundary between zones E and F constitute the Central East interface. Combining this interface with the interface between PJM and the downstate SuperZone defines the Total East interface group. The interface that divides the Upstate and Downstate SuperZones is the cable interface. The cable interface contains all the major underground and/or submarine cables supplying New York City and Long Island.

Table 2 presents the approximate coincident peak loads and capacity contained in the in the areas defined above projected for the summer 2007. Table 3 presents the nominal transfer capability across the major transmission interfaces defined above. The transmission facilities that make up the interfaces are the facilities that tie the zones together electrically.

Table 2: Approximate Summer Peak Load/Capacity

Zone	Peak Load (MW)	Capacity (MW)
West (A-E)	9,715	14,935
Upper Hudson Valley (F)	2,245	3,800
Lower Hudson Valley (G-I)	4,385	5,475
Upstate Total	16,345	24,210
New York City (J)	11,780	10,020
Long Island (K)	5,320	5,280
Downstate Total	17,100	15,300

Note: Numbers are approximate and based on the summer of 2007

Table 3: Nominal Transfer Capability

Transmission Interface	Transfer Capability (MW)
Total East	6,100
Central East	2,850
UPNY – SENY	5,100
Cable Interface	
• New York City	4,970
• Long Island	1,290

As a result of the distribution of load and capacity on the NYCA power system, power flows are primarily west to east and then southeast or predominantly from the northwest to the southeast into New York City and Long Island. All power flows from the west including the transmission ties to the neighboring control areas of Ontario, Quebec and PJM must cross the Total East Interface with large portions flowing across the Central East portion of the interface and then across the UPNY – SENY interface to reach the cable interface.

Based on the above system characteristics the following inferences and observations can be made for the Downstate and Upstate SuperZones.

Downstate

The Downstate SuperZone does not have sufficient capacity to supply its load and is dependent on the transmission system and capacity external to the SuperZone to meet the resource adequacy criterion. The more the Downstate SuperZone depends on external capacity to meet its resource adequacy requirements, the higher the NYCA IRM will be. This gives rise to the IRM and locational capacity (percent of peak load covered by capacity located in the Downstate SuperZone) relationship which says the less capacity located in the Downstate SuperZone the higher the NYCA IRM will be. It is this relationship that resulted in the concern that a subsidy from Upstate to the Downstate SuperZone might exist.

The primary drivers of this relationship are two fold. First, as the Downstate SuperZone dependency on external resources increases, it is drawing on a pool of resources in the Upstate SuperZone which have less favorable characteristics from an IRM point of view. These characteristics are higher EFORs and larger unit sizes. The other factor is the capability and availability of the transmission system supplying the Downstate SuperZone. Because the cables feeding the Downstate SuperZone can experience extended outages, the risk or impact on resource adequacy is modeled by utilizing an EFOR for the cables. Thus, the transfer capability of the transmission interface is reduced when a cable is on outage. This effectively makes capacity upstream of the cable interface look less available to the Downstate SuperZone and hence can increase the Downstate and NYCA IRM, depending on the quantity of capacity in the Upstate SuperZone that the Downstate SuperZone is utilizing to meet its resource adequacy criterion. In fact, at the “anchoring point,” a portion of the loss-of-load events are due to the cable outages and the inability to deliver capacity from Upstate to Downstate.

Upstate

The Upstate SuperZone on the other hand can meet its resource adequacy with resources located in the SuperZone. Also, it is better situated from deliverability point of view than the Downstate especially with respect to emergency assistance from neighboring areas. These factors have a positive (i.e., lowering) affect on the Upstate SuperZone IRM when both SuperZones are at equal risk. Also, it needs to be noted that a number of the generating and transmission facilities in the Upstate SuperZone were built primarily to serve the Downstate SuperZone and are jointly used. In fact, since the formation of the New York Power Pool in 1966 the operation and planning of the New York State bulk power system has been conducted as if the NYCA was an integrated system.

Observations

The analysis presented above results in the following observations. The first and foremost observation is that the Downstate SuperZone has more favorable system characteristics from an IRM perspective than the Upstate SuperZone. The advantage of these more favorable system characteristics, however, is offset by dependence on resources outside the SuperZone with less favorable characteristics and the availability of the transmission system to deliver those outside resources. The second observation is that the less favorable system characteristics of the Upstate Super zone are offset by its more favorable access to emergency assistance and the fact that deliverability is not a risk factor that needs to be reflected in the Upstate IRM when the systems are brought to equal risk.

The next section presents a summary of the results from the U-D study conducted by GE Energy Consulting followed by the Findings and Recommendations.

GE Executive Summary

The 2007 IRM Base Case, with 16% installed reserves and locational capacity requirements of 80% for Zone J and 99% for Zone K, resulted in a NYCA LOLE of 0.091 days per year. The corresponding risk for the Upstate region (Zones A through I) was 0.049 days/year. For the Downstate region (Zones J and K), the risk was 0.089 days/year. This gives the appearance that the Upstate region is much more reliable than Downstate. What this fails to recognize, however, is that some of the Upstate capacity actually "belongs" to Downstate, either through direct ownership or contractual purchases.

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), using contracts to more correctly account for the ownership of remote generation. GE's Multi-Area Reliability Simulation (MARS) was used to study the year 2007.

The analysis started from the 2007 IRM Base Case with a 16% statewide reserve margin and locational requirements of 80% for Zone J and 99% for Zone K. Firm contracts were used to transfer capacity between the SuperZones to calculate the point at which the two SuperZones would be at the same level of reliability in terms of daily LOLE (days/year).

A number of scenarios were considered to determine the impact of factors such as the average effective forced outage rate of generation, forced outages and dynamic transfer limits on the ties into Downstate, the amount of assistance provided to Upstate by Downstate, the locational capacity in the Downstate zones, the assistance from the outside regions, the addition of the Neptune Cable, and varying levels of IRM and LCRs.

The scenarios modeled are described in detail in Section 4 of the GE report in Appendix A.

Figure ES-1 shows the transfers required to achieve equal risk and the corresponding LOLE. For the Base Case, assuming an EFOR of 6.06%, the transfer of approximately 4,960 MW from Upstate to Downstate brought both superzones to a risk of 0.046 days/year. For all of the scenarios considered, the required transfers were in the range of 3,930 MW to 6,030 MW. The corresponding LOLE ranged from 0.014 days/year to 0.101 days/year, with many clustered at 0.047 days/year. The vertical line at 4,950 MW shows the transfers required, with 16% reserve margins for NYCA, to balance the reserve margins of the SuperZones.

Figure ES-2 summarizes for the various scenarios the difference in reserve margins (Downstate reserves minus Upstate reserves) at the point at which the superzones had equal risk. For the Base Case with an EFOR of 6.06%, the reserves were nearly balanced with Downstate requiring a reserve margin 0.1% greater than Upstate in order to maintain the same level of LOLE. For the scenarios modeled, the reserve margins of the superzones at the point of balanced risk ranged from 8.8% higher in Downstate as compared to Upstate to 7.6% higher in Upstate compared to Downstate.

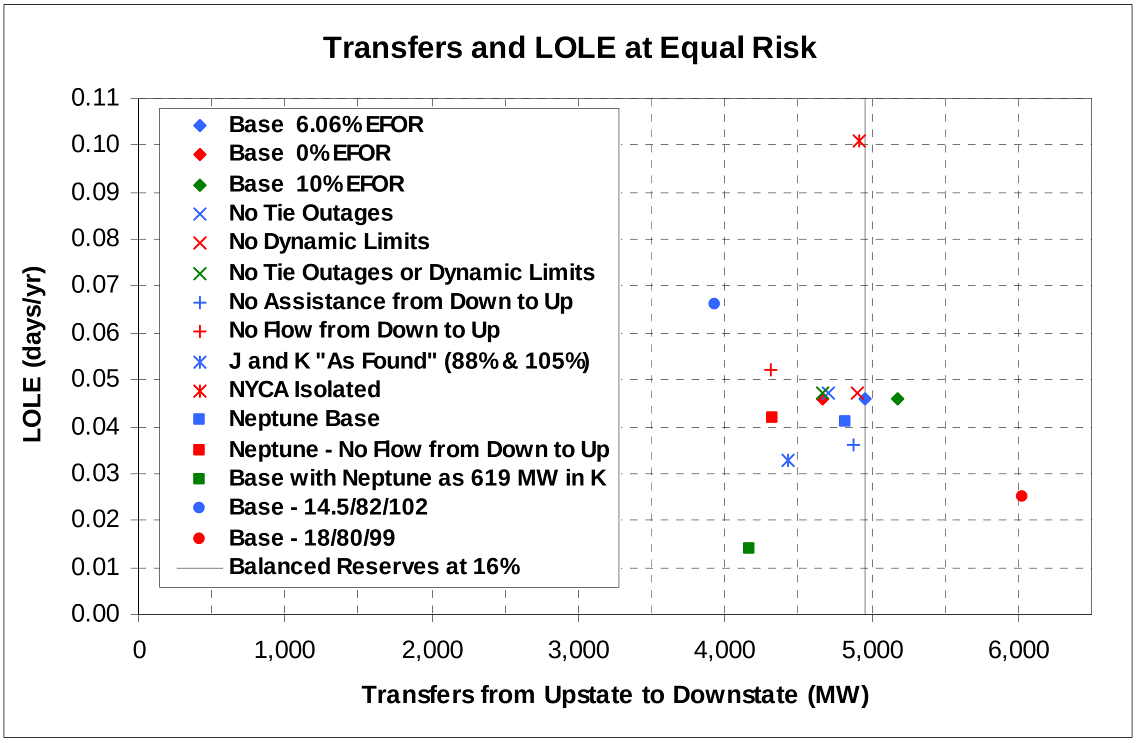

Figure ES-1 – Transfers and LOLE at Point of Equal Risk

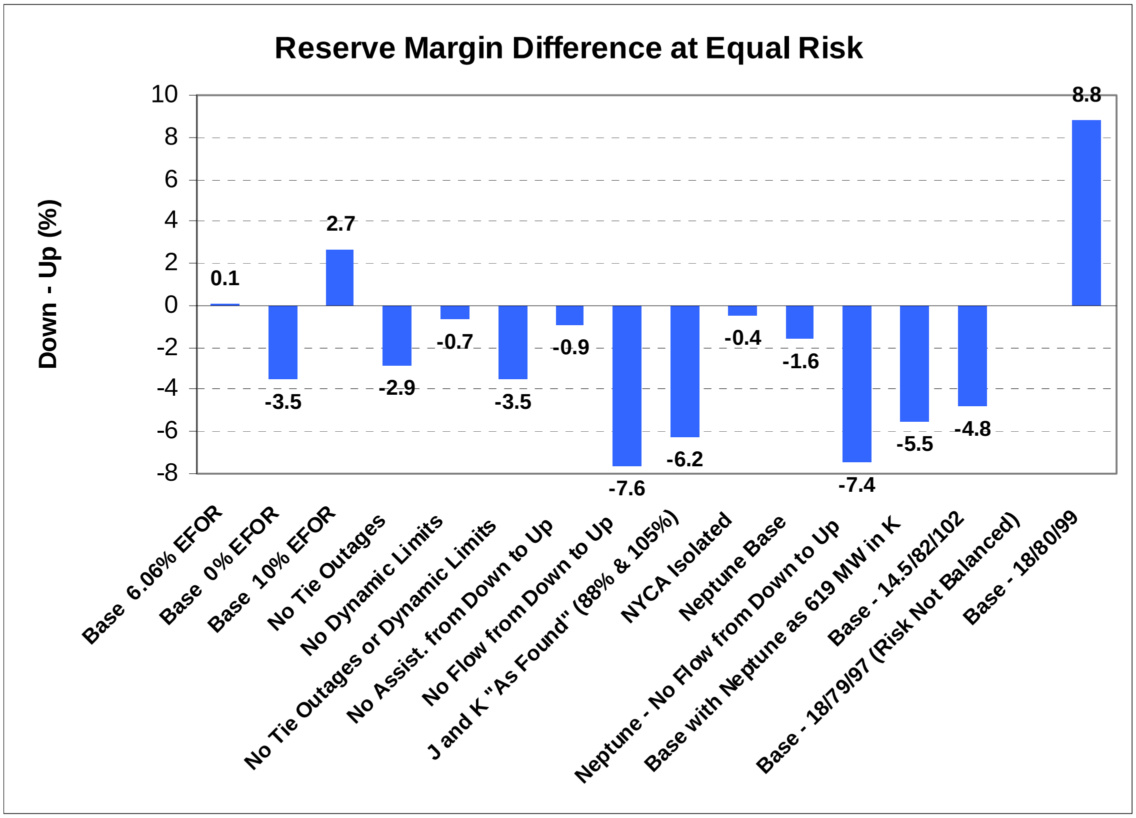

Figure ES-2 – Reserve Margin Difference at Point of Equal Risk

Observations

A driving force for this study was the concern that Upstate was carrying additional reserves in order to offset capacity deficiencies Downstate or insufficient transmission capability into Downstate. While this seemed to be true when NYCA reserves were at 18%, it appears not to be a concern when the reserves are lowered to 16%.

In general, changes in study assumptions that improved the Downstate risk, such as increased transfer capability or installed capacity Downstate, resulted in the balanced risk being achieved with lower levels of transfers, and thus at lower Downstate reserves and higher Upstate reserves.

The Base Case at 16% IRM with LCRs of 80% for Zone J and 99% for Zone K, as determined by the “tan 45” process, appears to be the minimum reserve point for the Upstate SuperZone, with balanced risk occurring at reserve margins of 16% in each SuperZone. If the NYCA reserve margin required for maintaining the 0.1 days/year is lowered by increasing the Downstate LCRs, the Downstate risk improves and balanced risk is achieved with lower levels of transfers, resulting in lower Downstate reserve margins and higher Upstate margins. The differential between the Upstate margin and the NYCA IRM would be greater than the decrease in the IRM.

For example, in the case with 14.5% IRM (a 1.5% decrease from the Base Case) and LCRs of 82% for Zone J and 102% for Load Zone K, balanced risk occurred when the Upstate reserves were at 17%, a 2.5% increase over the NYCA reserves, and Downstate was at 12%. Similar impacts can be seen when the transfer capability into Downstate is increased by removing the ties outages and dynamic limits.

Both Upstate and Downstate benefit as a result of being interconnected with one another. The amount of assistance provided by the SuperZones to each other depends on the assumptions for the starting point and how much of the capacity that is located in Upstate is actually obligated to Downstate.

Findings and Recommendation

Given the results of the GE U-D Study, the information presented in this document and cost-of-capacity studies presented by participants during the stakeholder process (see Appendix B) the following findings and recommendations can be drawn from the body of information presented.

Findings

1. If a subsidy is defined as one SuperZone having an IRM that is significantly lower than the statewide IRM while the other SuperZone would have a higher IRM when both SuperZones are at equal risk, the U-D study demonstrates that for the IRM base case the Upstate and Downstate IRMs are relatively balanced with the Downstate IRM of 16.0% slightly higher than the Upstate IRM of 15.9% compared to the statewide IRM of 16%. Therefore, a reliability subsidy as defined does not exist for the IRM base case.
2. Both Upstate and Downstate benefit as a result of being interconnected with one another. The amount of assistance provided by the SuperZones to each other depends on the assumptions for the starting point and how much of the capacity that is located in Upstate is actually obligated to Downstate. For the summer capability period, the Downstate SuperZone has procured approximately 5026 MW of capacity from the Upstate SuperZone to cover its statewide ICAP obligation.
3. As the amount of statewide capacity resources located in the Downstate SuperZone increases, all else being equal, the statewide IRM to meet the 0.1 days per year will be lower. This is the result of less dependence on the availability of

the transmission system and the need for the Downstate SuperZone to depend on external capacity resources which have higher EFORs. As the impact of these factors is reduced, the more favorable system IRM characteristics of the Downstate SuperZone become more dominant. However, as reported in the U-D study, a statewide IRM of 14.5% results in an IRM difference between Upstate and Downstate of -4.8%. This results in a reliability subsidy from Downstate to Upstate.

4. In general, as the statewide IRM is reduced from the base case number of 16% with a higher percentage of statewide capacity located in the Downstate SuperZone, a reliability subsidy accrues to the Upstate SuperZone with the Downstate SuperZone IRM below the statewide IRM. Likewise, as the statewide IRM is increased from the base case with a smaller percentage of the statewide capacity located in the downstate SuperZone, the reliability subsidy will begin to flow from the Upstate SuperZone to the Downstate SuperZone with Upstate IRM below the statewide IRM.

5. What does the analysis of the reliability subsidy imply about the existence of a cost subsidy? The cost subsidy is the crux of the National Grid complaint. Clearly, the cost-of-capacity studies presented during the stakeholder process and attached herewith in Appendix B demonstrate that as the statewide IRM decreases, the total cost of capacity decreases for the Upstate SuperZone and increases for the Downstate SuperZone. This is not only because of the lower quantity but because of the significant price difference for capacity between the Downstate and the Upstate SuperZones with Downstate costing significantly

more on a cost per kW basis. Also, the cost analyses provided by ConEd/LIPA demonstrated that the total cost of capacity on a statewide basis exhibited a u-shaped relationship with the minimum total statewide cost close to the anchoring point (i.e., “tan 45 point”) or elbow of the IRM/LCR curve relationship. The u-shape is the result of the dynamics of the demand curve. As the statewide IRM increases, the ROS supply and demand balance tightens and price increases more than offset downstate capacity cost reduction. This also turns out to be the point that results in both the Upstate and Downstate SuperZones having an IRM close to the statewide IRM when both are brought to equal risk by assigning capacity in the Upstate SuperZone to downstate through the use of contracts.

A cost subsidy would exist if one of the SuperZones was incurring significant cost that it would otherwise not incur because of a flawed cost allocation or market design or did not derive value from being interconnected with the other SuperZone. The information presented in this report demonstrates the following:

1. The SuperZones derive significant reliability benefits from being interconnected.
2. A reliability subsidy does not currently exist.
3. The GE report has concluded that the minimum IRM for the Upstate SuperZone occurs at the “tan 45” point or 16%.
4. The development of the NYCA system over the last forty years involves the use of many joint facilities that have been mutually developed by

transmission and generator owners who have operations in both the Upstate and Downstate SuperZones

As a result of these findings, the NYISO concludes that a cost subsidy does not currently exist and that the report supports the hypothesis that the current IRM methodology and capacity market design are equitable and nondiscriminatory...

However, the U-D study does indicate that at certain combinations of statewide IRM and LCR the potential for a significant reliability subsidy does exist from one SuperZone to the other and hence a cost subsidy could potentially result. This possibility should be avoided, as described in the next section.

Recommendation

The NYISO recommends that the analytical methods developed as part of the U-D study be incorporated into the annual IRM study in order to determine that the base case IRM does not result in a reliability subsidy between SuperZones. This will provide some level of assurance that a reliability subsidy which does not currently exist will not exist in future IRM study base cases that form the basis for establishing the statewide IRM and LCR.

Appendix A

GE Upstate-Downstate Study

GE Energy

Final Report to

NYISO

for

Upstate-Downstate "Superzone" Study

Prepared by

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June 5, 2007

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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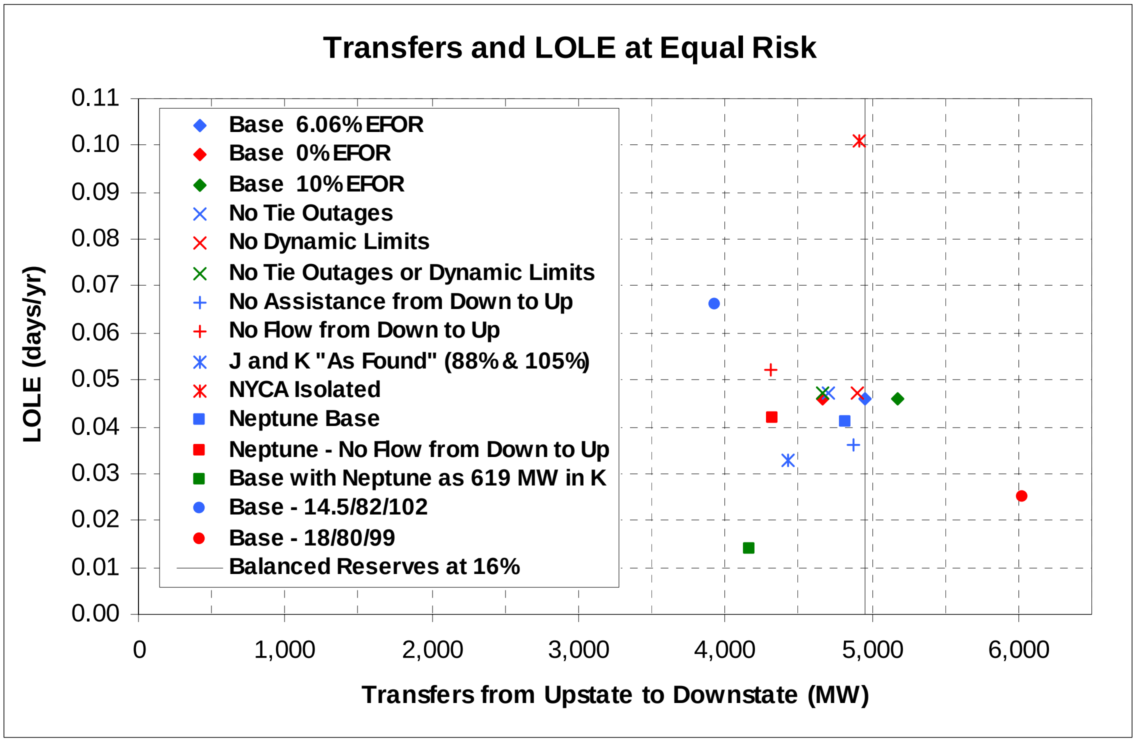

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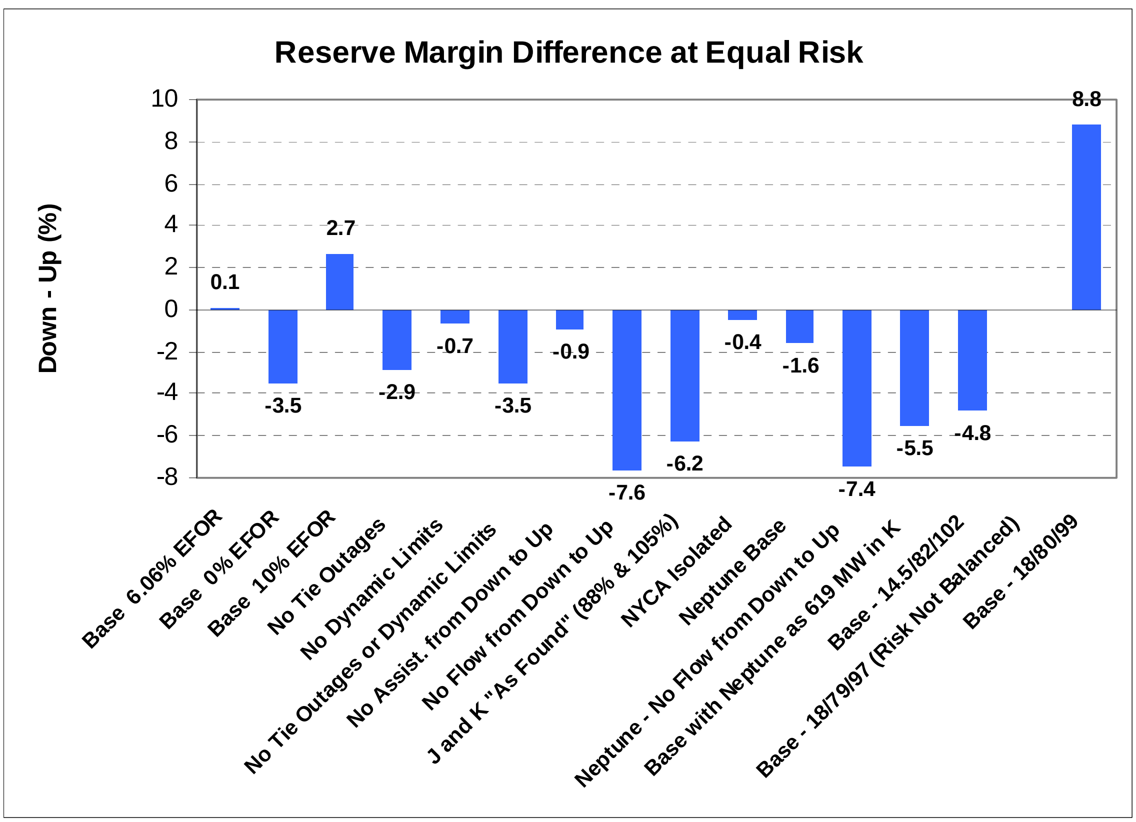

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1 Objective

The 2007 IRM Base Case, with 16% installed reserves and locational capacity requirements of 80% for Zone J and 99% for Zone K, resulted in a NYCA LOLE of 0.091 days per year. The corresponding risk for the Upstate region (Zones A through I) was 0.049 days/year. For the Downstate region (Zones J and K), the risk was 0.089 days/year. This gives the appearance that the Upstate region is much more reliable than Downstate. What this failed to recognize, however, was that some of the Upstate capacity actually "belongs" to Downstate, either through direct ownership or contractual purchases.

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2 Data

Data for this study was based on the current IRM Base Case for 2007 with the addition of the revised state transition rate data for the cable interfaces in the New York City area. In this case, the statewide reserve margin was 16%, with Zone J meeting locational requirements of 80% and Zone K at 99%. The installed capacity was 24,067 MW Upstate and 14,842 MW Downstate. Transfer limitations between individual zones, simultaneous interface limits, and the representation of outside control areas were based on the previously mentioned data source.

The IRM Base Case, which models NYCA as a single Area, was modified to split NYCA into two SuperZones or Areas: Upstate, which included Zones A through I, and Downstate, containing Zones J and K. The data describing the reserve sharing arrangements between pools was expanded to include Upstate assisting Downstate, and Downstate assisting Upstate, before either SuperZone provides assistance to zones outside of NYCA. Since the maintenance was scheduled on a NYCA-wide bases in the IRM Base Case, the maintenance schedule from the IRM case was used for all simulations.

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 in terms of load, with the Upstate peak load of 16,485 MW in 2007, and the Downstate peak load of

17,147 MW. The SuperZone loads at the time of NYCA peak were 16,480 MW Upstate and 17,065 MW Downstate.

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 50 MW, 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" (capacity without forced outages) between the SuperZones. Since MARS models contracts between zones and not tied to specific units, an average equivalent forced outage rate (EFOR) was used to convert the perfect capacity to real capacity for calculating reserve margins. The Base Case value of EFOR was 6.06%, which was the NYCA average EFOR in the 2007 IRM Base Case data.

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 (1,290 MW). This would ensure that any potential constraints internal to the SuperZones would not prevent a contract from being 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.

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. As with the other contracts, the PJM wheel modeled was derated by the average forced outage rate of 6.06%.

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 required by Zone I.

4 Results

4.1 Benchmarking the Base Case – NYCA as Two Areas

The only change made to the data that was used for the 2007 IRM Base Case was to revise the state transition rate data for the cable interfaces in the New York City area. As shown in Figure 1, the decreased forced outage rate on these interfaces resulted in a slight improvement in the NYCA LOLE, from 0.091 days/year to 0.083 day/year.

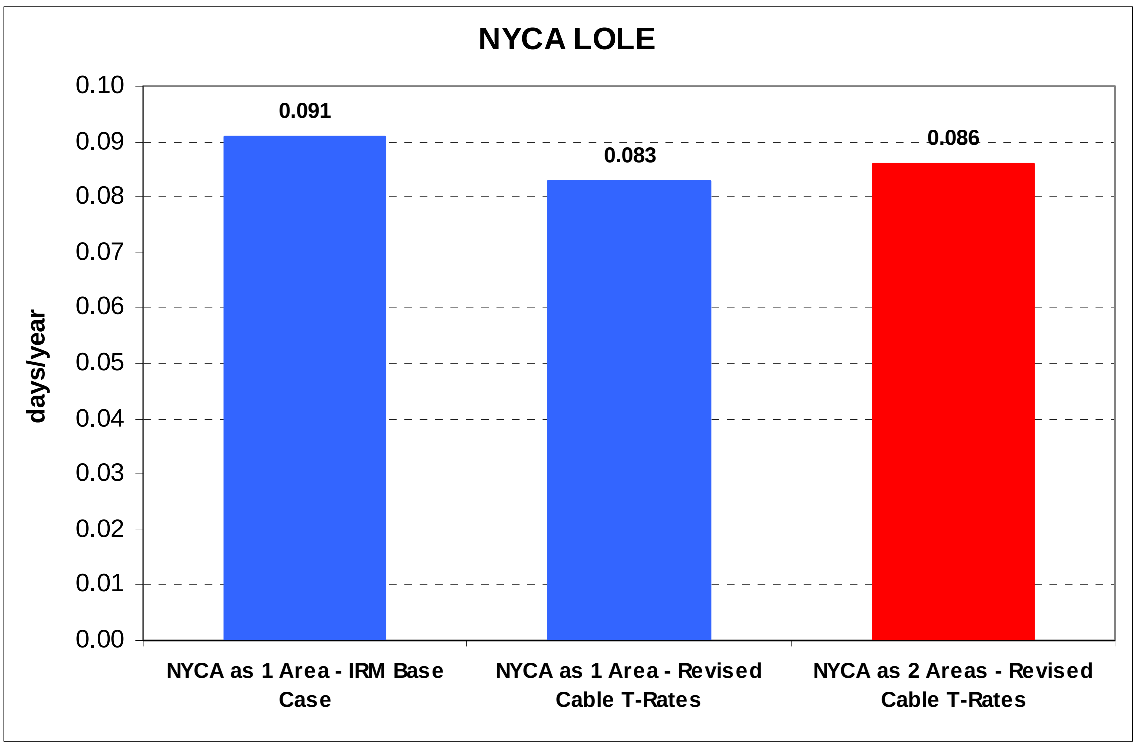


Figure 1 - NYCA LOLE for Benchmarking Cases

To correctly model in this study the reserve sharing between the SuperZones, NYCA was split into two Areas: an Upstate SuperZone (Zones A through I) and a Downstate SuperZone (Zones J and K).

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, according to a predetermined priority order, the sharing arrangements between Areas in which the zones within an Area will provide assistance to zones in other Area(s). 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.

If transfer limits restrict a zone from receiving the reserves that had been allocated to it, the undelivered portion of the reserves will be allocated among the remaining zones to which it can be delivered. For example, if Upstate and Downstate are sharing in assistance from Quebec and constraints into Downstate limit the amount that it can receive, the remainder will be made available to the Upstate zones.

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 0.083 days/year for NYCA as one Area to 0.086 days/year with NYCA as two Areas, as shown in Figure 1.

To confirm the impact of allowing outside flow, the cases with NYCA as one and two Areas were 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 as Upstate was now able to provide more assistance to Downstate. The reliability for NYCA as one Area also improved, to the same value, 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 the outside regions.

The remaining cases allowed flow through the outside Areas, consistent with the 2007 IRM Base Case.

4.2 Base Case

Starting from the 2007 Base Case with NYCA modeled as two Areas and with the 1,000 MW wheel from Zone G to PJM-East to Zone J, firm contracts were modeled between Upstate (Zone I) and Downstate (Zones J and K) in 500 MW increments to determine the level of transfers at which the Upstate and Downstate reliability were balanced. The contracts from Zone I were 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 (1,290 MW).

Figure 2 shows the LOLE for Upstate and Downstate as a function of the total transfers (including the 1,000 MW wheel) between the SuperZones. Also plotted in Figure 2 is the difference in reserve margins, based on the loads at time of NYCA peak, for the two SuperZones (Downstate minus Upstate) as the transfers change.

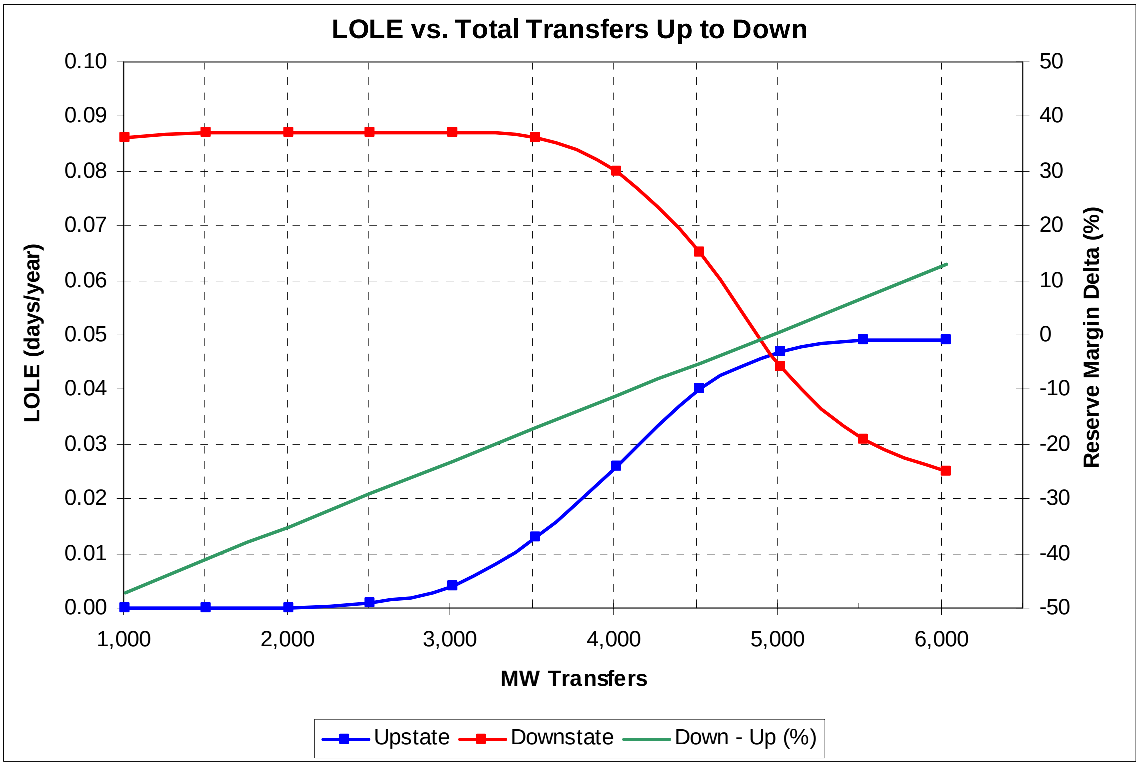


Figure 2 - Upstate and Downstate LOLE with Transfers
Base Case (EFOR = 6.06%)

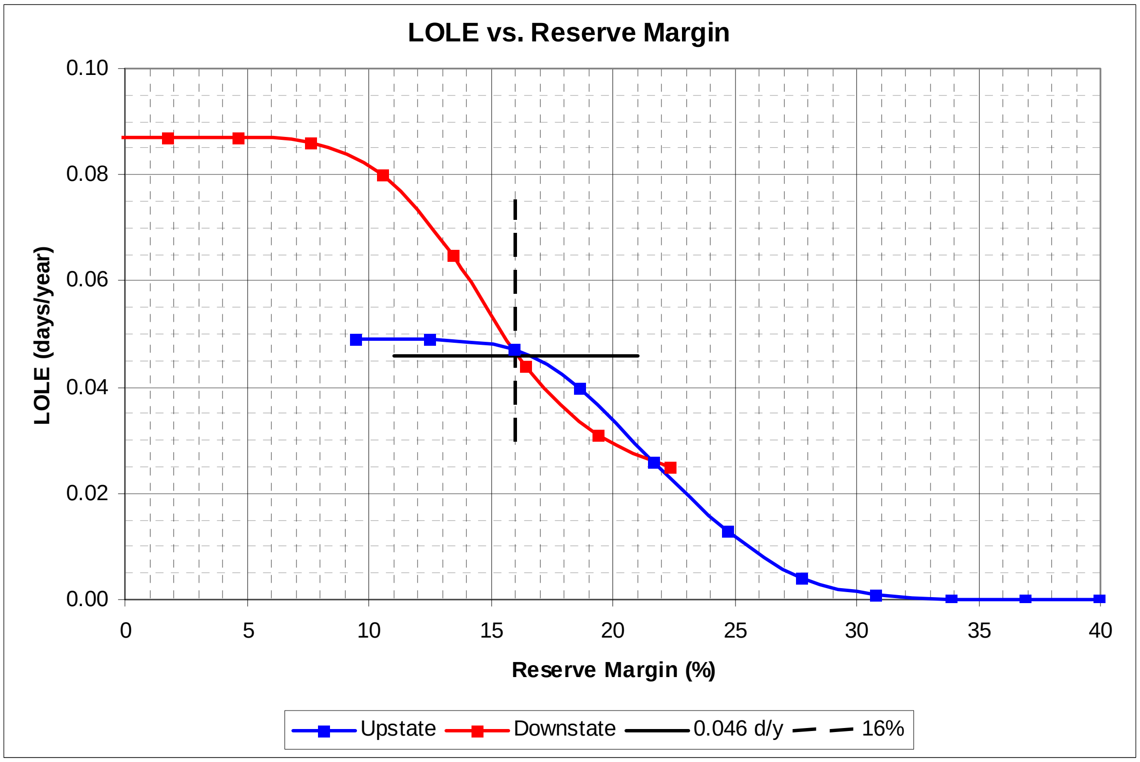


Figure 3 – Upstate and Downstate Reserve Margins
Base Case (EFOR = 6.06%)

With total transfers of approximately 4,960 MW, the LOLE of the two SuperZones were balanced at approximately 0.046 days/year each. At the level of transfers that balanced the risk, the reserve margins were nearly balanced, with the Downstate reserve margin being approximately 0.1 percentage points greater than the Upstate reserve margin.

Figure 3 plots the LOLE for the two SuperZones as a function of their reserve margins. At balanced reserve margins of 16%, the Upstate risk was just slightly less than the Downstate risk. At the point of balanced reliability at 0.046 days/year, the Downstate reserve margin was about 16.0% and Upstate was at 15.9%, for a difference of approximately 0.1%.

4.3 Effect of Equivalent Forced Outage Rate

Firm contracts were modeled to transfer capacity from Upstate to Downstate. To compute reserve margins, the perfect capacity of the contracts was then converted to real capacity using the average equivalent forced outage rate (EFOR) of the sending Area. The Base Case value of EFOR was 6.06%, which was the NYCA average EFOR in the 2007 IRM Base Case data.

Recognizing the potential for a range of values for EFOR, depending on the specifics of the contracts, lower and higher values were assumed in order to measure their impact on the level of transfers required to balance the risk, and the results are shown in Figure 4. The darker curves to the left are for an EFOR of 0% and the lighter curves to the right are for a 10% EFOR. The thin curves are for the Base Case EFOR of 6.06%.

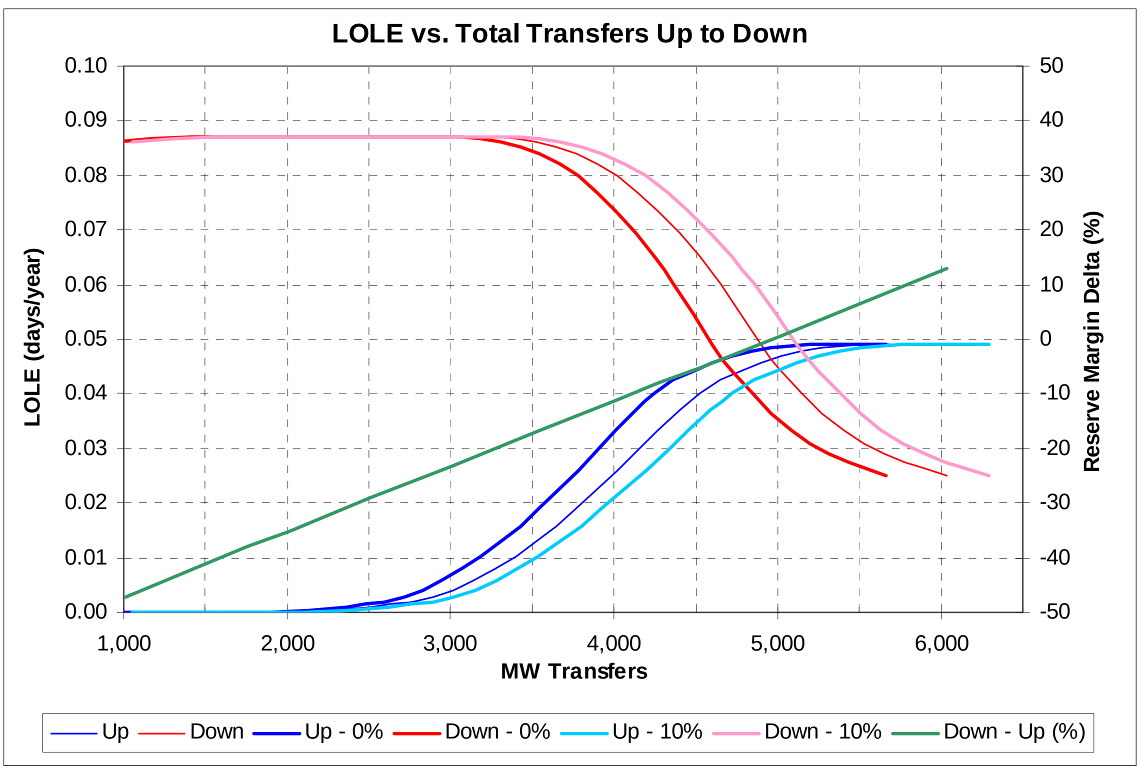


Figure 4 - Upstate and Downstate LOLE with Transfers
Base Case (EFOR = 0% and 10%)

With an EFOR of 0%, which would imply that less real capacity must be transferred for the same impact on reliability, the curves have the same shape as for the case with EFOR of 6.06%, but are shifted slightly to the left. With the lower EFOR, 4,660 MW of transfers were required to balance the LOLE at 0.046 days/year.

With the lower amount of transfers required to balance the risk, the resulting Upstate reserve margins were greater than before and the Downstate margins were less, resulting in the Downstate reserves being 3.5% lower than Upstate, as shown in Figure 5. At equal reserve margins of 16%, the Upstate LOLE was approximately 0.048 days/year, and Downstate was at 0.037 days/year.

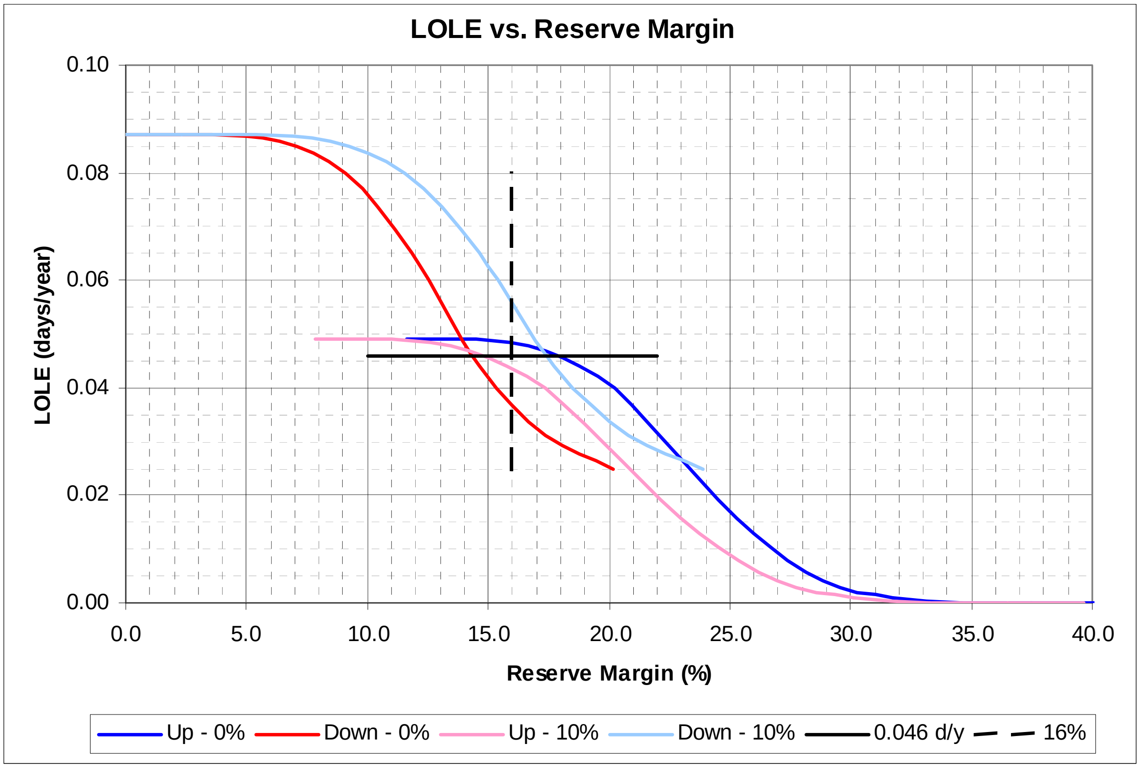


Figure 5 - Upstate and Downstate Reserve Margins
Base Case (EFOR = 0% and 10%)

Figure 4 and Figure 5 also show the results for the case in which an Upstate EFOR of 10% was assumed for calculating the reserve margins. As before, the shape of the plots of LOLE versus transfers are the same as for an EFOR of 6.06%, however they are now shifted to the right, indicating the need for greater amounts of real transfers to have the same reliability impact. As a result, 5,175 MW of capacity must be transferred to balance the risk at 0.046 days/year. This resulted in Downstate reserve margins that were 2.7% higher than Upstate.

The linear relationships between the value assumed for the EFOR and the reserve margin difference and EFOR and the transfers required to balance the reliability in the two SuperZones are shown in Figure 6.

The remainder of the study used an EFOR of 6.06% to convert the perfect capacity of the contracts into real capacity for the reserve margin calculations.

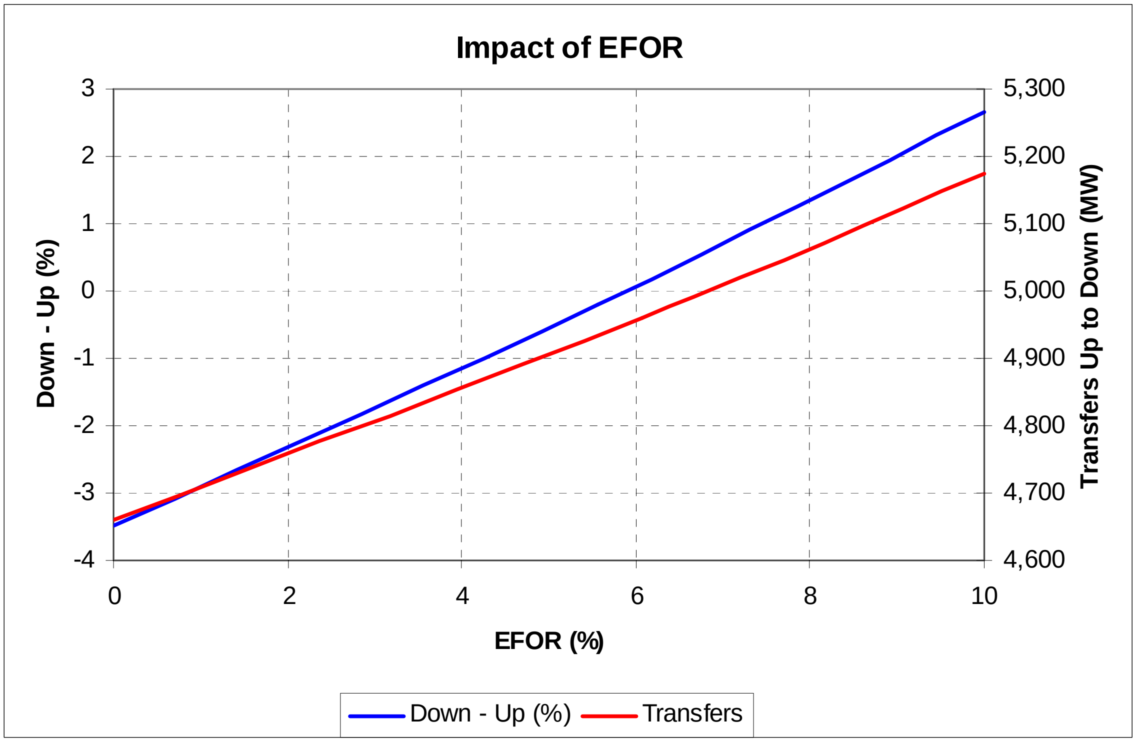


Figure 6 – Reserve Margin Difference and MW Transfers versus EFOR

4.4 Effect of Tie Outages and Transfer Limit Reductions

Two factors restricted the amount of assistance that Downstate could receive from Upstate and the outside regions. The most significant factor was the forced outages on the ties in the area of zones J and K. The other lesser factor was the dynamic limits being modeled on some of these interfaces. With the dynamic interface limits, the transfer limits can be specified as a function of the availability of certain units or the load level in specific zones.

As the level of transfers from Upstate to Downstate was increased and approached the transfer limits of the interfaces to which the transfers were assigned, these factors restricted the delivery of the full contracted amount. In the Base Case, approximately 8% of the wheel through PJM could not be delivered because of these factors. For the case in which an additional 4,000 MW was transferred directly from Upstate to Downstate, approximately 0.5% could not be delivered. As the level of transfers approached the maximum permissible, there were portions of the scheduled transfers for which Downstate was receiving no reliability benefit. The benefit was actually staying Upstate.

The next three scenarios considered the cases in which forced outages were not modeled, transfer limits were not reduced in response to dynamic limits, and the combination of both.

Figure 7 shows the Upstate and Downstate risk for the case with no forced outages on the interfaces. Even with low levels of firm transfers, the Downstate LOLE was reduced from 0.086 days/year to 0.078 days/year, reflecting the increased emergency assistance that could be delivered in the absence of the interface outages. As the level of transfers increased, Downstate continued to be more reliable than in the Base Case, and Upstate became slightly less reliable. The increase in the Upstate risk was the result of greater amounts of the contracts being delivered and to the fact that Downstate could now receive more of its allocated share of emergency assistance that previously could not be delivered, thus making it unavailable to Upstate.

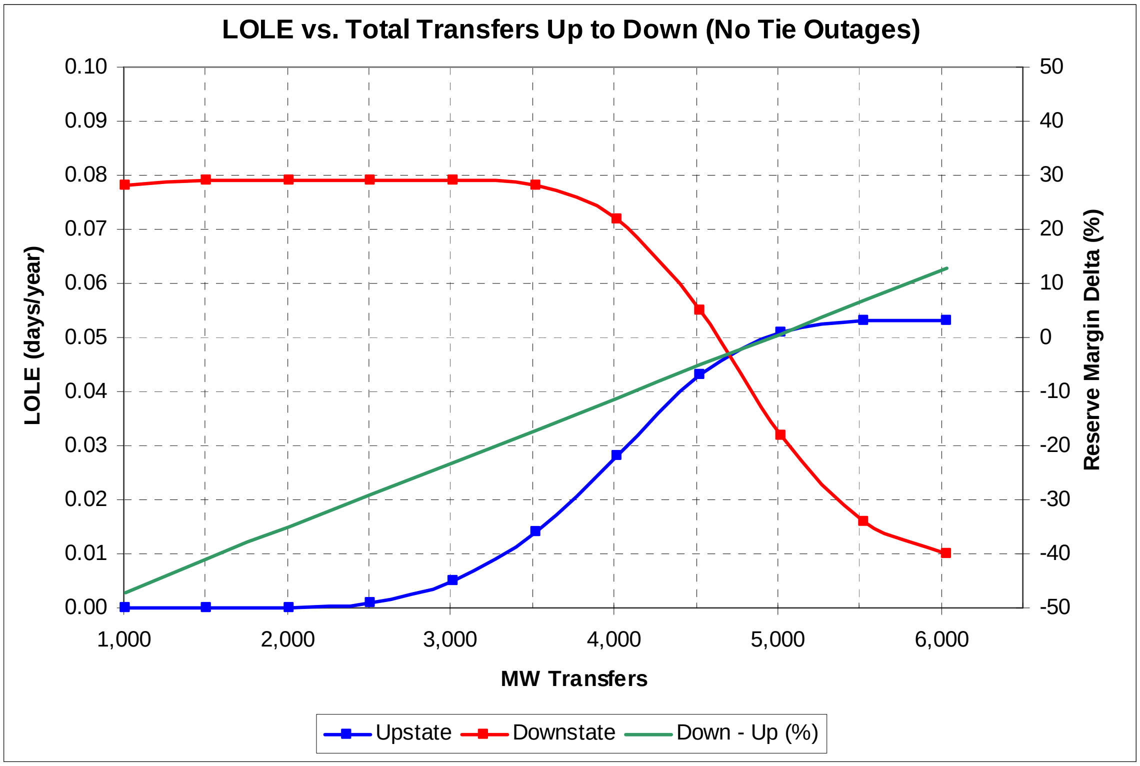


Figure 7 - Upstate and Downstate LOLE with Transfers
No Interface Outages

Without outages on the interfaces, the transfer of 4,710 MW was required to bring both Areas to an LOLE of 0.047 days/year. At this point, the Downstate reserve margin was 2.9% lower than Upstate, as shown in Figure 8.

Figure 9 and Figure 10 show that the dynamic interface limits had less of an impact, slightly changing the risk in the two Areas, and, reducing the transfers needed to balance reliability from 4,960 MW in the Base Case to 4,895 MW. The resulting difference in reserve margins was 0.7%.

The results for the combined case of no interface outages and no dynamic interface limits are shown in Figure 11 and Figure 12. Transfers of 4,660 MW balanced the risk in the two SuperZones at 0.047 days/year. The corresponding reserve margins were 3.5% less in Downstate than in Upstate.

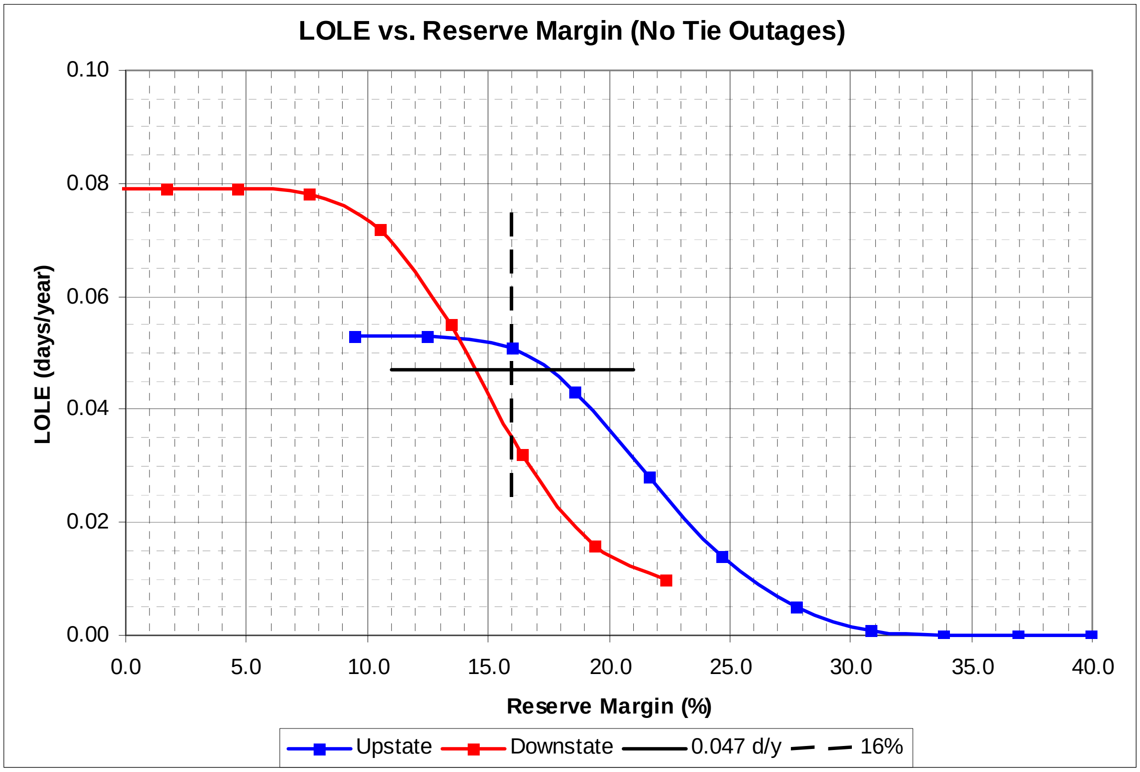


Figure 8 - Upstate and Downstate Reserve Margins
No Interface Outages

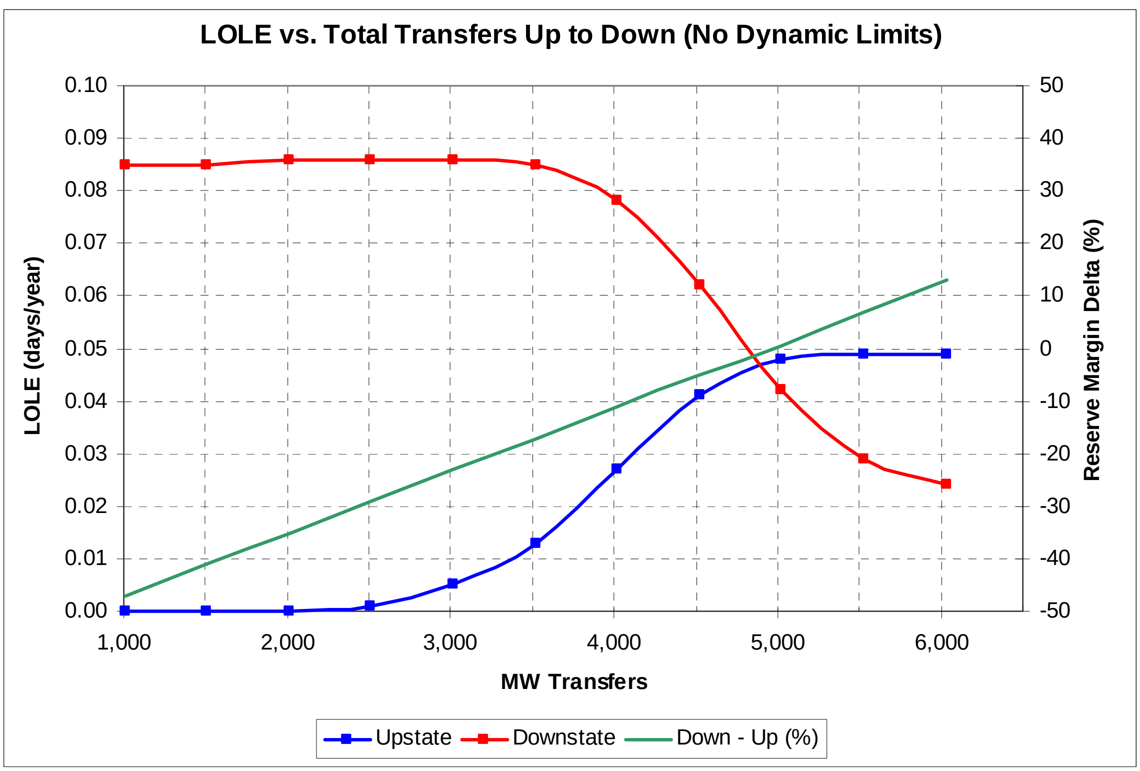


Figure 9 - Upstate and Downstate LOLE with Transfers
No Dynamic Interface Limits

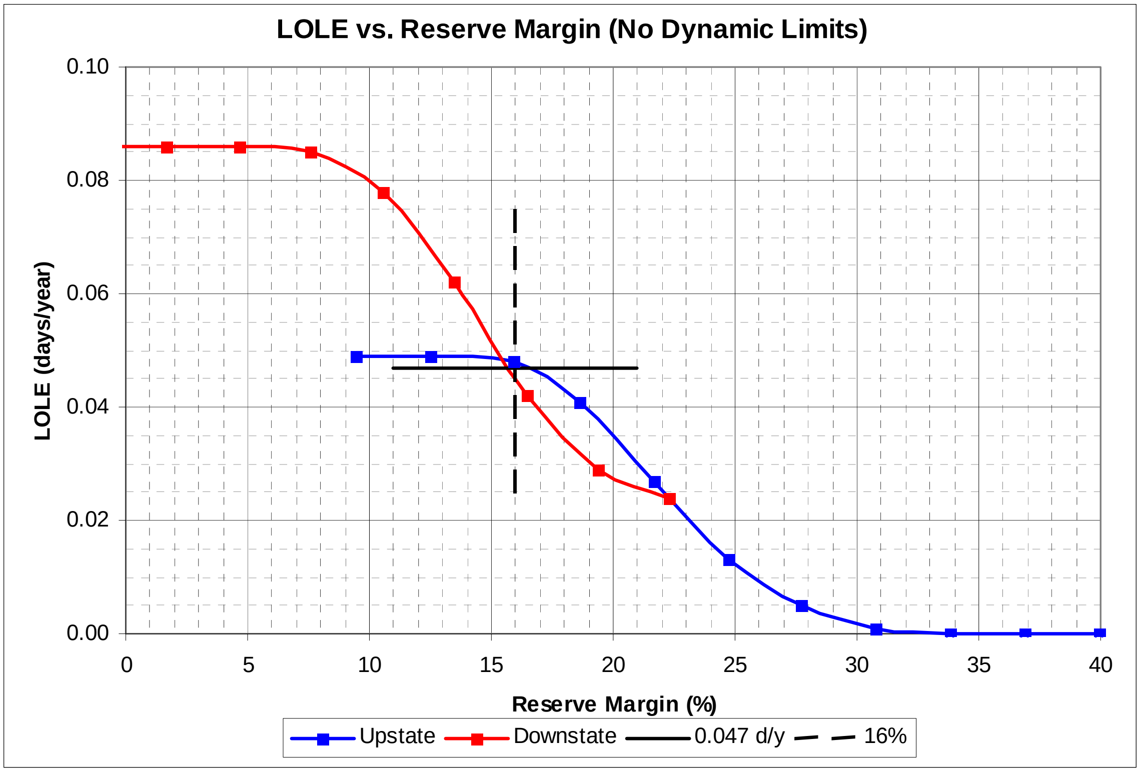


Figure 10 - Upstate and Downstate Reserve Margins
No Dynamic Interface Limits

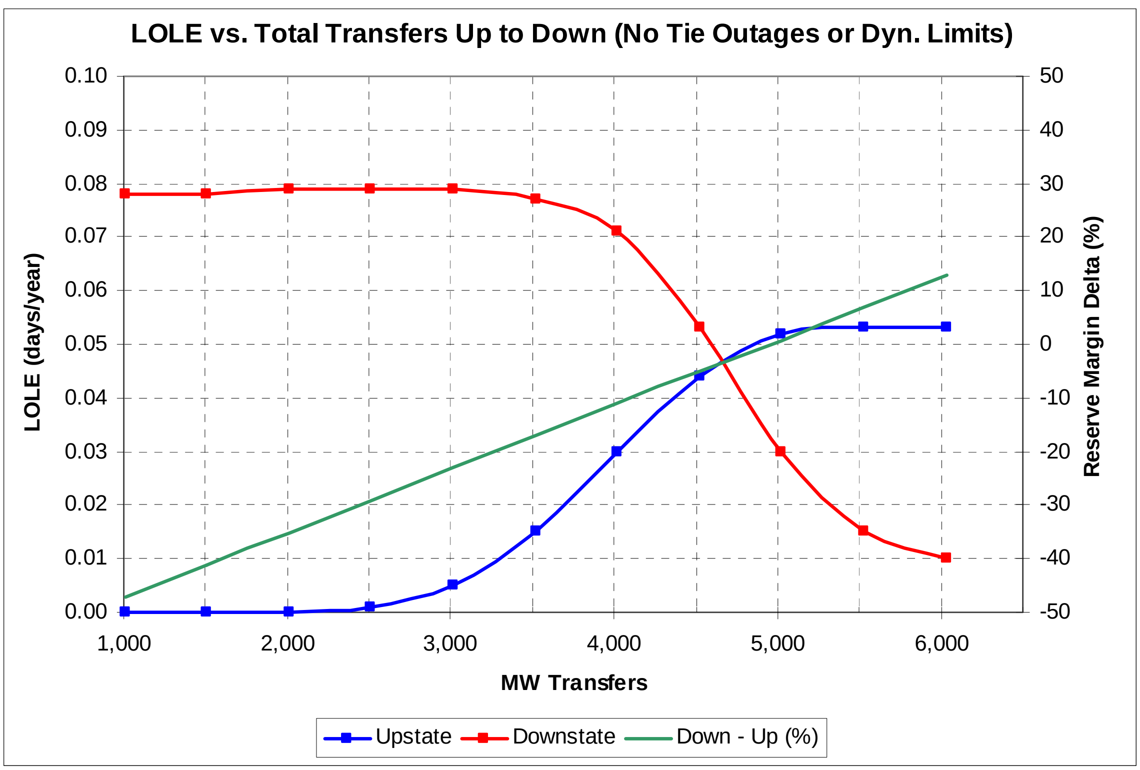


Figure 11 - Upstate and Downstate LOLE with Transfers
No Interface Outages or Dynamic Limits

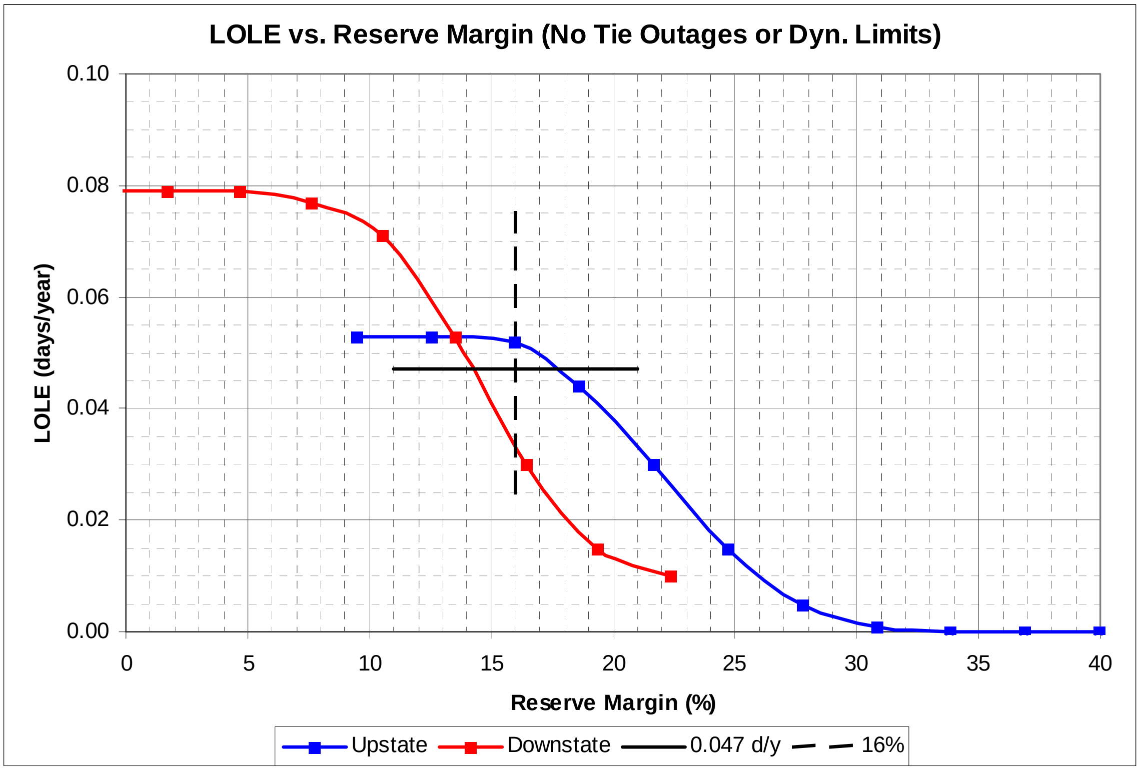


Figure 12 - Upstate and Downstate Reserve Margins
No Interface Outages or Dynamic Limits

4.5 Downstate Assistance to Upstate

The next two scenarios were designed to measure the assistance that Upstate receives from Downstate. The first case assumed that Downstate would not use its local resources to provide assistance to Upstate. However, Downstate would return to Upstate any capacity that was delivered in the form of contracts that Downstate did not need to meet its load. In the more extreme second case, Downstate did not even return unneeded transferred capacity back to Upstate.

Figure 13 shows that even at low levels of transfer, the Downstate risk has improved from 0.086 days/year in the Base Case to 0.059 days/year. This can be attributed to the way in which the assistance from Downstate was restricted and to the impact of flows from outside regions. To restrict Downstate resources from providing assistance to Upstate, the transfer limits for all of the ties leaving Downstate were set to zero. This included the ties from Zone K to New England. As a result, New England could no longer flow assistance through New York to cover deficiencies in Southwest CT. Since this assistance could no longer be used in New England, it became available to New York, reducing the Downstate risk and, to a lesser extent, the Upstate risk.

Because of the additional assistance available to both SuperZones from the outside, the reliability was balanced at 0.036 days/year with transfers of 4,875 MW from Upstate to Downstate. As shown in Figure 14, the reserve margin in Downstate was 0.9% lower than in Upstate at this point.

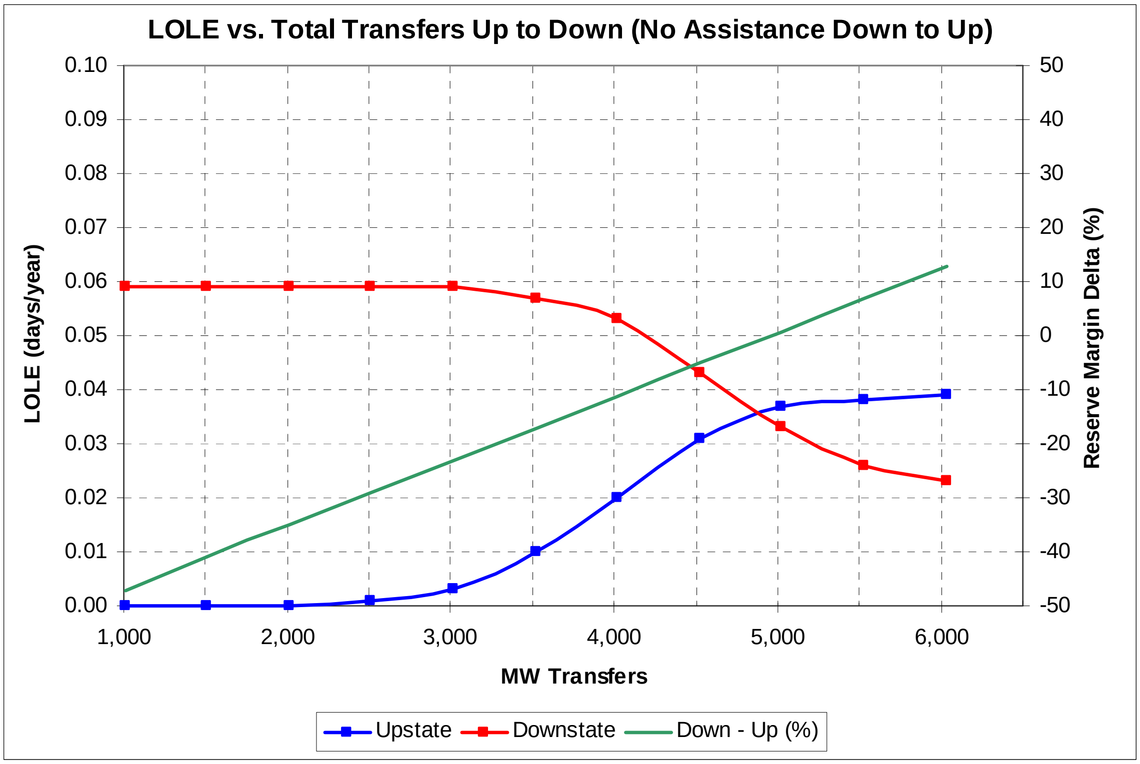


Figure 13 - Upstate and Downstate LOLE with Transfers
No Assistance to Upstate from Downstate Resources

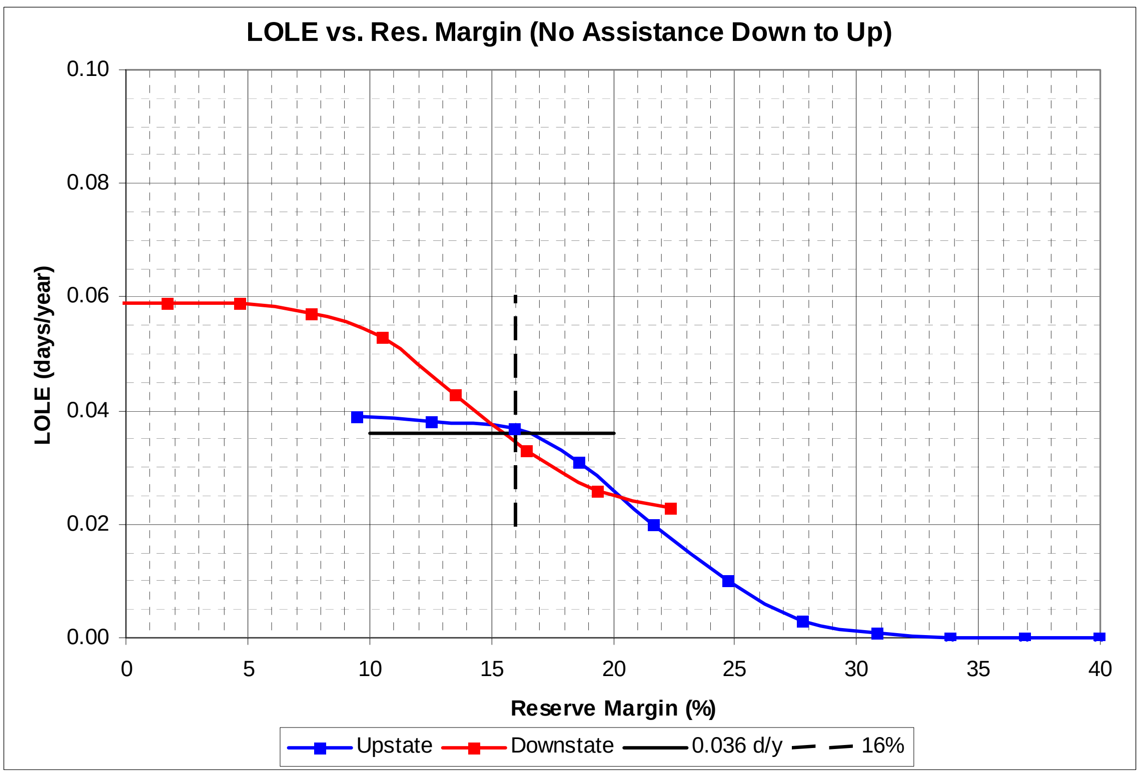


Figure 14 - Upstate and Downstate Reserve Margins
No Assistance to Upstate from Downstate Resources

In the more restrictive case, once capacity was transferred from Upstate to Downstate, it stayed Downstate even if Downstate did not need it to meet its load. As such, there were no transfers at all from Downstate to Upstate, even if Downstate had excess reserves.

As shown in Figure 15, the impact on the Upstate LOLE of removing increasing amounts of capacity was significant as the level of transfers exceeded 4,000 MW. With transfers of 4,523 MW, at which point the Upstate reserves were at 18.6%, Upstate, with no assistance at all from Downstate, was at 0.088 days/years. With 4,523 MW of transfers, Downstate had reserves of 13.5% and an LOLE of 0.051 days/year.

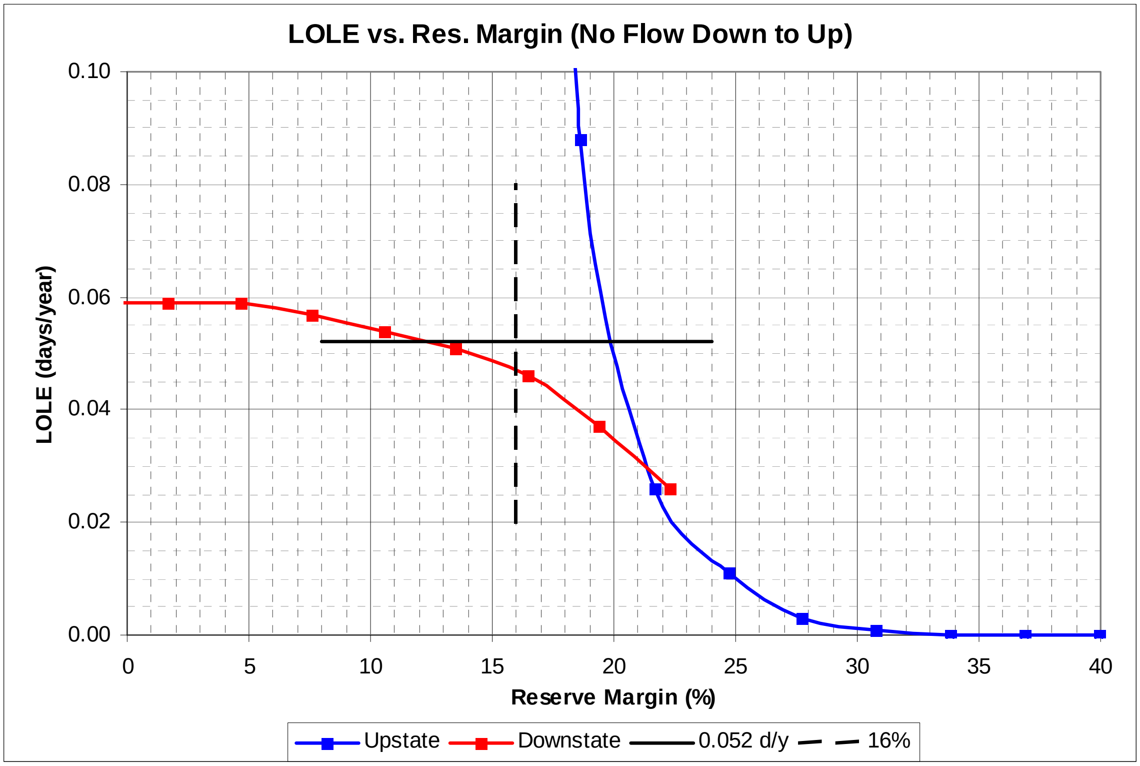


Figure 15 - Upstate and Downstate LOLE with Transfers
No Flow to Upstate from Downstate

A comparison with Figure 13 shows that the Downstate risk increased slightly for the case in which the flow of the contracts could not be reversed. The same mechanism that prevented the contract flows from Zone I to Zone J from being reversed to provide assistance to Upstate also prevented reversal of these flows to provide assistance through Zone I to Zone K. The increased LOLE in Zone K resulted in the increase in the Downstate LOLE.

Because of the sharp increase in the Upstate risk, the point of equal risk was achieved at a lower level of transfers of 4,315 MW and at a higher LOLE of 0.052 days/year. At this point, the Downstate reserve margin was at 12.3% and the Upstate margin equaled 19.9%, as shown in Figure 16.

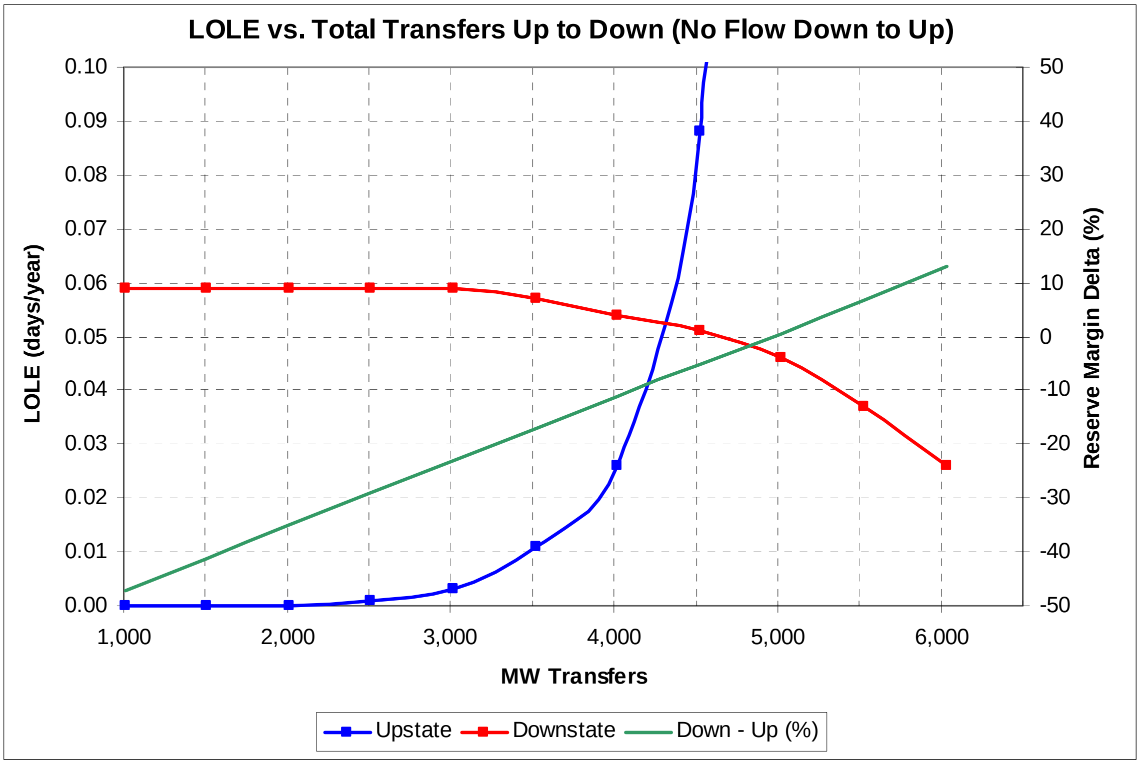


Figure 16 - Upstate and Downstate Reserve Margins
No Flow to Upstate from Downstate

4.6 Zones J and K "As Found"

All of the scenarios considered up to this point started from the 2007 IRM Base Case in which the statewide IRM was 16% with locational capacity requirements of 80% for Zone J and 99% for Zone K. This level of LCRs was modeled by shifting 837 MW of perfect capacity from Zone J to Upstate, and 335 MW from Zone K, with no corresponding flow being introduced on the ties. Assuming an EFOR of 6.06%, this would be equivalent to a total transfer from Downstate to Upstate of 1,248 MW.

In this scenario, Zones J and K were returned to their "as found" state with capacity in Zone J equal to 88% of its peak load, and capacity in Zone K equal to 105% of its peak. The capacity that had been shifted from Downstate was shifted back to Downstate before the other transfers occurred, so the first 1,248 MW of transfers were modeled as capacity returned from Upstate zones to Downstate zones, with no corresponding flow being introduced on the ties. The next 1,000 MW was modeled as the wheel from Zone G to Zone J on the ties from Zone G to PJM and from PJM to Zone J. The remaining transfers flowed directly on the ties from Zone I to Zone J and from Zone I to Zone K.

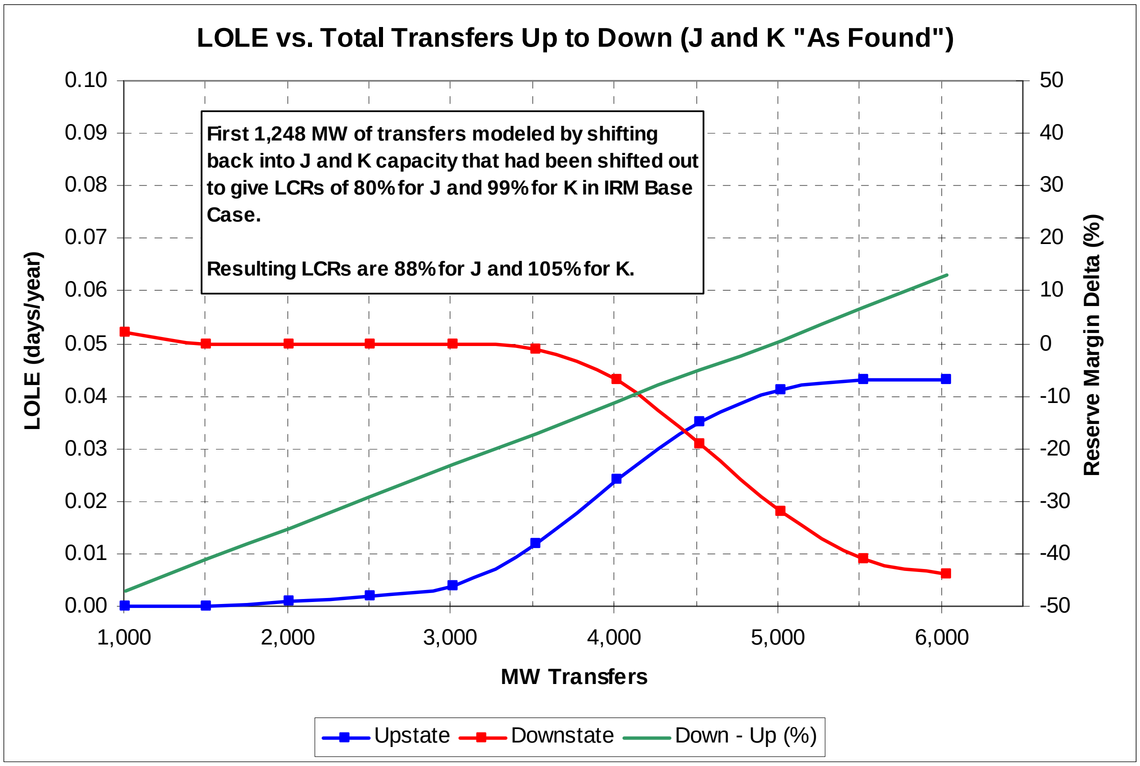


Figure 17 - Upstate and Downstate LOLE with Transfers With Zones J and K Returned to "As Found"

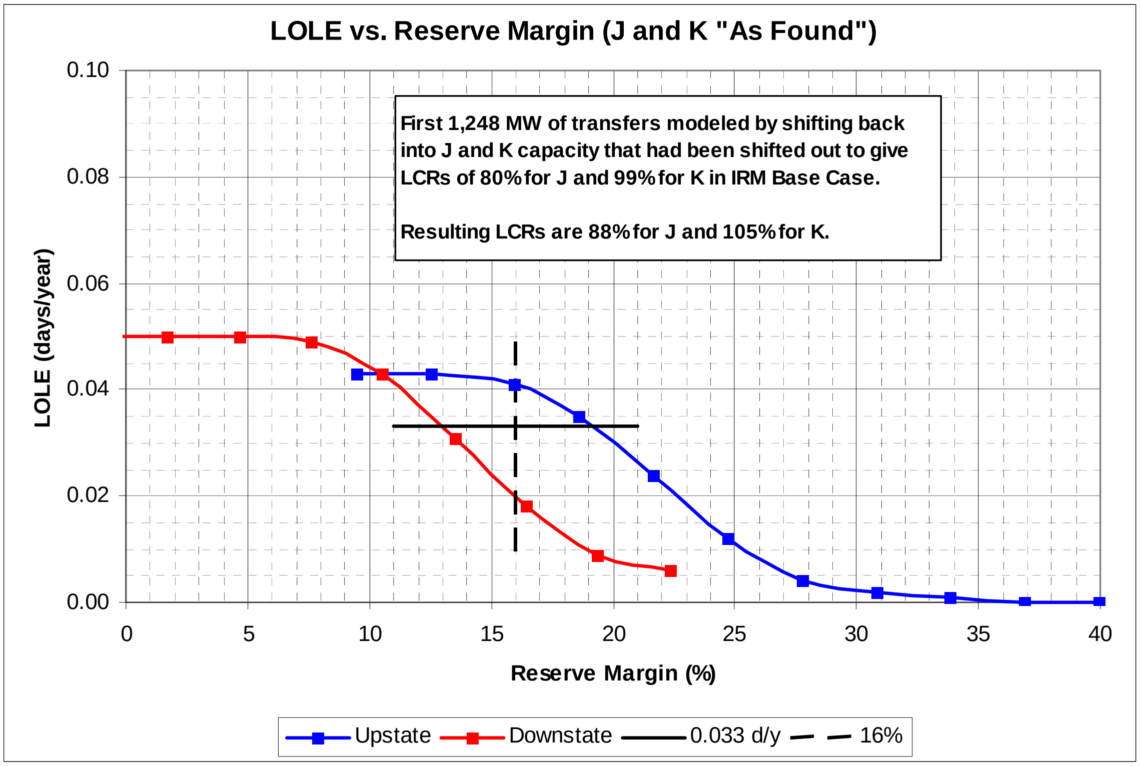


Figure 18 - Upstate and Downstate Reserve Margins With Zones J and K Returned to "As Found"

As seen in Figure 17, returning 1,248 MW of capacity from Zones A, C, and D to the Downstate zones without introducing the corresponding flow on the ties, including the ties within the Upstate SuperZone, significantly improved the LOLE in Downstate, and to a lesser degree in Upstate. With total transfers, including the returned capacity, of 4,430 MW, both SuperZones were at an LOLE of 0.033 days/year. Figure 18 shows that at the point of equal risk, the reserve margins in Downstate was 6.2% lower than in Upstate.

4.7 NYCA Isolated

This scenario was studied to see if the assistance from the outside regions was provided to the SuperZones in an equitable manner. In this scenario, all of the interfaces between NYCA and the outside regions were cut, with the exception of the ties associated with the 1,000 MW wheel through PJM. The ties from Zone G to PJM-East and from PJM-East to Zone J were restricted to delivery of the wheel from Upstate to Downstate; no emergency assistance flowed on those interfaces.

Figure 19 shows the LOLE for the SuperZones as a function of the transfers from Upstate to Downstate. With no assistance from the outside regions, the NYCA LOLE doubled to 0.175 days/year from the Base Case value of 0.086 days/year. With transfers of 4,915 MW, the risk was balanced at 0.101 days/year.

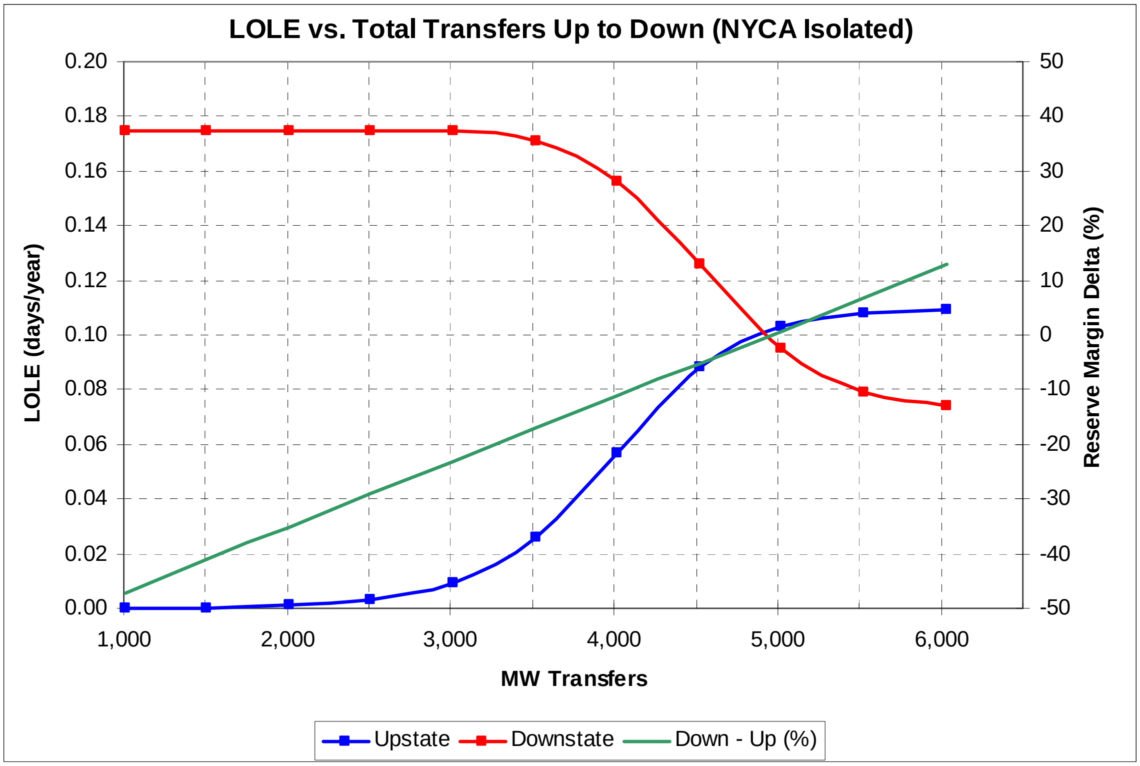


Figure 19 - Upstate and Downstate LOLE with Transfers With NYCA Isolated

As shown in Figure 20, at the point of balanced risk, the Upstate reserve margin was 16.2% and the Downstate margin was 15.8%, for a difference of 0.4%. For the Base Case, the Upstate reserve margin was 15.9% and Downstate was at 16.0%, for a difference of 0.1% in the opposite direction. These numbers would indicate that Upstate had a slight advantage over Downstate in terms of receiving assistance from the outside.

Because of transfer limits into Downstate, some of the assistance allocated to Downstate from outside could not be delivered, and so it was made available to Upstate, improving its risk.

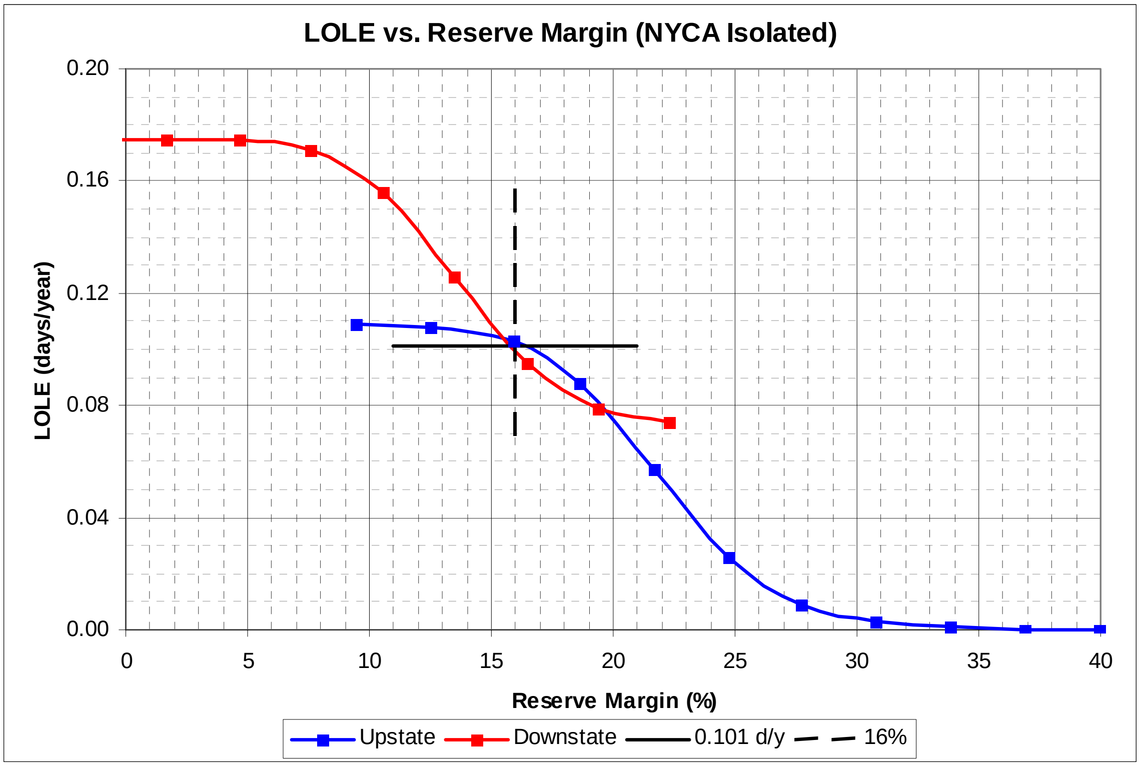


Figure 20 - Upstate and Downstate Reserve Margins With NYCA Isolated

4.8 Addition of Neptune Cable

Two of the scenarios previously described were simulated again with the addition of the Neptune Cable between PJM-East and Zone K: the Base Case, which was discussed in Section 4.2, and the case in which Downstate provided no assistance to Upstate, even from unneeded contracts, as described in the second scenario in Section 4.5.

For this analysis, the firm transaction associated with the Zone K unforced capacity deliverability rights (UDR) from PJM-East was modeled as 660 MW of capacity connected to the tie between PJM-East and Zone K. With the UDR counted as capacity in Zone K, other adjustments were made to the Base Case data to return NYCA to an IRM of 16% and to maintain the LCRs at 80% for Zone J and 99% for Zone K. One other adjustment to the Base Case data was to add 660 MW of capacity to PJM-East to replace the capacity that had been reassigned to Zone K through the UDR. This maintained PJM at the same reserve margin as in the Base Case. Though unrelated to Neptune but for consistency, a similar adjustment of 330 MW was made in New England to account for the Cross Sound Cable UDR.

The impact of modeling the Neptune Cable is shown in Figure 21. A comparison with the Base Case results in Figure 2 shows the Downstate LOLE at low levels of transfers improving from 0.086 days/year to 0.072 days/year. This improvement can be explained by the way in which capacity is shifted to meet the LCR for Zone K. A portion of the shifted capacity is taken from the zones that were added to model the UDR, which then allows additional emergency assistance to flow over the Neptune and Cross Sound Cables, improving the risk in Zone K.

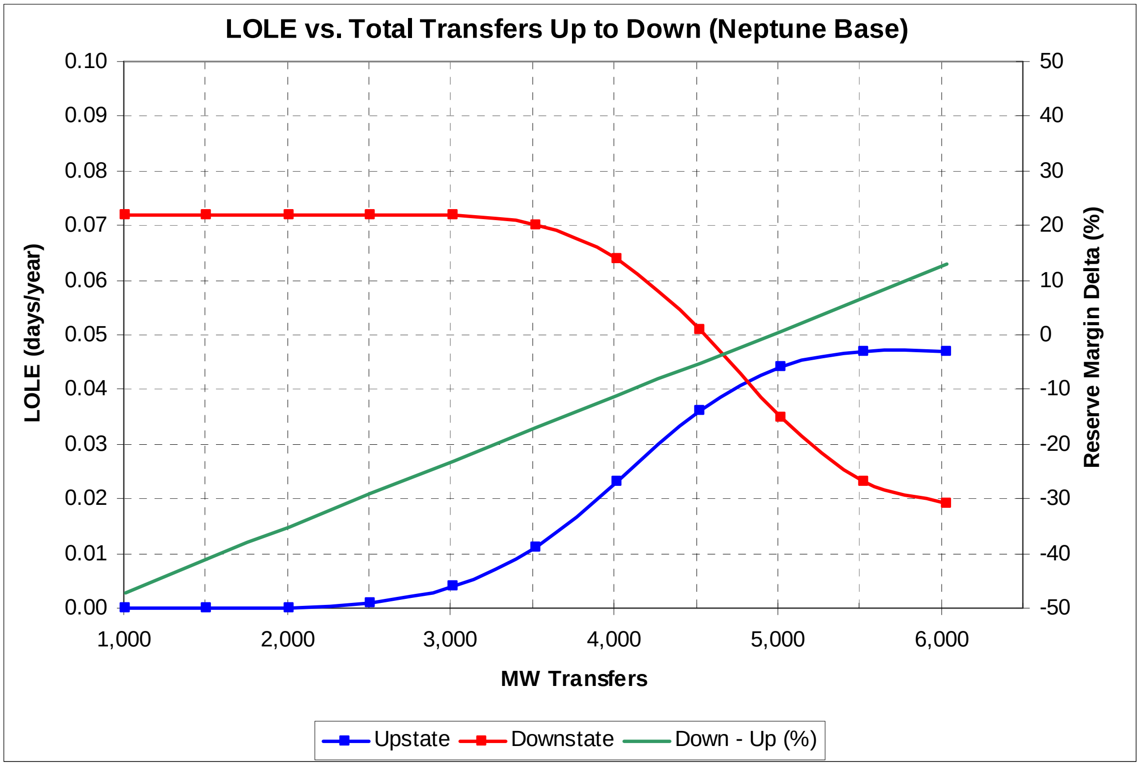


Figure 21 - Upstate and Downstate LOLE with Transfers Base Case with Neptune Cable

With the Neptune Cable in place, transfers from Upstate to Downstate of 4,820 MW were required to balance the risk for the SuperZones. This is 140 MW less than the transfers required in the Base Case. The LOLE at balanced risk was 0.042 days/year, compared to 0.046 days/year in the Base Case. The SuperZone risks as a function of their reserve margins are shown in Figure 22.

The relatively small impact, as compared to the Base Case, of adding the 660 MW Neptune Cable is the result of the way in which the system was returned to its Base Case conditions with the IRM at 16% and the LCRs at 80% for Zone J and 99% for Zone K. To measure the true impact of the Neptune Cable, a scenario was run in which Neptune was modeled in the Base Case as 619 MW of perfect capacity added to Zone K, which reflects the forced outages on the associated units and cable. The resulting NYCA reserve margin was 18% and the LCR for Zone K was 111%.

Figure 23 shows the Downstate risk improving to 0.022 days/year at low levels of transfer, with balanced risk of 0.014 days/year occurring with 4,165 MW of transfers from Upstate to Downstate. At the point of balanced risk, the Downstate reserve margin was 5.5% lower than Upstate's.

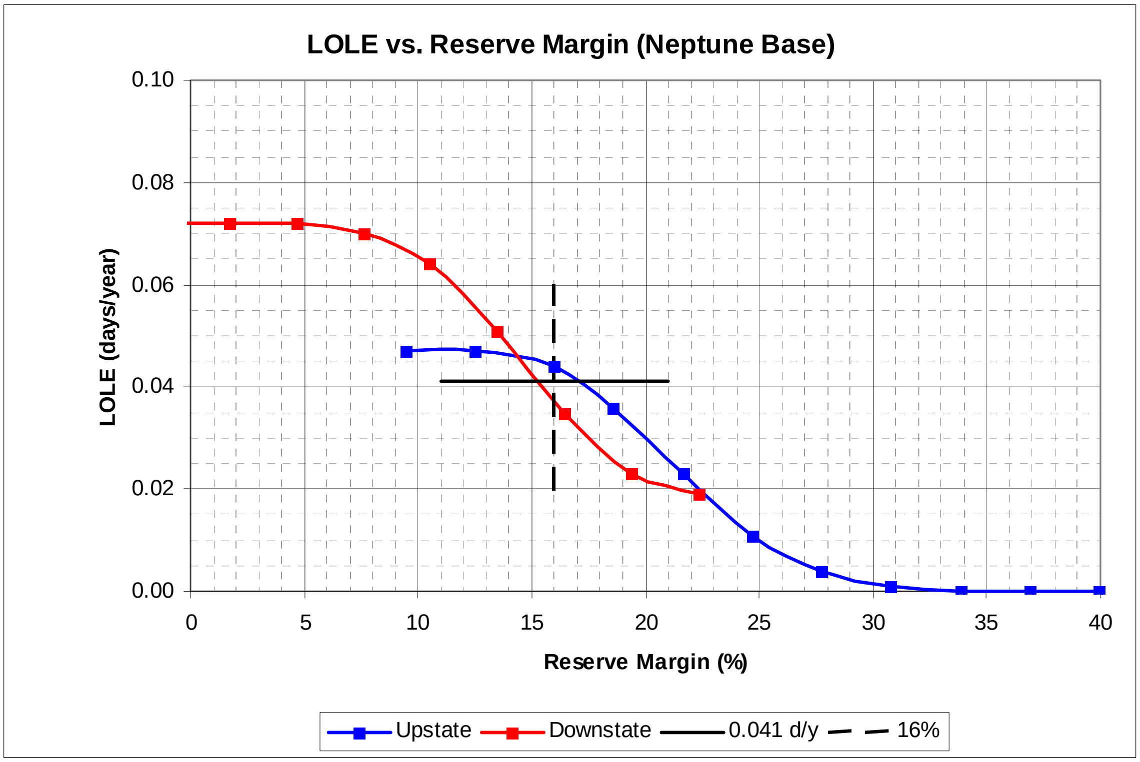


Figure 22 - Upstate and Downstate Reserve Margins
Base Case with Neptune Cable

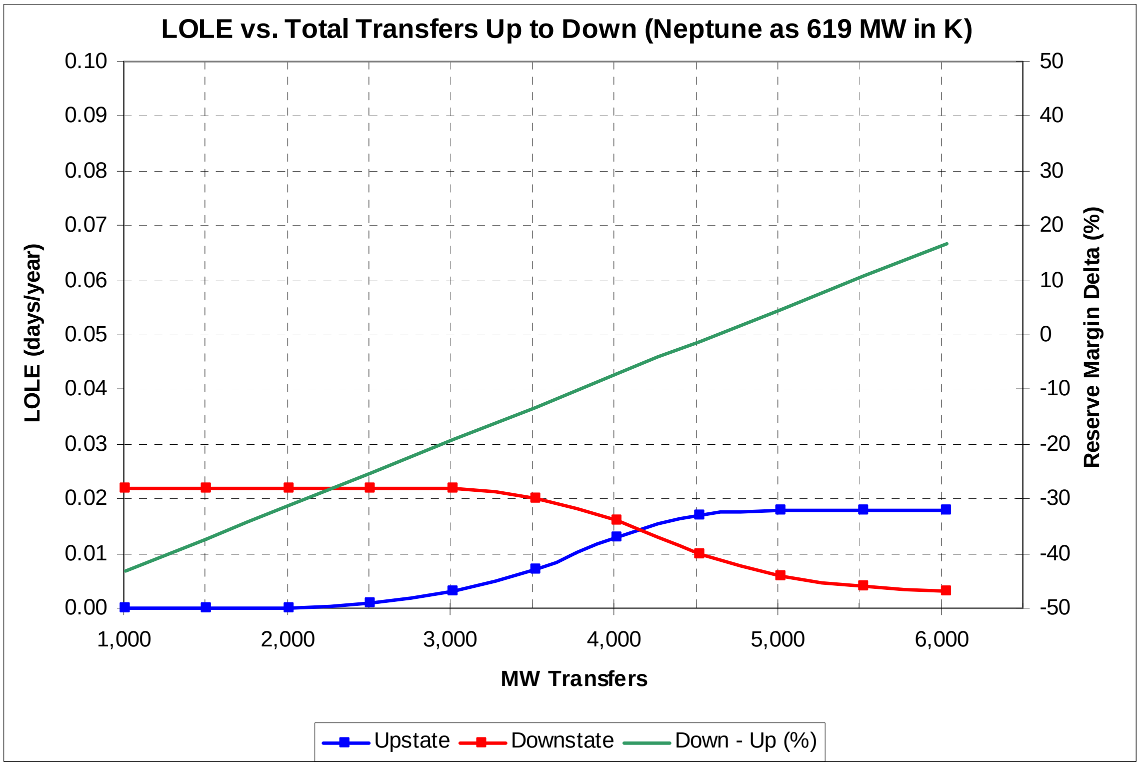


Figure 23 - Upstate and Downstate LOLE with Transfers
Base Case with Neptune Modeled as 619 MW in Zone K

The other Neptune scenario involved the case in which no flow was allowed from Downstate to Upstate, even from capacity transferred to Downstate which Downstate did not need. The results are shown in Figure 24 and Figure 25.

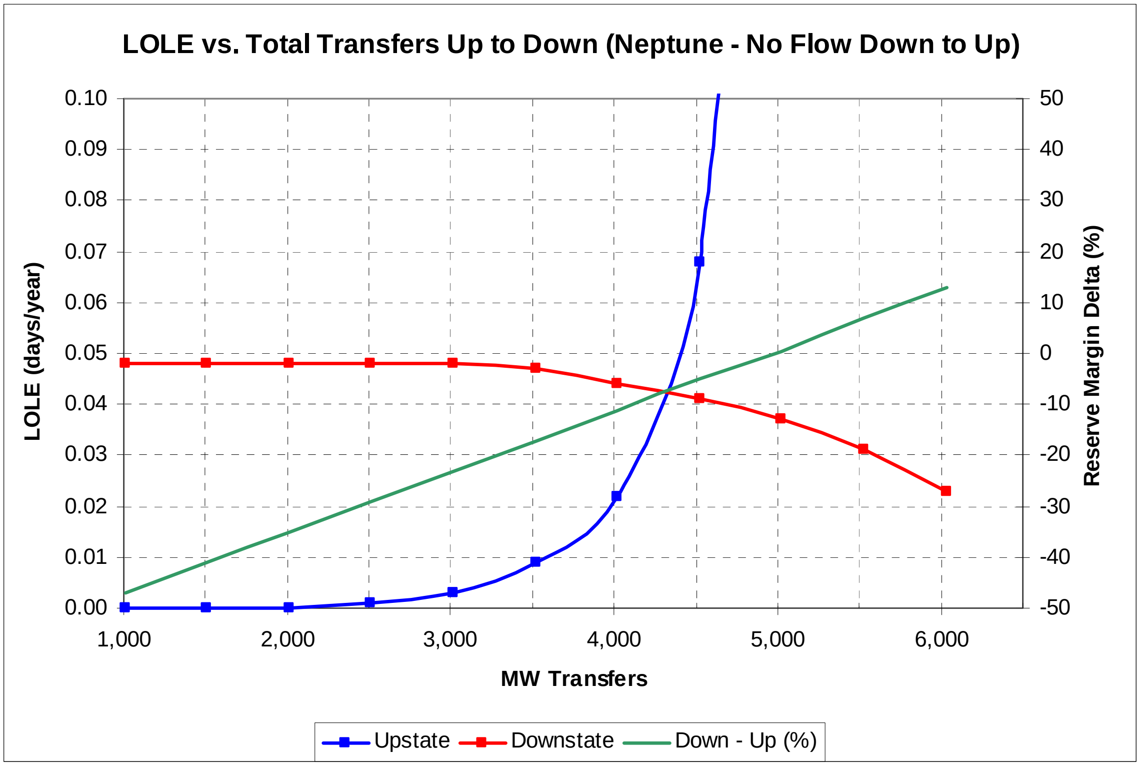


Figure 24 - Upstate and Downstate LOLE with Transfers
No Flow to Upstate from Downstate – Neptune In Service

A comparison with Figure 21 shows a net improvement in the Downstate risk at low levels of transfer from 0.072 days/year to 0.048 days/year when flow from Downstate to Upstate was blocked. As was explained in Section 4.5, the modeling that was used to restrict the flows also limited the ability of New England to flow assistance through New York to Southwest CT, thus making that assistance available to New York zones. Counteracting some of the improvement from the additional New England assistance was the fact that Zone J could no longer provide assistance to Zone K through Zone I.

Compared to the Base Case with no flows from Downstate to Upstate (Figure 15), the addition of Neptune improved the Downstate risk at low levels of transfer from 0.059 days/year to 0.048 days/year. Upstate risk was also slightly improved. The level of transfers required to balance the risk was nearly identical (4,330 MW with Neptune versus 4,315 MW without Neptune), although the balanced risk improved to 0.042 days/year with Neptune, down from 0.052 days/year without.

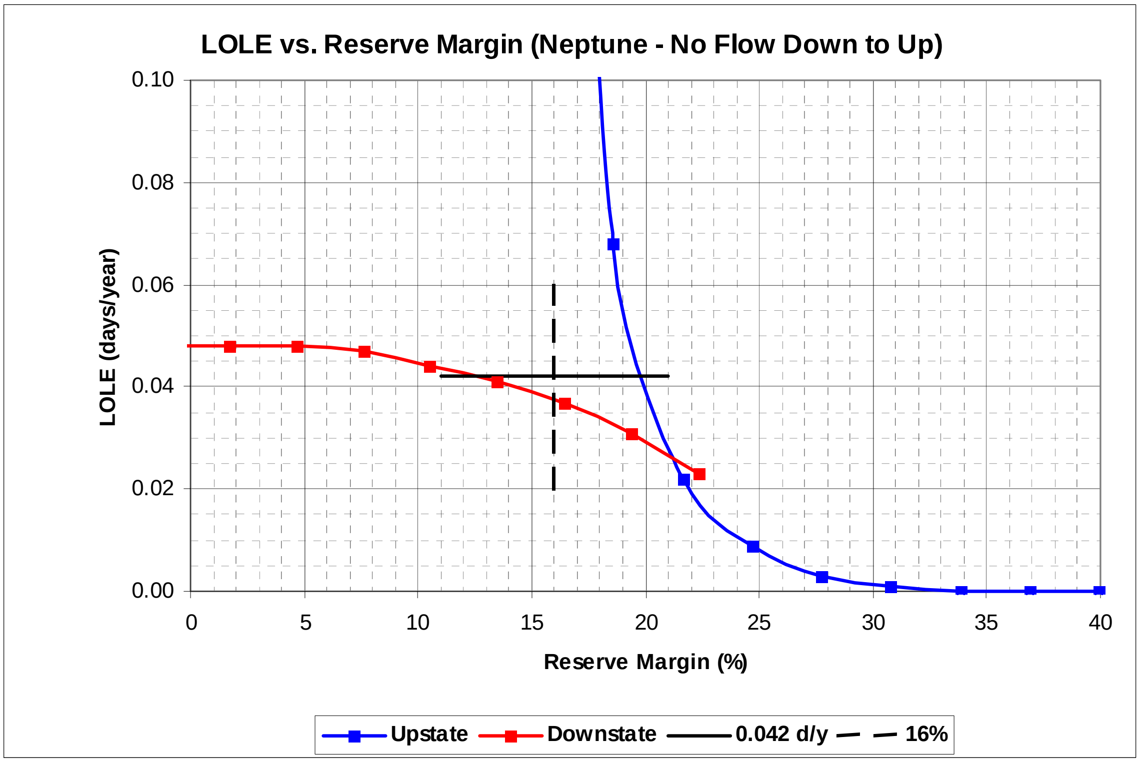


Figure 25 - Upstate and Downstate Reserve Margins
No Flow to Upstate from Downstate – Neptune in Service

4.9 Variations in IRM and LCR

These three scenarios focused on the impact of varying the state-wide reserve margin and the locational requirements for Zones J and K.

In the first case, the IRM was reduced to 14.5% from the Base Case value of 16%. The corresponding LCRs, that would maintain the NYCA LOLE at 0.1 days/year, were 82% for Zone J and 102% for Zone K, up from the 80% and 99% in the Base Case. The SuperZone LOLE as a function of transfers is shown in Figure 26. Lowering the IRM and increasing the LCRs decrease the Upstate capacity and increase the Downstate capacity, which resulted in higher risk Upstate and lower risk Downstate. Balanced risk was achieved with transfers of 3,930 MW at an LOLE of 0.066 days/year. As shown in Figure 27, the Downstate reserve margin was 4.8% lower than the Upstate margin at this point.

The second scenario considered an increase in IRM to 18% with the corresponding LCRs of 79% for Zone J and 97% for Zone K. As shown in Figure 28, increasing the IRM and reducing the LCRs reduced the Upstate risk and increased the Downstate risk to such an extent that the risk of the two SuperZones could not be balanced. (Note the 2,000 MW shift in scale for the x-axis in this figure.) As the level of transfers from Upstate to Downstate increased, the interfaces saturated at total transfers of approximately 6,500 MW, limiting the amount that could actually be delivered. The LOLE as a function of reserve margins is shown in Figure 29.

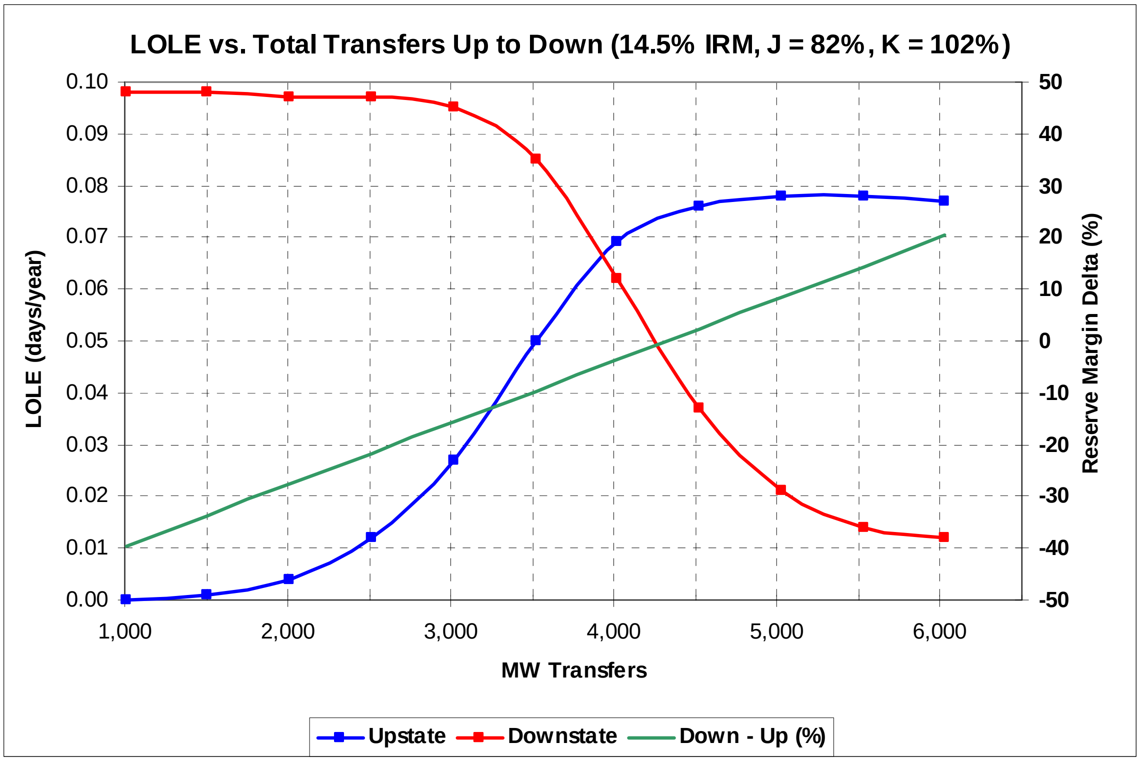


Figure 26 - Upstate and Downstate LOLE with Transfers
IRM = 14.5%, J = 82%, K = 102%

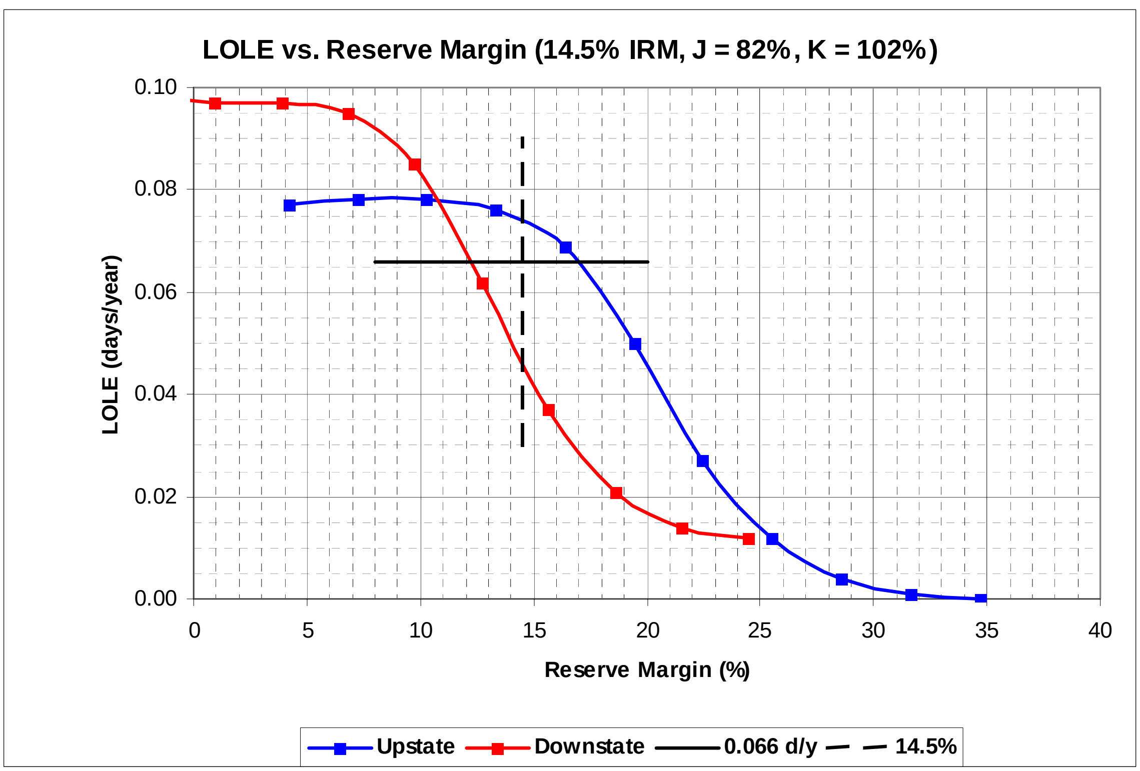


Figure 27 - Upstate and Downstate Reserve Margins
IRM = 14.5%, J = 82%, K = 102%

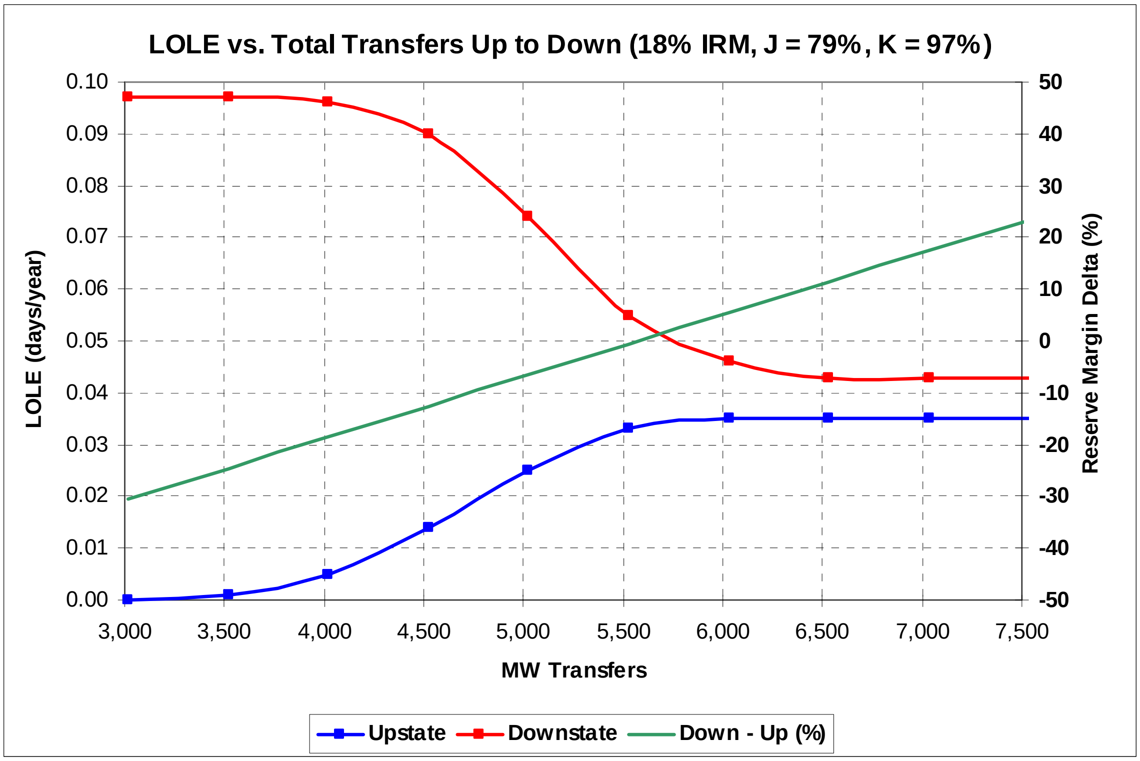


Figure 28 - Upstate and Downstate LOLE with Transfers
IRM = 18%, J = 79%, K = 97%

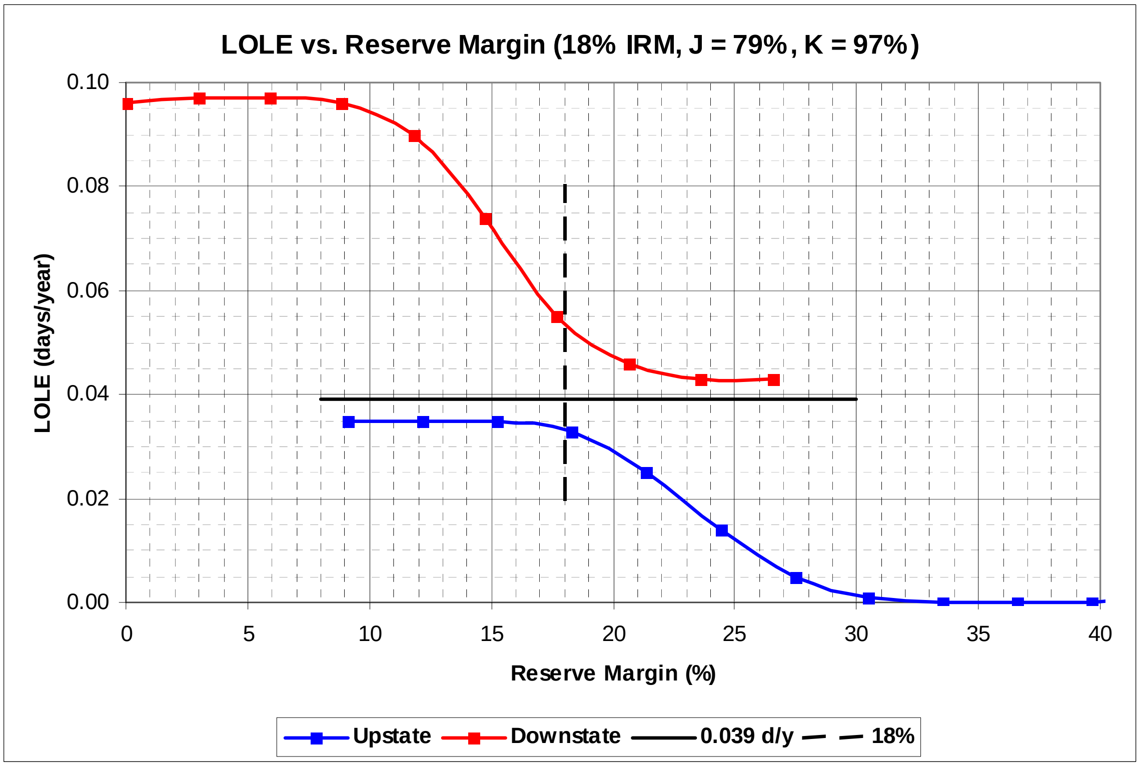


Figure 29 - Upstate and Downstate Reserve Margins
IRM = 18%, J = 79%, K = 97%

In the third scenario, the IRM was increased to 18% while holding the LCRs at 80% for Zone J and 99% for Zone K. This increase in reserves improved the NYCA risk, at the low levels of transfers, from 0.086 days/year in the Base Case to 0.061 days/year. It also significantly improved the Upstate risk. Figure 30 shows that transfers of 6,030 MW were required to balance the risk at 0.025 days/year. From Figure 31 we see that at the point of balanced risk, the Upstate reserve margin was 13.5% while the Downstate margin was 22.3%.

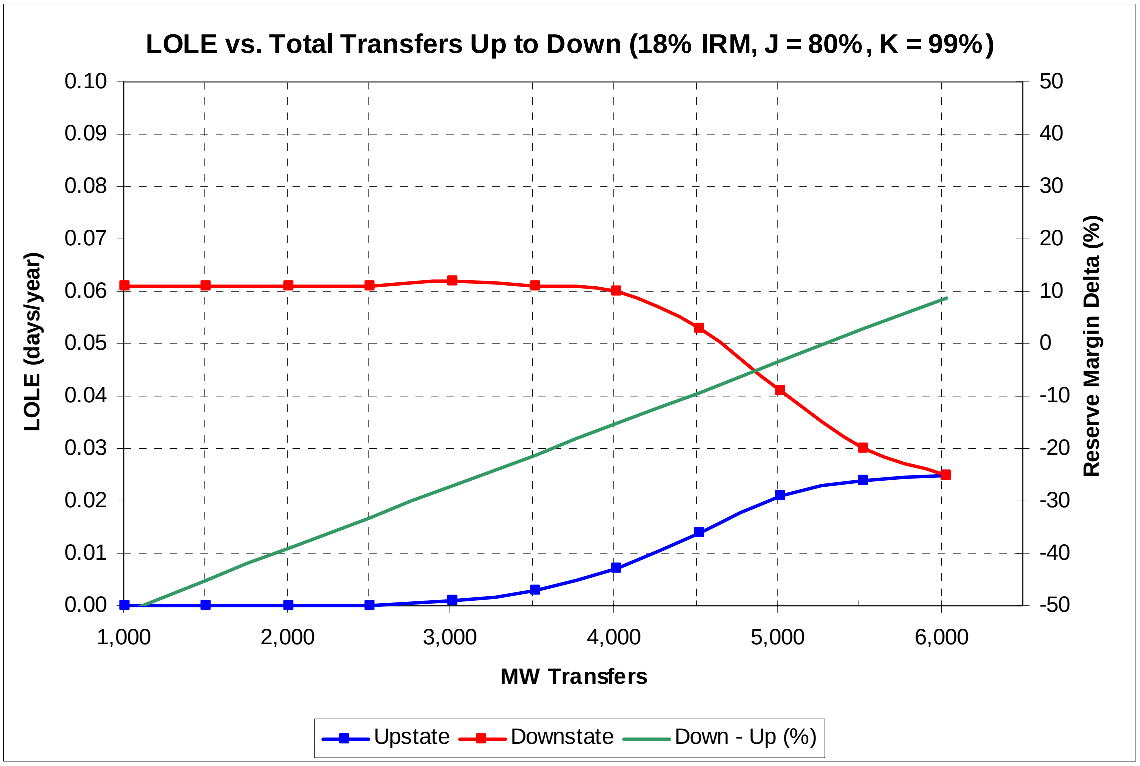


Figure 30 - Upstate and Downstate LOLE with Transfers
IRM = 18%, J = 80%, K = 99%

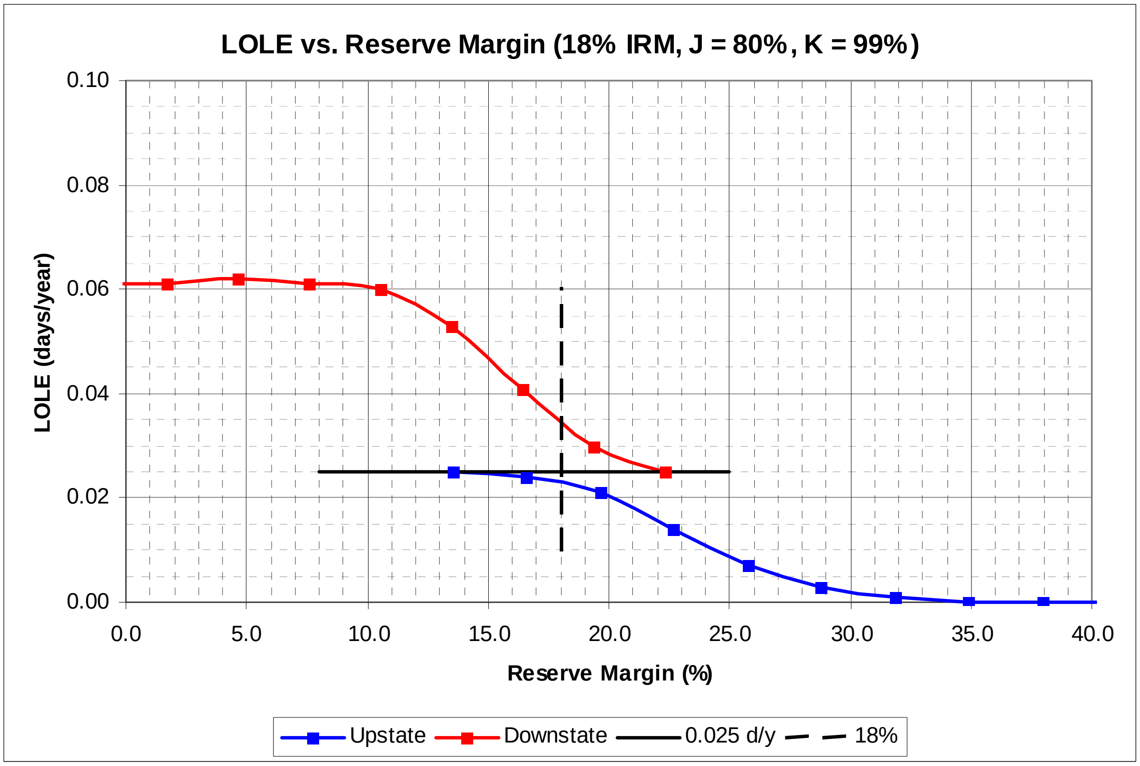


Figure 31 - Upstate and Downstate Reserve Margins
IRM = 18%, J = 80%, K = 99%

5 Conclusions

The results of the analysis are summarized in Figure 32 and Figure 33. Figure 32 shows the transfers required to achieve equal risk and the corresponding LOLE. For the Base Case, assuming an EFOR of 6.06%, the transfer of approximately 4,960 MW from Upstate to Downstate brought both SuperZones to a risk of 0.046 days/year. For all of the scenarios considered, the required transfers were in the range of 3,930 MW to 6,030 MW. The corresponding LOLE ranged from 0.014 days/year to 0.101 days/year, with many clustered at 0.047 days/year. The vertical line at 4,950 MW shows the transfers required, with 16% reserve margins for NYCA, to balance the reserve margins of the SuperZones.

Figure 33 summarizes for the various scenarios the difference in reserve margins (Downstate reserves minus Upstate reserves) at the point at which the SuperZones had equal risk. For the Base Case with an EFOR of 6.06%, the reserves were nearly balanced with Downstate requiring a reserve margin 0.1% greater than Upstate in order to maintain the same level of LOLE. For the scenarios modeled, the reserve margins of the SuperZones at the point of balanced risk ranged from 8.8% higher in Downstate as compared to Upstate to 7.6% higher in Upstate compared to Downstate.

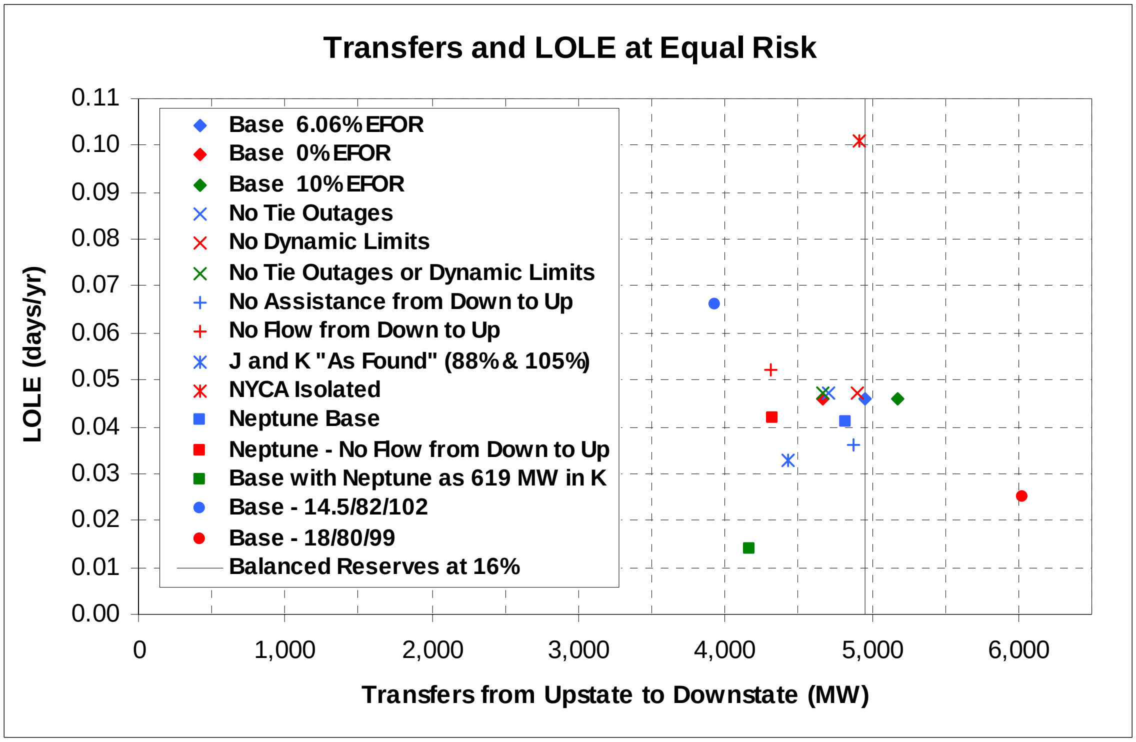


Figure 32 - Transfers and LOLE at Point of Equal Risk

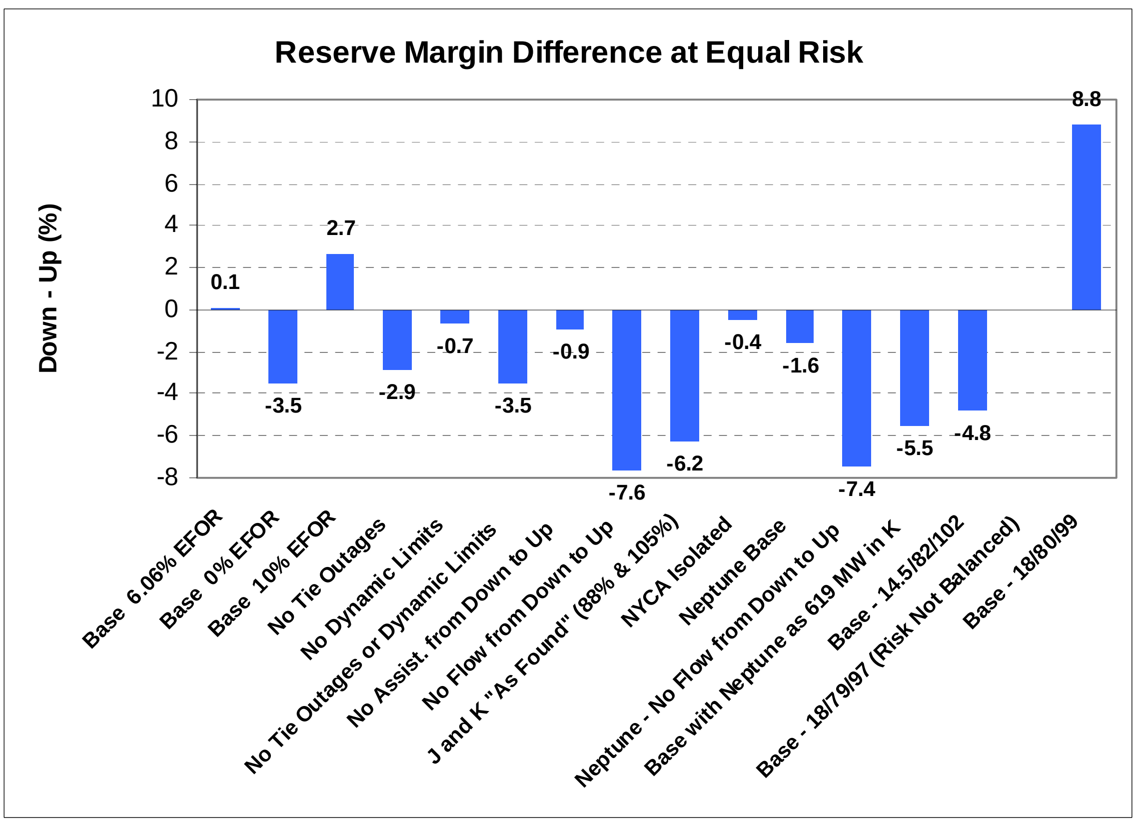


Figure 33 - Reserve Margin Difference at Point of Equal Risk

5.1 Observations

A driving force for this study was the concern that Upstate was carrying additional reserves in order to offset capacity deficiencies Downstate or insufficient transmission capability into Downstate. While this seemed to be true when NYCA reserves were at 18%, it appears to have gone away when the reserves are lowered to 16%.

In general, changes in study assumptions that improved the Downstate risk, such as increased transfer capability or installed capacity Downstate, resulted in the balanced risk being achieved with lower levels of transfers, and thus at lower Downstate reserves and higher Upstate reserves.

The Base Case at 16% IRM with LCRs of 80% for Zone J and 99% for Zone K, as determined by the "tan 45" process, appears to be the minimum reserve point for the Upstate SuperZone, with balanced risk occurring at reserve margins of 16% in each SuperZone. If the NYCA reserves required to maintain 0.1 days/year are lowered by increasing the Downstate LCRs, the Downstate risk improves and balanced risk is achieved with lower levels of transfers, resulting in lower Downstate reserve margins and higher Upstate margins. The differential between the Upstate margin and the NYCA IRM would be greater than the decrease in the IRM.

For example, in the case with 14.5% IRM (a 1.5% decrease from the Base Case) and LCRs of 82% for Zone J and 102%, balanced risk occurred when the Upstate reserves were at 17%, a 2.5% increase over the NYCA reserves, and Downstate was at 12%. Similar impacts can be seen when the transfer capability into Downstate is increased by removing the ties outages and dynamic limits.

Both Upstate and Downstate benefit as a result of being interconnected with one another. The amount of assistance provided by the SuperZones to each other depends on the assumptions for the starting point and how much of the capacity that is located in Upstate is actually obligated to Downstate.

Appendix B

Cost of Capacity Analyses

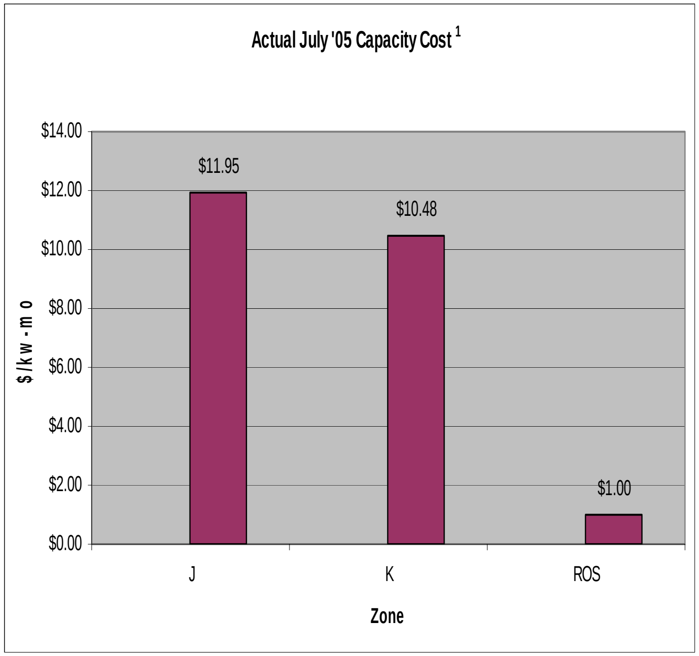
Draft – For discussion only

ConEd/LIPA Cost of Capacity Calculation Presented To Resource Adequacy Issues Task Force Meeting

August 3, 2006

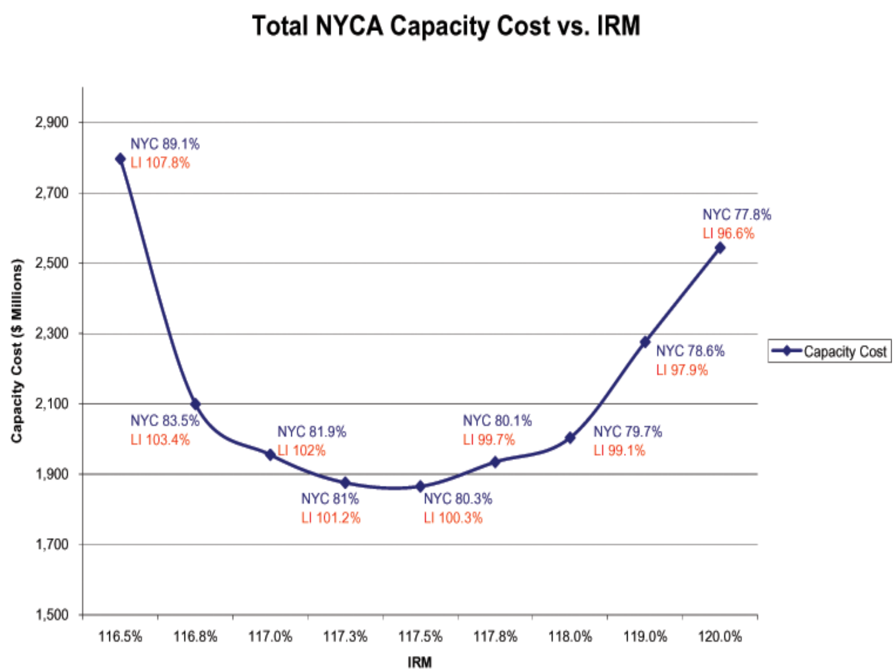
Anchor Point Should Send Appropriate Market Signals

- LOLEs in constrained zones must be higher than LOLEs in unconstrained zones
- Market Stability
  - An Unstable Anchoring point such as Free Flow will send volatile market signals which may increases risk premium and may deter long term investment
  - Free Flow may reduce liquidity in Locationally constrained zones and impact ability to negotiate bilateral as pricing goes up and down.
  - Tan 45 is consistent with Demand Curve in that produces less volatility in results.
- NYC and LI capacity prices already order of magnitude higher than Rest of NYCA and close to cost of new entry



[1] Consistent with market trends

All Things Equal Anchor Point Should not Result in Unreasonable Consumer Costs



- Tan 45 results in NYCA capacity costs that are in the vicinity of NYCA minimum costs.
- Free Flowing Anchor Maximizes NY Capacity Costs – by almost a Billion Dollars~!!
- This is unjust and discriminatory.
- The Free Flow is inconsistent with the LBMP-based energy market where statewide bid production costs are minimized.

10

National Grid/NYSEG Cost of Capacity Calculation Presented To Resource Adequacy Issues Task Force August 2006

NYCA Capacity Cost Analysis & Downstate Capacity Subsidy

		WINTER 2005-2006		SUMMER 2006		TOTAL 2005-2006	
		16.50%	18.00%	16.50%	18.00%	16.50%	18.00%
		Free-Flowing Equivalent (FFE)	TAN 45 IRM Anchor	Free-Flowing Equivalent (FFE)	TAN 45 IRM Anchor	Free-Flowing Equivalent (FFE)	TAN 45 IRM Anchor
ICAP Obligation Basis							
Peak Load - New York Control Area (NYCA)	MW	31,962	**31,962**	33,295	**33,295**		
Peak Load - New York City (NYC)	MW	11,298	**11,298**	11,630	**11,630**		
Peak Load - Long Island (LI)	MW	5,231	**5,231**	5,348	**5,348**		
LCR - New York City (NYC)	LCR%	**89.1%**	**79.7%**	**89.1%**	**79.7%**		
LCR - Long Island (LI)	LCR%	**107.8%**	**99.1%**	**107.8%**	**99.1%**		
ICAP - New York Control Area (NYCA)	MW	37,236	37,715	38,789	39,288		
ICAP - New York City (NYC)	MW	10,067	9,005	10,362	9,269		
ICAP - Long Island (LI)	MW	5,639	5,184	5,765	5,300		
ICAP - Downstate NY	MW	15,706	14,188	16,127	14,569		
ICAP - Rest of State (ROS)	MW	21,530	23,527	22,661	24,719		
UCAP Obligation Basis							
EFORd - New York Control Area (NYCA)	EFORd%	5.18%	**5.18%**	5.43%	**5.43%**		
EFORd - New York City (NYC)	EFORd%	5.19%	**5.19%**	5.42%	**5.42%**		
EFORd - Long Island (LI)	EFORd%	4.17%	**4.17%**	3.48%	**3.48%**		
UCAP - New York Control Area (NYCA)	Req'd MW	35,307	35,762	36,682	37,155		
UCAP - Locational New York City (NYC)	Req'd MW	9,544	8,537	9,801	8,767		
UCAP - Locational Long Island (LI)	Req'd MW	5,404	4,968	5,565	5,115		
UCAP - Locational Downstate NY	Req'd MW	14,948	13,505	15,365	13,882		
UCAP - Rest of State (ROS)	Req'd MW	20,359	22,257	21,317	23,273		
100% Equilibrium UCAP		6 months	6 months	6 months	6 months	12 months	12 months
UCAP Price - New York Control Area (NYCA)	$.kW-month	$7.16	$7.26	$7.40	$7.50		
UCAP Price - Locational New York City (NYC)	$.kW-month	$16.41	$14.68	$16.95	$15.16		
UCAP Price - Locational Long Island (LI)	$.kW-month	$14.46	$13.29	$14.79	$13.59		
100% UCAP Cost - Locational NYC	$	$939,916,217	$752,056,341	$996,729,250	$797,514,224	$1,936,645,466	$1,549,570,566
100% UCAP Cost - Locational LI	$	$468,888,159	$396,258,921	$493,674,109	$417,205,609	$962,562,268	$813,464,530
100% UCAP Cost - Locational Downstate	$	$1,408,804,376	$1,148,315,262	$1,490,403,359	$1,214,719,833	$2,899,207,735	$2,363,035,096
100% UCAP Cost - Rest of State (ROS)	$	$875,063,814	$968,943,345	$946,714,469	$1,046,860,924	$1,821,778,283	$2,015,804,269
100% UCAP - New York Control Area (NYCA)	$	$2,283,868,190	$2,117,258,607	$2,437,117,828	$2,261,580,757	$4,720,986,018	$4,378,839,365
100% UCAP Costs (Savings)							
New York City (NYC)	$	$187,859,876		$199,215,025		$387,074,901	
Long Island (LI)	$	$72,629,238		$76,468,500		$149,097,738	
Downstate NY	$	$260,489,114		$275,683,526		$536,172,639	
Rest of State (ROS)	$	($93,879,531)		($100,146,455)		($194,025,986)	
Total NY Statewide (NYCA)	$	**$166,609,583**		**$175,537,071**		**$342,146,653**	

100% Equilibrium Regional UCAP

	Unit	6 months	6 months	6 months	6 months	12 months	12 months
NEW YORK CITY (NYC) @ 100% UCAP							
NYC Total ICAP Obligation	MW	13,162	13,332	13,549	13,723		
NYC Total UCAP Obligation	MW	12,480	12,641	12,813	12,978		
NYC Minimum Locational UCAP	MW	9,544	8,537	9,801	8,767		
NYC Upstate UCAP Balance Required	MW	2,936	4,104	3,013	4,211		
NYC Locational UCAP Price	$.kW-month	$16.41	$14.68	$16.95	$15.16		
ROS Upstate UCAP Price	$.kW-month	$7.16	$7.26	$7.40	$7.50		
NYC Cost - Minimum Locational UCAP	$	$939,916,217	$752,056,341	$996,729,250	$797,514,224	$1,936,645,466	$1,549,570,566
NYC Cost - ROS UCAP Required Balance	$	$126,207,352	$178,663,293	$133,789,590	$189,443,802	$259,996,942	$368,107,095
NYC Cost - Total UCAP Obligation	$	$1,066,123,569	$930,719,634	$1,130,518,839	$986,958,026	$2,196,642,408	$1,917,677,660
NYC Total UCAP Cost (Savings) with FFE		**$135,403,935**		**$143,560,813**		**$278,964,748**	
LONG ISLAND (LI) @ 100% UCAP		6 months	6 months	6 months	6 months	12 months	12 months
LI Total ICAP Obligation	MW	6,094	6,173	6,230	6,311		
LI Total UCAP Obligation	MW	5,840	5,915	6,014	6,091		
LI Minimum Locational UCAP	MW	5,404	4,968	5,565	5,115		
LI Upstate UCAP Balance Required	MW	436	947	449	976		
LI Locational UCAP Price	$.kW-month	$14.46	$13.29	$14.79	$13.59		
ROS Upstate UCAP Price	$.kW-month	$7.16	$7.26	$7.40	$7.50		
LI Minimum Locational UCAP	$	$468,888,159	$396,258,921	$493,674,109	$417,205,609	$962,562,268	$813,464,530
LI Upstate UCAP Balance Required	$	$18,745,158	$41,246,562	$19,944,171	$43,884,849	$38,689,329	$85,131,411
LI Total UCAP Costs	$	$487,633,318	$437,505,483	$513,618,280	$461,090,458	$1,001,251,597	$898,595,941
LI Total UCAP Cost (Savings) with FFE		**$50,127,835**		**$52,527,821**		**$102,655,656**	
REST OF STATE (ROS) @ 100% UCAP		6 months	6 months	6 months	6 months	12 months	12 months
ROS Upstate Total ICAP Obligation	MW	na	na	na	na		
ROS Upstate Total UCAP Obligation	MW	20,359	22,257	21,317	23,273		
ROS UCAP Remaining for Upstate Obligation	MW	16,987	17,205	17,856	18,086		
Downstate UCAP Subsidy	**MW**	**-219**		**-230**			
ROS Upstate UCAP Price	$.kW-month	$7.16	$7.26	$7.40	$7.50		
Upstate UCAP Obligation Cost	$	$730,111,304	$749,033,491	$792,980,709	$813,532,273	$1,523,092,013	$1,562,565,764
Upstate Total UCAP Cost (Savings) with FFE		**($18,922,187)**		**($20,551,564)**		**($39,473,751)**	**Downstate Subsidy**
NYCA Total @ 100% UCAP		6 months	6 months	6 months	6 months	12 months	12 months
NYC Total ICAP Obligation	MW	37,236	37,715	38,789	39,288		
NYC Total UCAP Obligation	MW	35,307	35,762	36,682	37,155		
TOTAL NYCA 2005-06 100% UCAP Costs	$	$2,283,868,190	$2,117,258,607	$2,437,117,828	$2,261,580,757	$4,720,986,018	$4,378,839,365
TOTAL NYCA 2005-06 UCAP COSTS (SAVINGS) with FFE		**$166,609,583**		**$175,537,071**		**$342,146,653**	

Auction Basis UCAP Procurement

NEW YORK CITY (NYC) @ UCAP AUCTION							
NYC - Total UCAP Obligation	MW	12,480	12,641	12,813	12,978		
NYC - Minimum Locational UCAP	MW	9,544	8,537	9,801	8,767		
NYC - UCAP Auction Procurement Percentage	%	110.68%	110.68%	103.19%	103.19%		
NYC - Locational UCAP Procured at Auction	MW	10,564	9,449	10,114	9,047		
NYC - Locational UCAP Auction Price	$.kW-month	**$17.32**	**$5.97**	**$23.96**	**$12.47**		
NYC - Locational UCAP Cost	$	$1,097,716,585	$338,308,235	$1,453,830,054	$677,039,659		
NYC - Upstate UCAP Balance Required	MW	1,917	3,192	2,700	3,932		
NYC - Upstate UCAP Auction Price	$.kW-month	**$0.00**	**$0.83**	**$1.55**	**$2.44**		
NYC - Upstate UCAP Cost	$	$0	$15,857,032	$25,079,973	$57,507,543		
NYC - Total UCAP Auction Cost		$1,097,716,585	$354,165,267	$1,478,910,028	$734,547,202	$2,576,626,613	$1,088,712,469
NYC Total UCAP Auction Cost (Savings) with FFE		**$743,551,318**		**$744,362,826**		**$1,487,914,143**	
LONG ISLAND (LI) @ UCAP AUCTION							
LI - Total UCAP Obligation	MW	5,840	5,915	6,014	6,091		
LI - Minimum Locational UCAP	MW	5,404	4,968	5,565	5,115		
LI - UCAP Auction Procurement Percentage	%	107.88%	107.88%	108.74%	108.74%		
LI - Locational UCAP Procured at Auction	MW	5,830	5,359	6,051	5,563		
LI - Locational UCAP Auction Price	$.kW-month	**$15.12**	**$7.47**	**$14.82**	**$6.99**		
LI - Locational UCAP Cost	$	$528,968,838	$240,245,641	$537,898,147	$233,395,257		
LI - Upstate UCAP Balance Required	MW	10	556	0	529		
LI - Upstate UCAP Auction Price	$.kW-month	**$0.00**	**$0.83**	**$1.55**	**$2.44**		
LI - Upstate UCAP Cost	$	$0	$2,761,061	$0	$7,730,581		
NYC - Total UCAP Auction Cost		$528,968,838	$243,006,702	$537,898,147	$241,125,838	$1,066,866,985	$484,132,541
NYC Total UCAP Auction Cost (Savings) with FFE		**$285,962,136**		**$296,772,309**		**$582,734,445**	
REST OF STATE (ROS) @ UCAP AUCTION							
ROS - Total UCAP Obligation	MW	20,359	22,257	21,317	23,273		
ROS - UCAP Auction Procurement Percentage	%	**110.63%**	**110.63%**	**108.10%**	**108.10%**		
ROS - Upstate UCAP Procured at Auction	MW	22,523	24,623	23,044	25,157		
ROS - Upstate UCAP Procured by Downstate NY	MW	1,927	3,747	2,700	4,460		
ROS - Upstate UCAP Balance Procured by Upstate	MW	20,597	20,875	20,344	20,697		
ROS - Downstate Capacity Subsidy	**MW**	**-278**		**-353**			
ROS - Upstate UCAP Auction Price	$.kW-month	**$0.00**	**$0.83**	**$1.55**	**$2.44**		
ROS - Total UCAP Auction Cost		$0	$103,710,548	$188,989,521	$302,729,142	$188,989,521	$406,439,690
ROS - Total UCAP Auction Cost (Savings) with FFE		**($103,710,548)**		**($113,739,622)**		**($217,450,169)**	**Downstate Subsidy**
NYCA Total @ UCAP AUCTION							
ROS - Total UCAP Auction Cost		$1,626,685,423	$700,882,517	$2,205,797,696	$1,278,402,183	$3,832,483,119	$1,979,284,700
ROS - Total UCAP Auction Cost (Savings) with FFE		**$925,802,906**		**$927,395,513**		**$1,853,198,419**	

Auction Basis UCAP Procurement

NEW YORK CITY (NYC) @ UCAP AUCTION

NYC - Total UCAP Obligation	MW	12,480	12,641	12,813	12,978		
NYC - Minimum Locational UCAP	MW	9,544	8,537	9,801	8,767		
NYC - UCAP Auction Procurement Percentage	%	110.68%	110.68%	103.19%	103.19%		
NYC - Locational UCAP Procured at Auction	MW	10,564	9,449	10,114	9,047		
NYC - Locational UCAP Auction Price	$.kW-month	**$17.32**	**$5.97**	**$23.96**	**$12.47**		
NYC - Locational UCAP Cost	$	$1,097,716,585	$338,308,235	$1,453,830,054	$677,039,659		
NYC - Upstate UCAP Balance Required	MW	1,917	3,192	2,700	3,932		
NYC - Upstate UCAP Auction Price	$.kW-month	**$0.00**	**$0.83**	**$1.55**	**$2.44**		
NYC - Upstate UCAP Cost	$	$0	$15,857,032	$25,079,973	$57,507,543		
NYC - Total UCAP Auction Cost		$1,097,716,585	$354,165,267	$1,478,910,028	$734,547,202	$2,576,626,613	$1,088,712,469
NYC Total UCAP Auction Cost (Savings) with FFE		**$743,551,318**		**$744,362,826**		**$1,487,914,143**	

LONG ISLAND (LI) @ UCAP AUCTION

LI - Total UCAP Obligation	MW	5,840	5,915	6,014	6,091		
LI - Minimum Locational UCAP	MW	5,404	4,968	5,565	5,115		
LI - UCAP Auction Procurement Percentage	%	107.88%	107.88%	108.74%	108.74%		
LI - Locational UCAP Procured at Auction	MW	5,830	5,359	6,051	5,563		
LI - Locational UCAP Auction Price	$.kW-month	**$15.12**	**$7.47**	**$14.82**	**$6.99**		
LI - Locational UCAP Cost	$	$528,968,838	$240,245,641	$537,898,147	$233,395,257		
LI - Upstate UCAP Balance Required	MW	10	556	0	529		
LI - Upstate UCAP Auction Price	$.kW-month	**$0.00**	**$0.83**	**$1.55**	**$2.44**		
LI - Upstate UCAP Cost	$	$0	$2,761,061	$0	$7,730,581		
NYC - Total UCAP Auction Cost		$528,968,838	$243,006,702	$537,898,147	$241,125,838	$1,066,866,985	$484,132,541
NYC Total UCAP Auction Cost (Savings) with FFE		**$285,962,136**		**$296,772,309**		**$582,734,445**	

REST OF STATE (ROS) @ UCAP AUCTION

ROS - Total UCAP Obligation	MW	20,359	22,257	21,317	23,273		
ROS - UCAP Auction Procurement Percentage	%	**110.63%**	**110.63%**	**108.10%**	**108.10%**		
ROS - Upstate UCAP Procured at Auction	MW	22,523	24,623	23,044	25,157		
ROS - Upstate UCAP Procured by Downstate NY	MW	1,927	3,747	2,700	4,460		
ROS - Upstate UCAP Balance Procured by Upstate	MW	20,597	20,875	20,344	20,697		
ROS - Downstate Capacity Subsidy	**MW**	**-278**		**-353**			
ROS - Upstate UCAP Auction Price	$.kW-month	**$0.00**	**$0.83**	**$1.55**	**$2.44**		
ROS - Total UCAP Auction Cost		$0	$103,710,548	$188,989,521	$302,729,142	$188,989,521	$406,439,690
ROS - Total UCAP Auction Cost (Savings) with FFE		**($103,710,548)**		**($113,739,622)**		**($217,450,169)**	**Downstate Subsidy**

NYCA Total @ UCAP AUCTION

ROS - Total UCAP Auction Cost		$1,626,685,423	$700,882,517	$2,205,797,696	$1,278,402,183	$3,832,483,119	$1,979,284,700
ROS - Total UCAP Auction Cost (Savings) with FFE		**$925,802,906**		**$927,395,513**		**$1,853,198,419**	