IRM Anchoring Method

The Case for Establishing a Free-Flowing Equivalent IRM

for the New York Control Area

Presented to the
Joint NYSRC-NYISO
Resource Adequacy Issues Task Force (RAITF)

August 3, 2006

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Note from the Authors

This information was originally presented to the NYSRC Executive Committee (EC) meeting on July 14, 2006. This slightly modified version of our presentation therefore reflects the inclusion of certain clarifications, corrections and other input received from the EC participants.

Consistent with regulated wholesale electric markets in New York, utilities depend on developers to provide sufficient resources that will satisfy necessary capacity obligations and maintain system reliability. Moreover, investors base their decisions on risk and return on capital not on reliability studies. To ensure the continued reliability of the system, markets must provide appropriate incentives so resources get built when and where they are needed.

In light of the current market based paradigms, the authors firmly believe that it is critical to provide proper economic incentives in order to maintain resource adequacy requirements. However, the request of the New York State Reliability Council Executive Committee was to focus the discussion on reliability. Therefore, this paper will not address the need to integrate proper market designs with reliability needs or other market design considerations.

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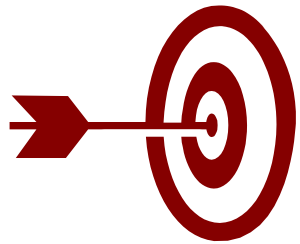
Reliability Criteria drives the IRM ... and LCRs are directly linked to the IRM

- In transmission-constrained systems, resource adequacy criteria are maintained through combined use of *Minimum* **Locational Capacity Requirements (LCRs)** and system-wide **Installed Reserve Margin (IRM)** requirements.

- In the New York Control Area (NYCA), many IRM and LCR combinations exist that equally satisfy resource adequacy criteria and deliver a Loss of Load Expectation (LOLE) of 0.1 day/year.

- The selection of an IRM and corresponding LCRs from several IRM/LCR "point pairs" is heavily influenced by qualitative assessments and engineering judgment.

LOLE = 0.1 days /year

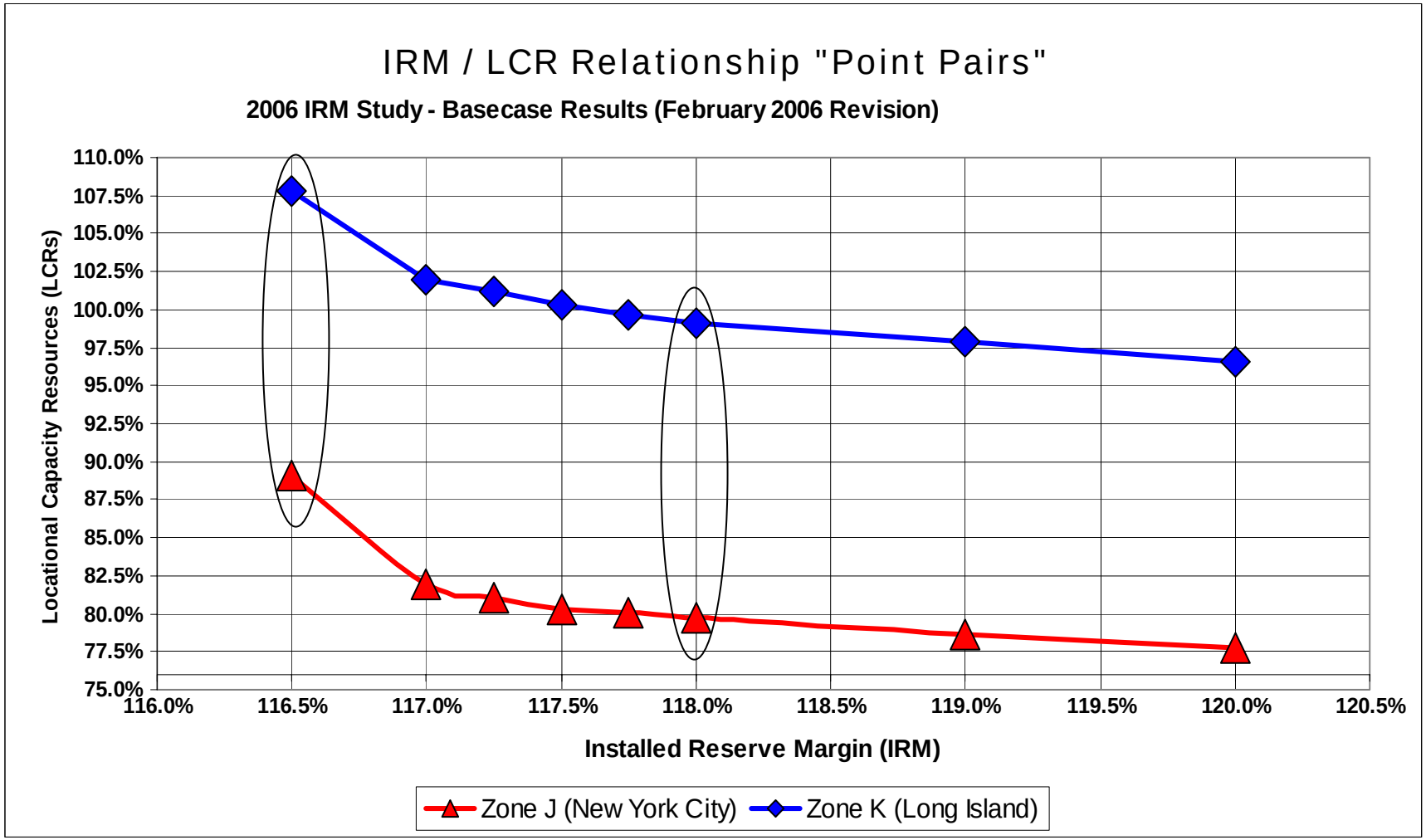


Currently, the NYSRC approved an 18% Installed Reserve Margin (IRM) to meet the 0.1 LOLE requirement for NYCA.

An 18% IRM reflects *Minimum* LCRs of 80% (NYC) and 99% (LI).

IRM / LCR Relationship *(From the February 2006 Revised IRM Study)*

IRM / LCR "point pairs" can be established anywhere along the IRM / LCR curves to meet 0.1 LOLE. At a 16.5% IRM, LCRS for NYC and LI are 89% and 107%, respectively – while at 18% IRM, LCRs are 80% and 99%. <u>All pairs meet 0.1 LOLE</u>



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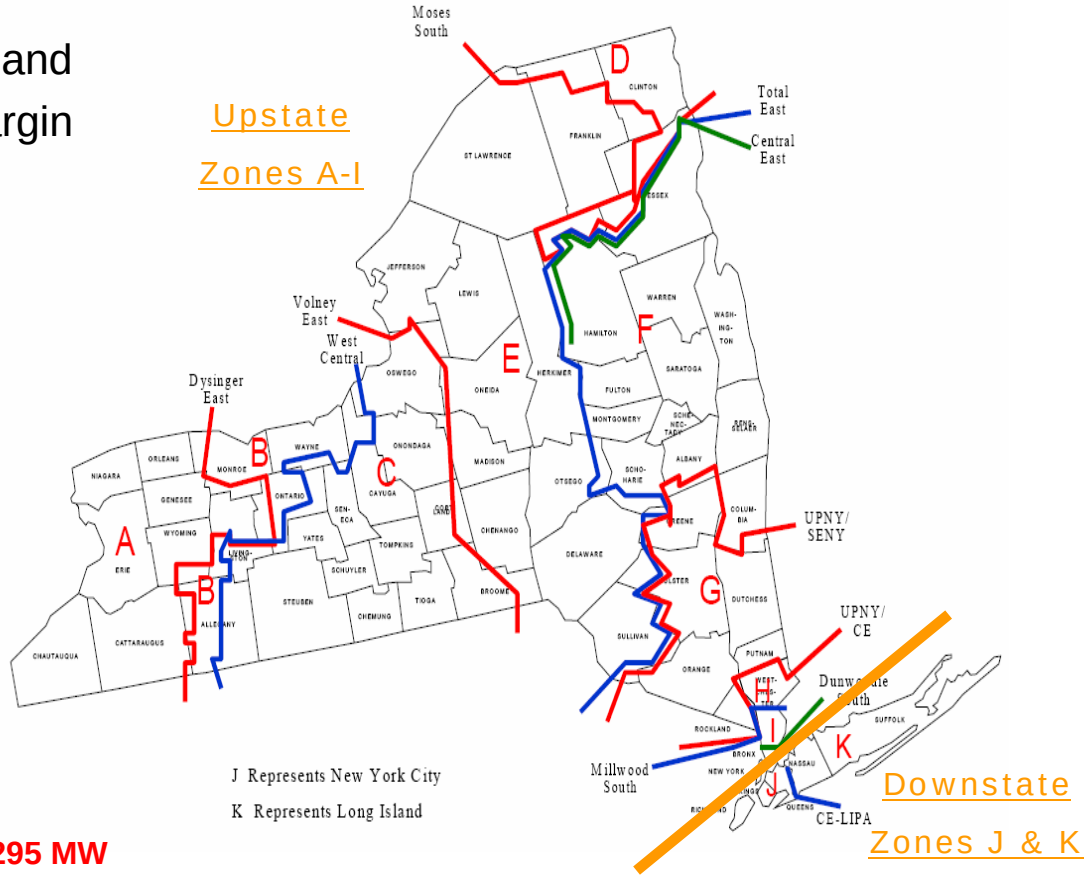
NYCA "As-Found" System compared to 18% IRM Capacity Obligation

2006 Installed Capacity, Load and "As-Found" (A.F.) Reserve Margin



NYCA

NYCA Installed = 40,947 MW

NYCA Peak Load = 33,295 MW

NYCA A.F. Margin = 23%

NYCA Coincident Peak for 2006 = 33,295 MW

NYCA Installed Capacity Obligations @ 18% = 33,295 MW x 1.18 IRM ➔ 39,288 MW

NYCA Installed Capacity = 40,947 MW

NYCA Installed Excess Capacity = 1,659 MW

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Unified Method & LCR Study Summary

The NYISO's Revised Locational Installed Capacity Requirements Study report for the 2006 - 2007 Capability Year provides the following data for NYCA at 18% IRM:

Zone	Capacity	Load
A	5,155	2,771
B	1,017	1,914
C	6,680	3,080
D	1,512	1,155
E	1,022	1,496
F	3,924	2,193
G	3,423	2,242
H	2,070	618
I	13	1,802
J	10,364	11,630
K	5,767	5,348
Totals	**40,947**	34,249
	Coincident Peak	**33,295**

NYCA Capacity Requirement	**18%**
NYCA Capacity Obligation	**39,288**
Total NYCA Actual Installed Capacity	**40,947**
Difference between NYCA Actual Capacity and Obligation	**1,659**
Zone J Locational Capacity Requirement	**80%**
Zone J Locational Capacity Obligation	**9,304**
Zone K Locational Capacity Requirement	**99%**
Zone K Locational Capacity Obligation	**5,295**
Total Locational Capacity Obligation	**14,599**
Total Actually Installed Capacity in Zone J and K	**16,131**
Difference between Zones J and K Actual Capacity and Obligation	**1,532**

Unified Method @ 18% IRM

STEP1

The initial step in the Unified Method removes 1,659 MW from "capacity rich" Upstate Zones A, C and D. **However, the NYCA LOLE is below (more reliable) than 0.1.**

STEP 2

For Downstate Zones J and K The difference between actual installed capacity and locational obligation is 1,532 MW. This amount was shifted from J and K back to Upstate Zones A, C and D … until 0.1 LOLE is achieved.

RESULT:

At an 18% IRM with associated LCRs, the NYCA LOLE is maintained with essentially all installed capacity in Upstate Zones A-I intact … **and 1,532 MW of capacity from Zones J and K *removed* from the NYCA.**

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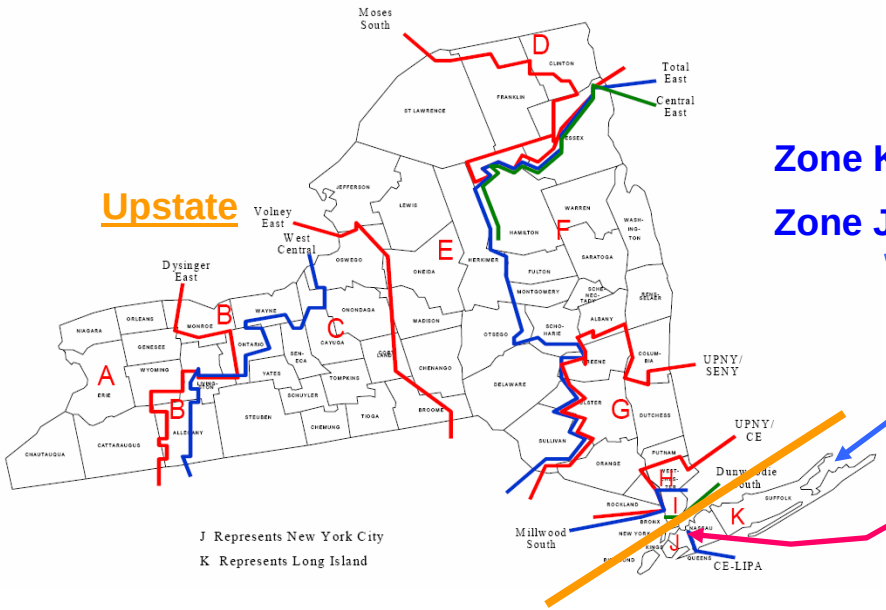
Minimum Locational Capacity Requirements (LCRs)



Zone K (LI) LCR = 99%

Zone J Capacity Obligation = 5,295 MW

Zone J (NYC) LCR = 80%

Zone J Capacity Obligation = 9,304 MW

Downstate

Total Downstate Locational Capacity Obligation = **14,599 MW**

Total Downstate Installed Capacity = **16,131 MW**

Total Excess Downstate Installed Capacity = **1,532 MW**

From a reliability perspective, why should the constrained zones not account for all actual installed capacity?

Total Rest of State (ROS) Capacity Obligation = **24,690 MW**

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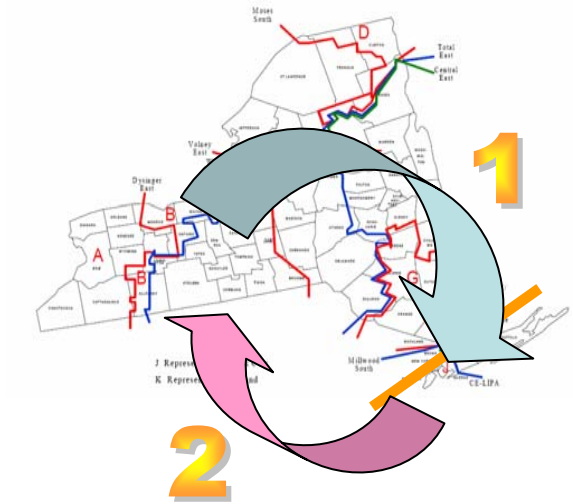
Critique of the Unified Method



- For the 2006–2007 Capability Year, NYCA LOLE is maintained essentially with all "as found" capacity in Upstate Zones A-I intact and 1,532 MW of "as found" capacity removed from Zones J and K.
- Under the current method, no point on the IRM-LCR curve is a result of adding more capacity to Zones J and K than is planned (forecasted) to exist.
- A potential criticism of the FFE is that it would require more capacity than is planned to exist…this is not a valid concern under the Unified method.

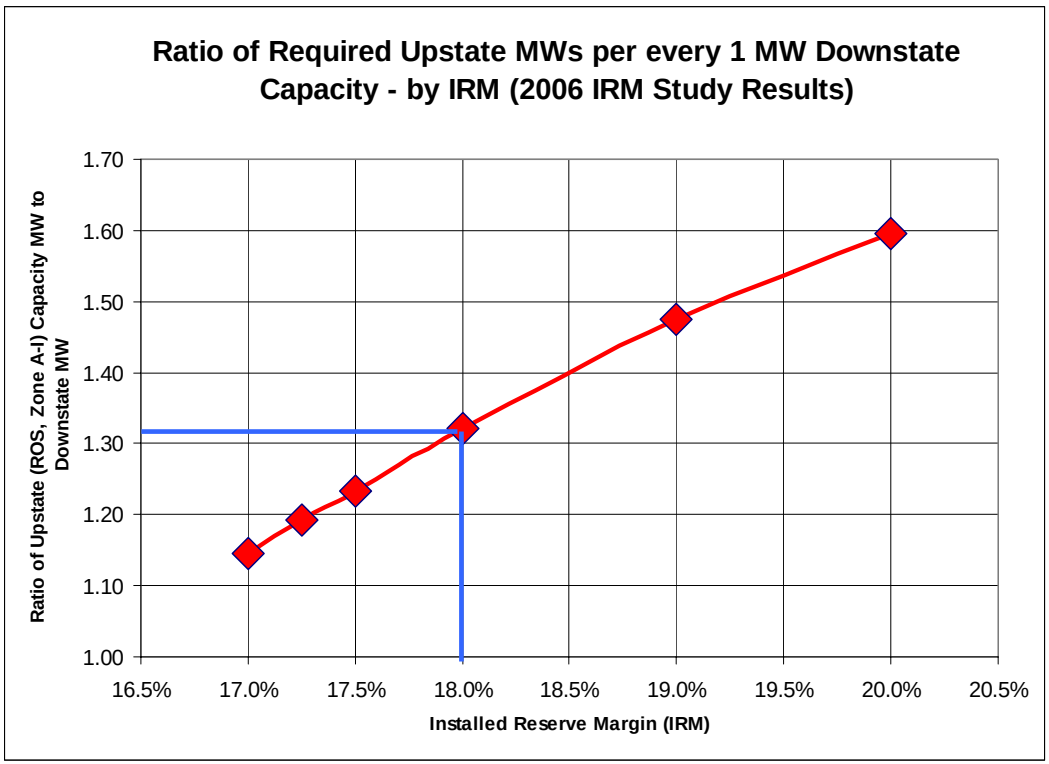
An inverse relationship exists between IRM and the LCRs.

Therefore, whenever the corresponding LCRs are reduced, the constrained zones would rely more upon imports to serve their load – at the expense of a higher statewide IRM.

As a general matter, the NYSRC and NYISO should carefully examine the potential reliability issues associated with simply increasing the IRM to achieve a lower (but physically attainable) LCR in order to maintain LOLE criteria should Zone J and K resources retire, load growth within Zone J and K reduce the ratio of installed capacity to load, or transmission degrade into Zones J and K.

The diminishing value of Upstate capacity assistance

- The amount of import capacity needed to reliably serve constrained load is influenced by locational capacity levels and transmission constraints.
- In a free-flowing transmission system, 1 MW of capacity located anywhere on the system could reliably serve 1 MW of load anywhere on the system.
- **At the current IRM and LCR levels, it takes on average 30% more capacity from Upstate Zones A - I to reliably serve 1 MW of Load in Downstate Zones J & K.**



Whenever there is a need for capacity in Downstate Zones J and K, the capacity assistance from Upstate Zones A-I may be disproportionately large.

As the curve approaches 1MW on both the x and y-axes, the result reflects a more free-flowing system – a one-for-one MW capacity relationship.

Thus, any point that exists beyond the 1.00 MW Upstate capacity (on y-axis) and the 16.5% Free-Flowing Equivalent (FFE) IRM (on x-axis) represents a Downstate **"reliability subsidy"**

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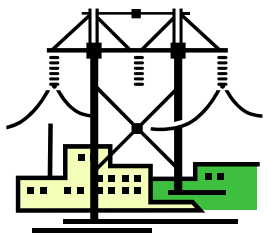
Free-Flowing Equivalent IRM System

At the Free-Flowing Equivalent IRM, the mathematical meaning of an approximate 1:1 relationship between constrained load and import capacity assistance is consistent with a physical system where virtually all the effects of transmission constraints have been accounted for … or eliminated with downstream capacity.

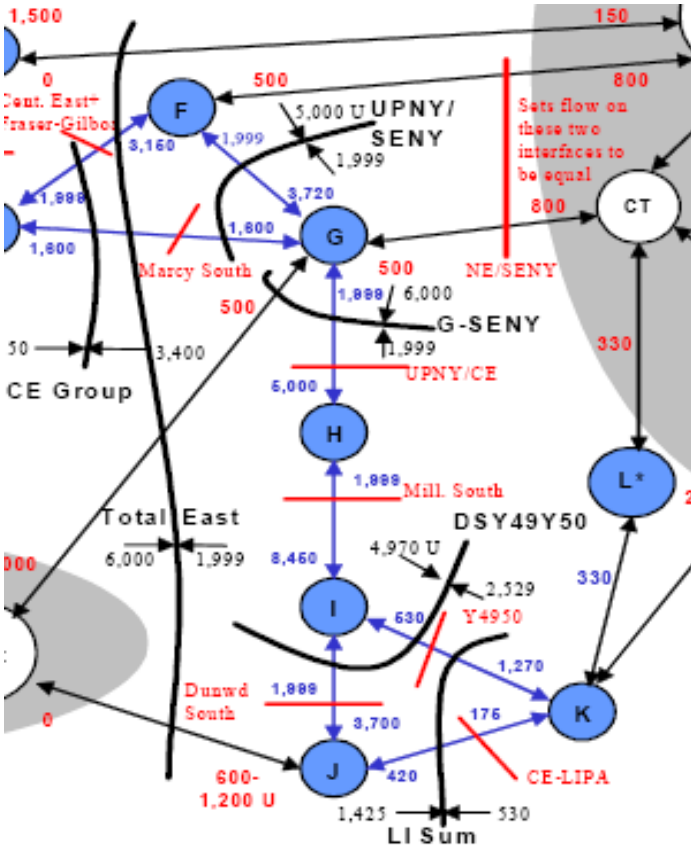
A potential criticism of the Free Flowing Equivalent IRM is that it may result in a resource adequacy requirement that cannot be satisfied with existing resources. Under the Unified Method, the amount of installed capacity shifted out of Zones J and K is limited by actual installed capacity (steel in the ground). Therefore, this is not a valid concern for the IRM study year.

However, the general concern of demand outpacing supply is valid for years beyond the IRM study year, but this is not exclusive to the Free Flowing Equivalent IRM; this is also a valid concern with any other IRM anchoring method.



For, example the NYISO recently performed a study showing that if NYPA's Poletti unit (located in Zone J) were to retire, the installed capacity in Zone J would fall below 80%. Hence, an IRM anchored by the TAN 45 IRM approach could also have resulted in an LCR for Zone J that exceeds the available supply in Zone J.

Moving away from the Free-Flowing Equivalent IRM poses additional reliability challenges ...



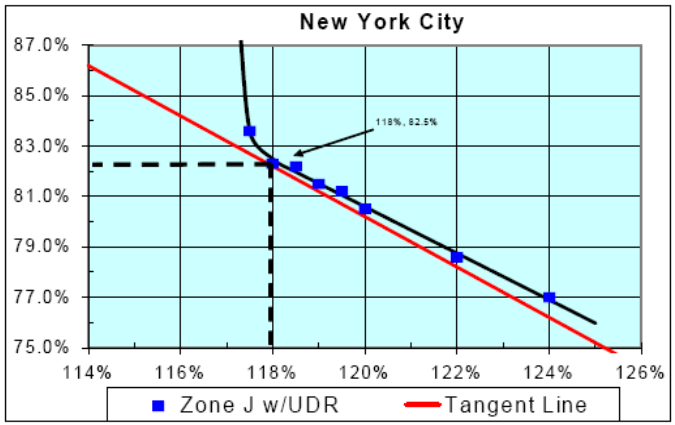
Based on their recent voltage studies, the NYISO concluded that voltage-based transfer limits primarily affecting the UPNY/SENY, UPNY/CONED, Dunwoodie South and Y49/Y50 interfaces are degrading.

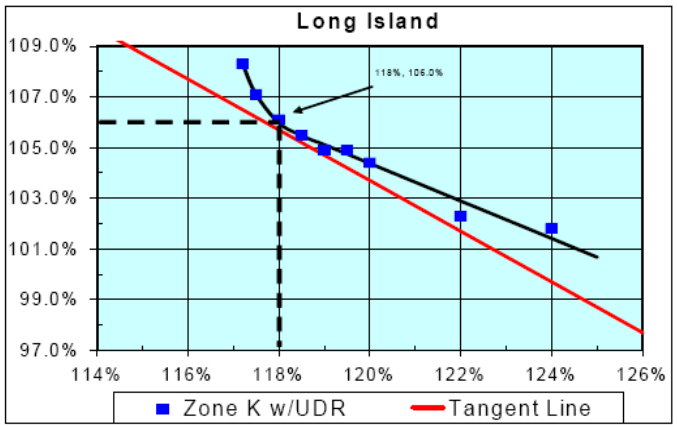
Given the uncertainty of these evolving voltage based transfer limit studies and the fact that other equally reliable IRM/LCRs exist, needlessly challenging the accuracy of those studies is unwarranted.

Unless the intent of New York's resource adequacy policy is to intentionally create "latent" installed reserves (such as the 1,532 MW of excess Downstate Installed Capacity), it is ill-advised to ignore (as is currently the case) the reliability improvements that increased locational capacity requirements can provide.

Refuting the "TAN 45 IRM" Anchoring approach...

The current 18% IRM requirement was determined as the point equal to the intersection between the IRM vs. LCR curve and a tangent with an inclination of -45 degrees (the "TAN 45 IRM" approach).





Above curves are UDR Basecase results from the 2006 IRM Study. The curve used in the TAN 45 IRM approach was developed with the Unified Method and is defined by IRM on the x-axis and an LCR on the y-axis.

TAN 45 IRM approach perpetuates the Downstate "reliability subsidy"

As the IRM increases, there is also an increasing **disproportionate amount** of Upstate capacity assistance required from Zones A – I to serve the constrained load in Downstate Zones J and K.

Contrary to the rationale implied by defining an IRM with this approach, there is little reliability benefit derived from a physical system with a TAN 45 IRM; **it is merely an arbitrary mechanism used to establish 0.1 LOLE and addresses an economic tradeoff.**.

The claim of "stability" from anchoring at the TAN 45 IRM is an economic tradeoff, not a reliability concern. All point pairs along the IRM / LCR curves are equally reliable and equally meet the 0.1 LOLE criteria.

Note: An 18% IRM requirement is in fact the IRM of choice selected by the NYSRC. (See EC Special Meeting # 2, 2006)

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Concerns with the "TAN 45" IRM approach...

Due primarily to the underlying probabilistic nature of existing transmission interface limits, the capacity assistance required from Upstate Zones A – I can be disproportionately larger than a specified amount of capacity need in Downstate Zones J and K.

At the current 18% IRM, not all capacity in Zones A - I is deliverable to constrained zones for all hours… it takes **1.3 MW** of capacity from Upstate Zones A - I to replace 1 MW of capacity located in Downstate Zones J and K.

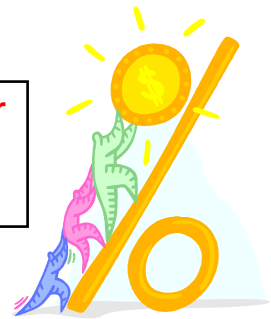
Thus, the one-for-one result at TAN 45 of a curve defined by IRM (%) on the X-axis and LCR (%) on the Y-axis does not address a reliability concern but rather, depicts an economic tradeoff. For example, a slight reduction in transmission capability to a constrained zone would result in an increase in both IRM and LCR.

It is <u>counterproductive</u> to have a resource adequacy policy that:

1. *Raises capacity requirements upstream of a constraint due to load growth within the constrained area or due to other issues that affect a constrained zone reliability needs,*

2. *Satisfies reliability criteria by increasing the need for imports across a constrained interface rather than increasing the locational capacity requirements.*

The TAN 45 IRM approach will raise both IRM and LCR requirements for a number of changes that directly impact the capacity needs of the constrained zones.



"TAN 45" and its associated benefits of providing a one-for-one relationship between the Upstate and Downstate zones exist <u>only</u> at the Free Flowing Equivalent IRM!

"TAN 45 IRM" does not adhere to Policy 5

Nothing in the interpretation of Policy 5 indicates that the results of "TAN 45 IRM" are more acceptable or superior to the Free-Flowing Equivalent IRM.

Policy No. 5-1 - Procedure for Establishing New York Control Area Installed Capacity Requirements …

Page 9 states:

> "Intra-zonal transmission constraints are addressed in the annual NYISO Locational Installed Capacity study for determining LSE ICAP requirements. The statewide ICR study considers intra-zonal transmission constraints through the modeling of locational capacity requirements of constrained zones. This ensures that transmission constraints, both into a zone and internally within a zone, are considered and do not impact NYCA capacity requirements."

- It is a well-accepted fact that a lower IRM can be achieved when LCRs properly account for intra-zonal transmission constraints. It is also clear that the TAN 45 IRM does indeed impact the NYCA capacity requirements.

- By not considering all actual Locational Installed Capacity, the reduced LCRs essentially force a higher NYCA capacity requirement. Thus, TAN 45 is not in agreement with Policy 5.

The capacity assistance needed to serve incremental increases in load within Zones J and K at the TAN 45 point is disproportionately large. Therefore, IRM and LCR requirements established with the TAN 45 approach purposefully incorporate a sizeable economic impact as opposed to a balanced construct designed to mitigate reliability impacts.

Conclusions

- In the current method, Minimum LCRs do not account for all planned installed capacity behind the constraint. With LCRs of 80% (NYC) and 99% (LI), there is excess installed Downstate capacity of 1,532 MW. The planned capacity in 2006 actually provide a locational capacity margins of 89% for Zone J and 108% for Zone K.

- At the Tan 45 IRM, the capacity assistance (MW) required from Zones A – I can be disproportionately larger than a specified amount of capacity need (MW) in Zones J and K. At the current 18% IRM, not all capacity in Zones A - I is deliverable to constrained zones for all hours…it takes 1.3 MW of capacity from Zones A - I to replace 1 MW of capacity located in Zones J and K.

- Thus, the one-for-one result at TAN 45 of a curve defined by IRM (x-axis) and LCR (y-axis) does not address a reliability concern but rather, depicts an economic tradeoff.

- It is counterproductive to have a resource adequacy policy that:

    1) Raises capacity requirements upstream of a constraint due to load growth within the constrained area, and

    2) Considers increasing imports across a constrained interface as more reliable than raising the locational capacity requirement





Recommendations

- **Reject the TAN 45 IRM Method** – the EC approved this method only conditionally for a one-year trial period in order to assess the potential reliability improvements of other IRM methods.

- **Adopt the Free-Flowing Equivalent IRM** - a Free Flowing Equivalent (FFE) IRM should be adopted. The FFE IRM construct would properly assess the reliability status of the physical system and avoid the ill-considered consequences of needlessly increasing capacity assistance from areas external into the constrained zones.

- **Adjust LCRs to account for Actual Installed Capacity** – When developing LCRs, constrained zones should fully account for **planned** installed locational capacity within their zone. This would improve reliability by minimizing the amount of imported capacity that must be delivered across voltage-based interface limits.