Setting of the IRM and LCRs
The Basic Process

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Objectives

- **Basic understanding of the NYSRC's process for setting the IRM[1]**
- **Basic understanding of the NYISO's process for setting the LCRs[2]**
    - ***The LCR process starts with the completed base case database for the IRM.***

1. **To find NYSRC Policy 5-8 go to Documents/Policies at http://www.nysrc.org.**
2. **To find NYISO LCR Calculation Process go to NYISO website at nyiso.com and look under Market Data/ICAP/Reference Documents/LCR_Calculation_Process**

IRM Process - Background

- The IRM study[3] occurs over a calendar year for an upcoming Capability Year (May-April)
- NYISO populates data and performs simulations under guidance of NYSRC's ICS.
- The NYISO is a technical resource for the NYSRC

3. To find present and past IRM reports go to Documents/Reports at http://www.nysrc.org.

IRM Process - Background

- IRM answers the question of how much ICAP is needed to meet the peak load.
- The year is simulated at least 1,000 times to give a Loss of Load Expectation (LOLE).
- Capacity is adjusted so that over the 1,000 iterations, the LOLE comes out to the NYSRC criterion of 0.100 days/year.

IRM Process – Load Inputs

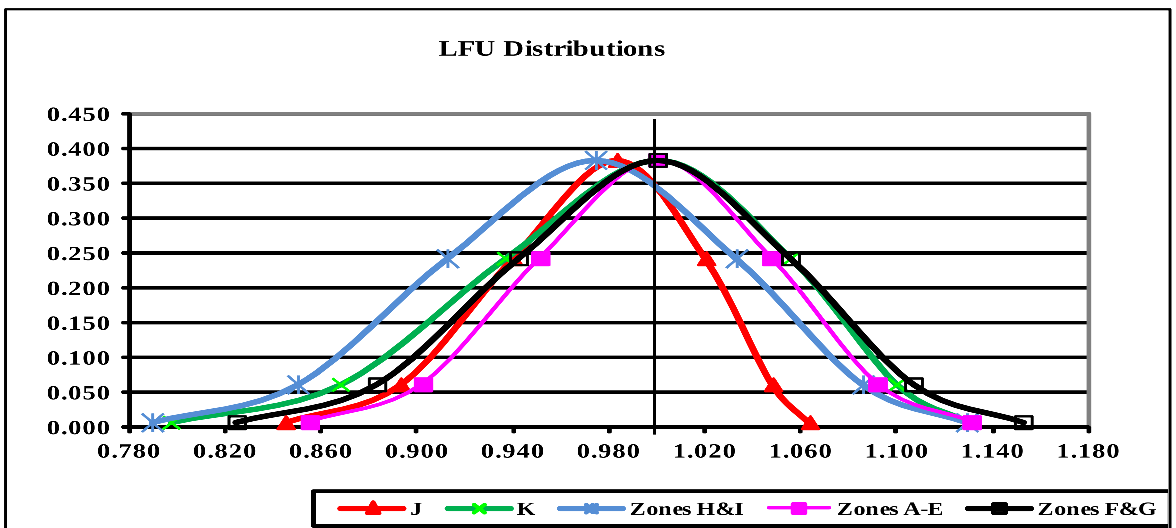
- **The load forecast is based on previous year actual plus forecast growth (TO/NYISO agreement)**
  - *The forecast represents a 50% chance the actual load is higher (50/50 forecast)*
- **Uncertainty of load due to weather is studied.**
  - *Each 1,000 iteration case is run against seven load levels with various probabilities.*
  - *For example, one of the levels could indicate the load if there was only a 6% probability of being above that load (94/6 forecast).*
- **Each load level can have its own historic hourly load shape.**
  - *We currently use 3 shapes.*

Load Forecast Uncertainty

LFU Model

Load Forecast Uncertainty Models

Multiplier	Zones A-E	Zones F&G	Zones H&I	Con Ed (J)	LIPA (K)
0.0062	0.8550	0.8245	0.7893	0.8449	0.7971
0.0606	0.9021	0.8830	0.8500	0.8929	0.8677
0.2417	0.9510	0.9420	0.9123	0.9397	0.9364
0.3830	1.0000	1.0000	0.9741	0.9831	1.0000
0.2417	1.0474	1.0554	1.0329	1.0202	1.0554
0.0606	1.0916	1.1067	1.0856	1.0481	1.0996
0.0062	1.1309	1.1524	1.1289	1.0635	1.1295



IRM Process, Load Inputs-continued

- **Reasons for using different load shapes:**
  - ***Historically, years where the peak was around the 90/10 forecast (higher load level), the hourly load shapes were peaked.***
    - **By peaked, we mean that the number of days whose peaks are near to the peak day were small**
    - **The shapes chosen are based on a conservative year, a peaked year, and a typical year**
- **Even though there are seven load levels, risk (LOLE events) occurs only in the top four bins.**

IRM Process – Capacity Inputs

- 5 years of historical performance is used to predict future availability of thermal and large hydro generators.
  - *Wind and solar use one year of production data.*
  - *Run of river hydro uses a plot of monthly output based on history*
- The simulation program uses a Monte Carlo methodology to probabilistically generate hourly outage patterns for thermal units for each of the 1,000 iterations.
- Special Case Resources (SCRs) are modeled based on registrations and are derated based on tested and historic performance.

IRM Process – Other Inputs

- **We model interface limits between Zones and between Areas[4] (line and bubble diagram).**
- **Unforced Deliverability Rights (UDR) facilities, to the extent they have not elected to return them for the upcoming Capability Year (i.e., notification to NYISO by August 1) are modeled as contracts.**
  - ***Contract levels on UDRs are considered confidential***
  - ***Any tie capacity left (after contracts) is available for emergency assistance***

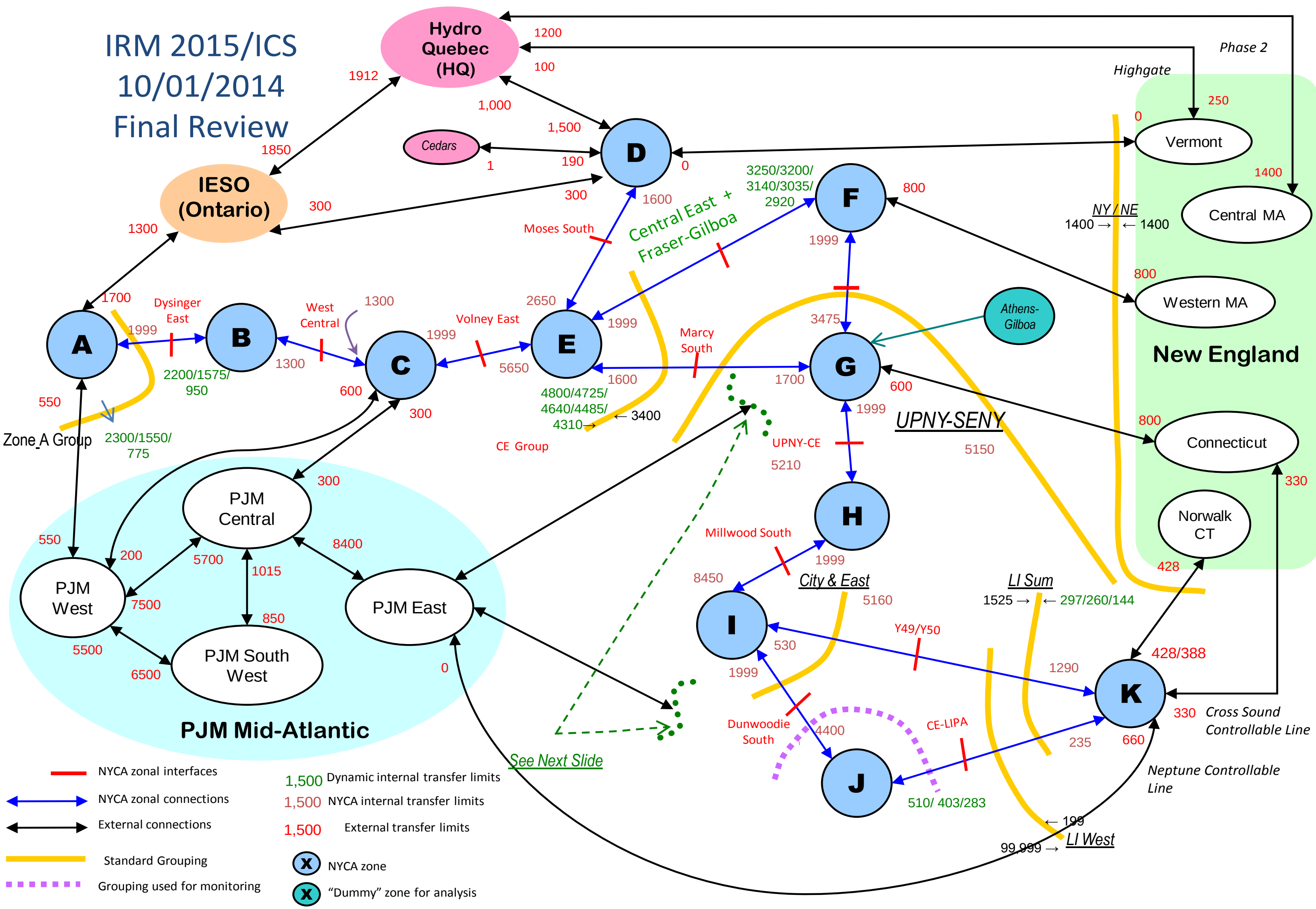
4. Current computing capabilities do not support use of a power flow model in GE MARS.

IRM Process – Other Inputs

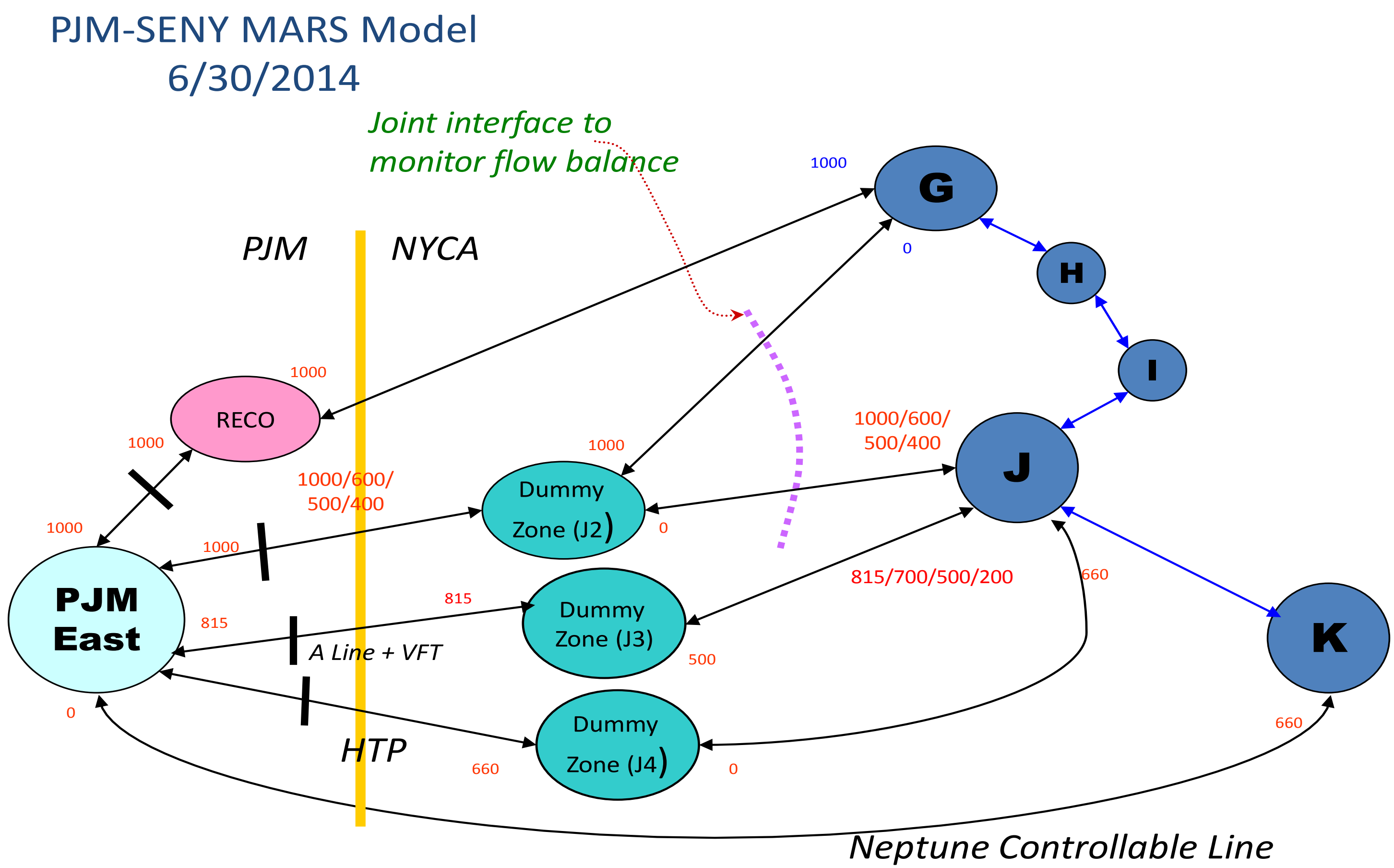
- **We model the Emergency Operator Procedures (EOPs) that can be employed during a system emergency.**
  - ***Such as: Voltage reductions, Emergency Demand Response Program (EDRP), Public Appeals, voluntary industrial curtailments, and operating reserves.***
- **Finally, we can ask for emergency assistance from our neighbors.**
  - ***We model neighboring interconnected Control Areas of PJM (classic footprint), New England, Ontario and Quebec***

Transmission System Representation for Year 2015 - Summer Emergency Ratings (MW) 6/30/2014

IRM 2015/ICS
10/01/2014
Final Review



Transmission System Representation for Year 2015 - Summer Emergency Ratings (MW)



<u>(PJM East to RECO) + (PJM East to J2) + (PJM East to J3) + (PJM East to J4) = 3075 MW</u>

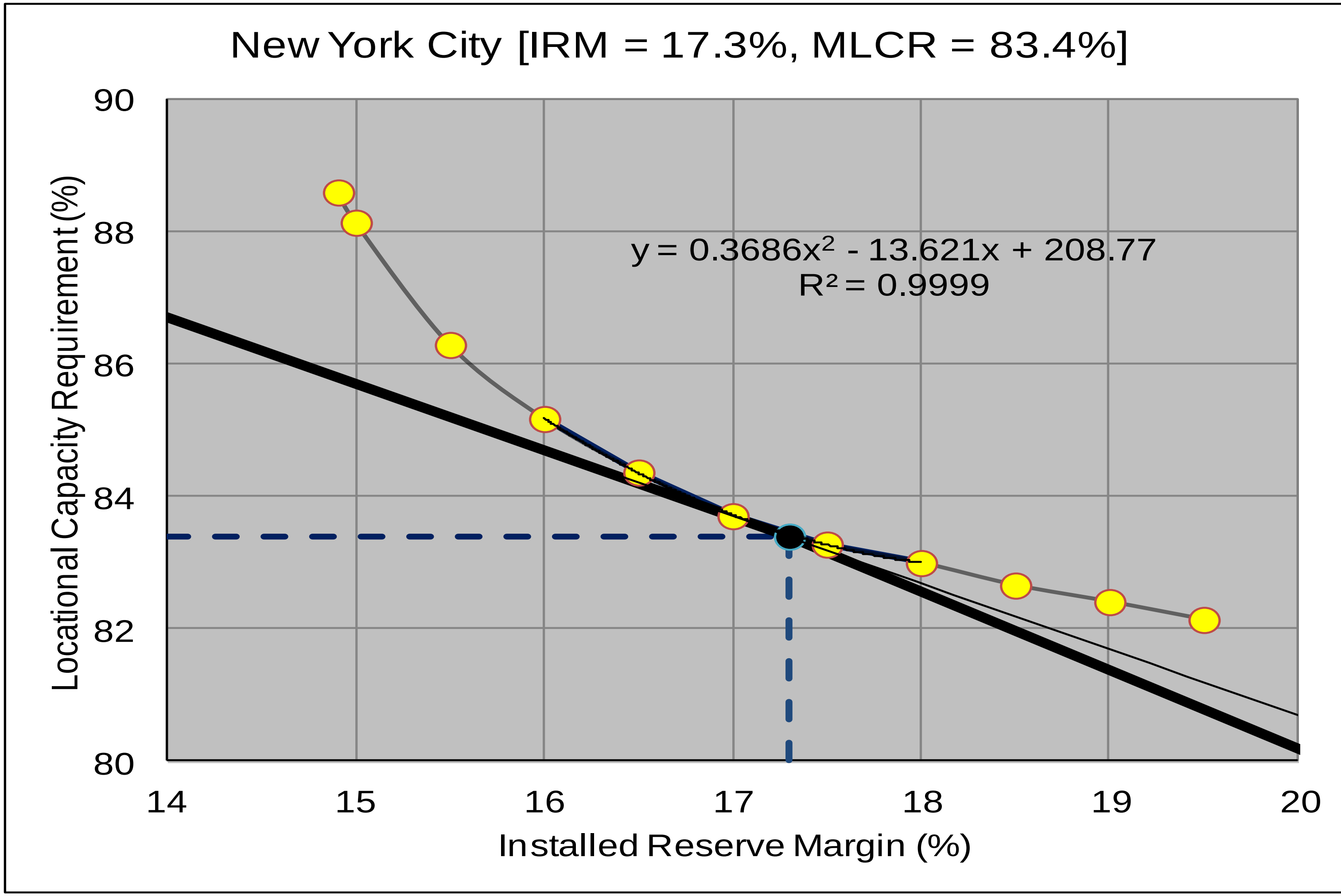
IRM Process – One Curve Point

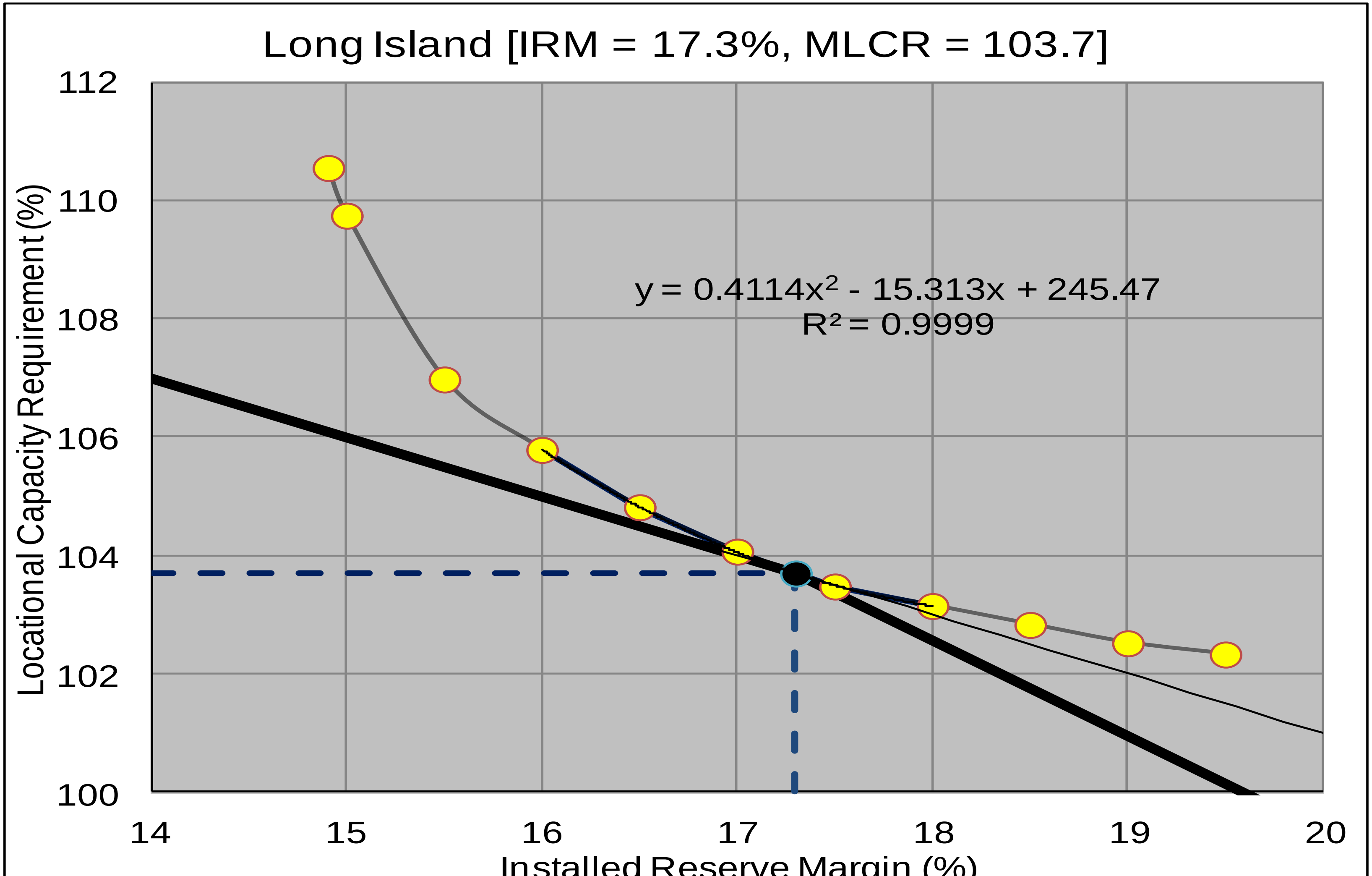
- **If, after utilizing all means possible to meet the peak load, there is still a shortage, a loss of load event is registered.**
- **A single load level LOLE value is the expected loss of load events per year at this level.**
  - ***The final LOLE is arrived at by multiplying each load level probability times its result and adding the seven values.***
- **The model is re-run varying the amount of capacity removed until 0.100 LOLE is met.**
  - ***NYCA currently has excess capacity***

IRM Process – Multiple Curve Points

- Capacity upstate has a different statewide LOLE impact than capacity downstate.
- Where and how the capacity is adjusted affects the final results.
- The IRM-LCR curve (next slide) shows the relationship of the tradeoffs between statewide and J&K locality values (all points are at criteria).
- The NYSRC technical report indicates the IRM at the knee (or tan 45) of the curve.

Figure 3-2 NYCA Locational Requirements vs. Statewide Requirements





DRAFT – FOR DISCUSSION PURPOSES ONLY

LCR Process - Background

- The IRM study shows indicative LCR values for Zones J & K. Actual LCR values are found during the LCR study.
  - *The LCR Study starts with the completed IRM database*
- The LCR values must also comply with the LOLE criteria.
- A separate IRM-LCR curve is not created since the IRM value is a fixed input to the LCR study.

LCR Process – Input Changes

- The load forecast is updated between the time of the IRM and LCR studies.
- Other material changes[5] could also be incorporated.
  - *The resulting LCRs could look different than the ones shown in IRM.*

5. Material capability changes are individual changes that would increase or decrease generation, CRIS MW, or transmission transfer capability by 200 MW or greater.

LCR Process – Steps

- **At the established IRM study point:**
  - ***Reset all capacity to Zones J & K. to their 'as found' condition.***
  - ***Shift capacity from Zone J to upstate zones (A, C, and D) until the LOLE criteria is met.***
  - ***Reset the capacity from J and shift from Zone K.***
  - ***Reset the capacity from K and shift from J & K based on ratios found above. This sets the recommendation for the J and K LCRs.***
  - ***Reset J's capacity and freeze K's at the above found LCR level.***
  - ***Shift capacity from G-J. The remaining capacity divided by the G-J peak load is the proposed G-J LCR[6].***

6. The LCR values are rounded to the nearest 0.5% and the LOLE is verified to satisfy LOLE criteria

Numerical Example[7] of LCR Calculations

Setting of Zones J and K LCRs (example)

Zones	MWs Shifted:	J Ratio:	K Ratio:		Starting Capacity	After Shift Capacity	Peak Load Forecast	Margin %
Shift J alone	500				10500	10000	11929	
Shift K alone	400				6000	5600	5539	
		=500/(400+500)	=400/(400+500)					
Ratios found:		0.5555556	0.4444444					
Shift J and K	700							
Final J	388.9	=700*0.56			10500	10111.1	11929	84.8%
Final K	311.1	=700*0.44			6000	5688.9	5539	102.7%

Setting LCRs for the G -J Locality (example)

Zones	MWs Shifted:	J Ratio:	K Ratio:		Starting Capacity	After Shift Capacity	Peak Load Forecast	Margin %
Shift G - J	705				15425	14720	16340	90.1%
Fixed Shift of K:	311.1				6000	5688.9	5539	102.7%

7. All capacity values are in ICAP

Numerical Example[8] of LCR Calculations

After 600 MW Unit Addition in Zone G

Setting of Zones J and K LCRs (example)

Zones	MWs Shifted:	J Ratio:	K Ratio:		Starting Capacity	After Shift Capacity	Peak Load Forecast	Margin %	Initial Case Margin(%)
Shift J alone	*600*				10500	9900	11929		
Shift K alone	*500*				6000	5500	5539		
Ratios found:		0.545455	0.454545						
Shift J and K	*900*								
Final J	490.9				10500	10009.1	11929	83.9%	84.8%
Final K	409.1				6000	5590.9	5539	100.9%	102.7%

Setting LCRs for the G -J Locality (example)

Zones	MWs Shifted:	J Ratio:	K Ratio:		Starting Capacity	After Shift Capacity	Peak Load Forecast	Margin %	
Shift G - J	*905*				***16025***	15120	16340	92.5%	90.1%
Fixed Shift of K:	409.1				6000	5590.9	5539	100.9%	102.7%

8. All capacity values are in ICAP

The New York Independent System Operator (NYISO) is a not-for-profit corporation that began operations in 1999. The NYISO operates New York's bulk electricity grid, administers the state's wholesale electricity markets, and provides comprehensive reliability planning for state's bulk electricity system.

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