

Amount of Capacity Required

Interviewer: Kelly Stegmann

Senior Market Trainer, Market Training, NYISO

Subject Matter Expert: Nathaniel Gilbraith, PhD

Manager, Energy Market Design

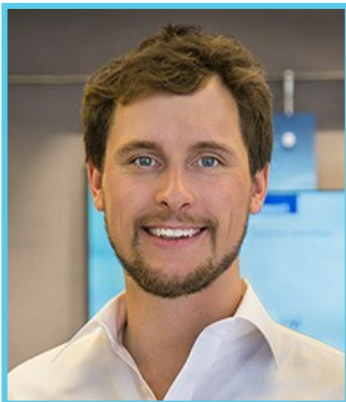
Intermediate ICAP Course

April 12-13, 2022

Remote Learning

SME Bio

Nathaniel Gilbraith, PhD Manager, Energy Market Design



Nathaniel Gilbraith is the Manager of Energy Market Design for the New York Independent System Operator (NYISO), which operates New York's high-voltage transmission system, manages the state's competitive wholesale electricity markets, and conducts comprehensive power system planning.

Nate joined the NYISO in 2015 as part of the Market Mitigation & Analysis Department, helping to ensure the markets functioned efficiently and appropriately. Nate then served as Supervisor of Resource Adequacy in Market Operations, where his team was responsible for aiding in the establishment of the annual Installed Reserve Margin and Locational Installed Capacity Requirements used to administer the NYISO ICAP Market. These studies play an important role supporting reliability in New York State, sending the market price signal for system reliability needs, and compensating resources for their reliability contributions.

Nathaniel Gilbraith earned a Doctor of Philosophy, PhD, from Carnegie Mellon University as well as a Master's of Science in Environmental Engineering from Clarkson University.

He has been featured in industry publications Utilities Policy and RTO Insider as well as the New York Times.

Topics for Discussion:

- Establishing the NYCA Minimum Installed Capacity Requirement
- Modeling studies used for calculating the annual NYCA Minimum Installed Capacity Requirement
- Locational Minimum Installed Capacity Requirements (“LCRs”)

Topic 1:

Establishing the NYCA Minimum Installed Capacity Requirement

NYCA Minimum ICAP Requirement = Forecasted NYCA Peak Load x (1+IRM)

NYCA Minimum Installed Capacity Requirement

- Ensures resource adequacy
 - Supply is sufficient to meet load
 - Meets reliability standards
- Established annually

New York State Reliability Council (NYSRC)

Northeast Power Coordinating Council (NPCC)
Reliability Criteria

*Loss of Load Expectation (LOLE) not more than
0.1 days / year.*



Installed Reserve Margin

NYISO Planning:
NYCA Forecasted Peak Load (MW)

NYSRC establishes IRM for NYCA (%)



NYISO Sets: Minimum Installed Capacity Requirements

NYCA Minimum ICAP Requirement

Locational Minimum ICAP Requirements (LCRs)

Amount of Capacity Required

**NYCA Minimum Installed Capacity Requirement
= NYCA Forecasted Peak Load x (1 + IRM)**

- **NYCA Minimum Installed Capacity Requirement ensures reliability in excess of 100% of NYCA forecasted peak Load so the formula includes the Installed Reserve Margin**

Installed Reserve Margin (IRM)

As described in the “IRM Study” ...

- *Capacity above firm system demand [load] required to provide for equipment forced and scheduled outages and transmission capability limitations*
 - *Loss of Load Expectation (LOLE) not more than 1 day in 10 years*
 - *0.1 days / year*
 - *Probability of disconnecting firm load not more than once in 10 years*

Installed Reserve Margin (IRM)

- Established annually by the NYSRC for upcoming Capability Year
 - May 1st – April 30th
- Used to derive the amount of capacity that must be available to the NYCA to ensure resource adequacy and reliability criteria are met
- Expressed as a percentage
- Annual NYSRC “IRM Study” posted on NYSRC Web site
 - http://www.nysrc.org/NYSRC_NYCA_ICR_Reports.html

Installed Reserve Margin (IRM)

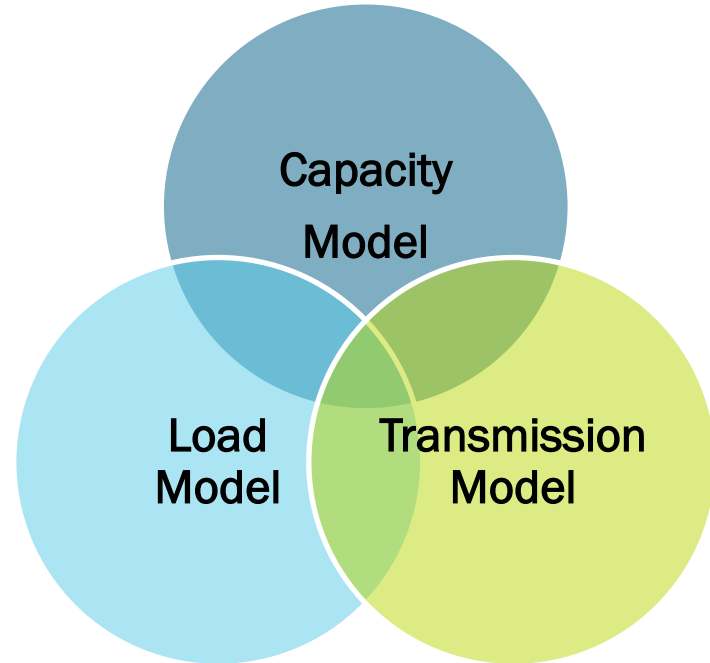
- **Based on regulatory standards**
 - North America Electric Reliability Corporation (NERC) Standards
 - Northeast Power Coordinating Council (NPCC) Resource Adequacy Design Criteria
 - NY State Reliability Council (NYSRC) Reliability Rules
 - Loss of Load Expectation (LOLE) of no more than 1 day in 10 years
 - *Probability of disconnecting firm load not more than once in 10 years*

Topic 2:

Modeling studies used for calculating the annual NYCA Minimum Installed Capacity Requirement

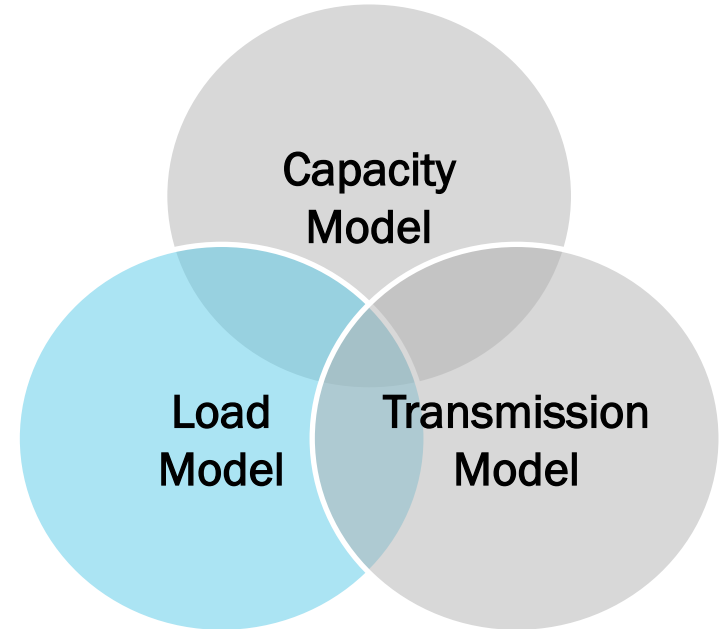
“IRM Study” - Approach

- Calculates the probabilities of generator unit outages, in conjunction with Load and transmission representations to determine the number of days per year of expected capacity shortages - (LOLE)



“IRM Study” - Load Model

- Peak Load Forecast
- Load Forecast Uncertainty
- Load Shape Model



NYCA Forecasted Peak Load

- Based on Highest Adjusted Actual Load for NYCA in the immediately preceding Capability Year
- IRM Study uses this year's Adjusted Actual Load to determine the Forecasted Peak Load for the next Capability Year

NYCA Forecasted Peak Load

■ Adjusted Actual Load reflects

- Load relief measures such as voltage reduction
- Load reductions provided by Demand Side Resources
- Weather-normalized conditions and Losses
- Station Power delivered that is not self-supplied

■ Forecasted Load reflects

- Regional Load Growth Factor of each Transmission District or Locality applied to the adjusted actual load, which may increase or decrease the load of the current year

■ Load Model Impact

- Each Transmission District and Locality can contribute to increasing or decreasing the IRM

**Refer to the NYISO Load Forecasting Manual and the MST Sections 2.1, 5.10, 5.11*

Load Forecast Uncertainty Model

- **Calculates the expected load for each Zone for various weather conditions**
 - There are seven different conditions that are examined
 - One condition is the forecasted load at average peak day weather conditions
 - Three conditions are higher, by 1, 2 or 3 standard deviations above average
 - Three conditions are lower, by 1, 2 or 3 standard deviations below average
 - Each of the seven conditions has a different probability of occurrence

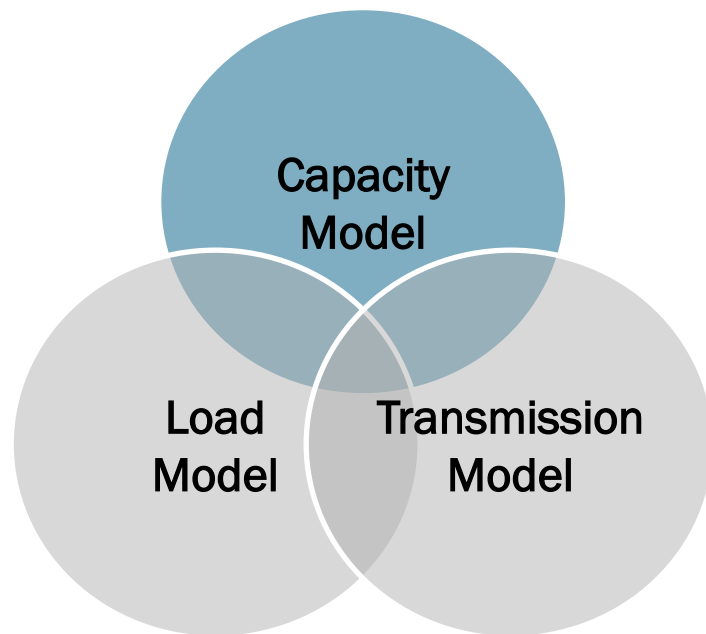
- **The IRM study then performs a Monte-Carlo simulation**
 - The simulation estimates the probability that a system-wide outage will occur, taking all seven conditions into consideration. This probability is then used to determine the Installed Reserve Margin for the case of a system-wide outage that might occur for 1 day in 10 years (an industry-wide standard)

Load Shape Model

- **Three historical years are selected for the IRM: 2002, 2006 and 2007 to represent future load patterns**
 - The three years were selected to represent three different patterns of hourly loads in summer
 - Each year, the hourly loads in each NYCA zone are adjusted to match the coincident and non-coincident peak loads for the forecasted loads in the year of the IRM Study

“IRM Study” - Capacity Model

- **Non-Wind Facilities (Planned, Existing, Retirements and Re-ratings)**
 - Based on DMNC
 - Accounts for deliverability
 - Generator availability based on five year average
- **Wind Facilities and Solar**
 - Nameplate capacity
 - Incorporates capacity factor

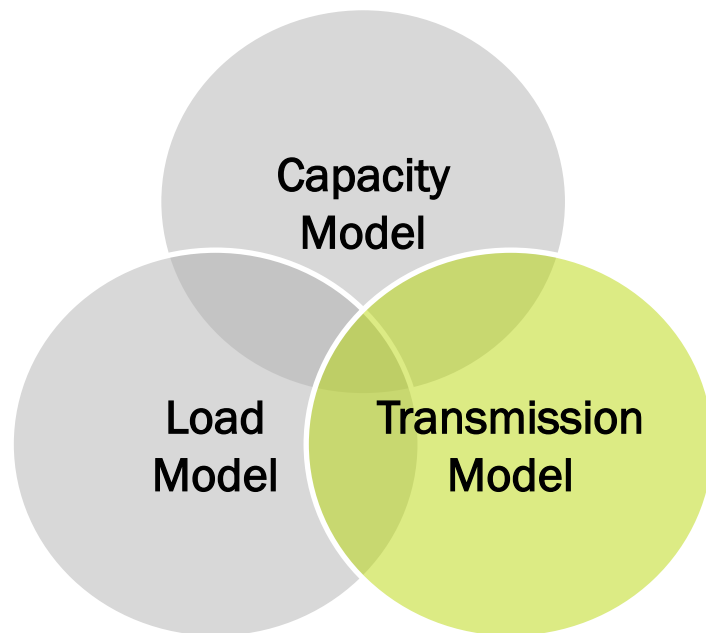


“IRM Study” - Capacity Model

- **Emergency Operating Procedures (EOP)**
 - Special Case Resource program (SCR)
 - Emergency Demand Response Program (EDRP)
 - Other mandatory and voluntary programs
- **Unforced Capacity Deliverability Rights (UDR)**
 - Controllable transmission projects with a Locality interface, combined with UCAP
 - Can make a one time election per year to have the capacity included in the “IRM Study”
- **Capacity Model Impact**
 - Availability of capacity can increase or decrease the IRM

“IRM Study” - Transmission System Model

- **Internal Transmission Model**
 - Interface limits
 - Forced outages of merchant transmission cables (UDRs)
- **Outside World Model (PJM, ISO-NE, IESO, HQ)**
 - Interface limits
 - Emergency assistance
 - Capacity purchases and sales



“IRM Study” - Transmission Model

■ Topology

- Power flow analysis uses Interface connections and limits
 - *Refer to the 2019 IRM Topology in the Appendix*
- Transfer capability between the areas and regions
- Merchant transmission cable (UDR) Forced Outages

■ Transmission Model Impact

- The modeling of potential constraints generally will influence the IRM and LCRs

Development of IRM Base Case

- Starts from the previous year's base case
- An incremental process occurs whereby changes are made, one at a time, and results are calculated
- Changes include incorporating new model functionality, altering assumptions, and updating data
- Final database incorporates all changes

Sensitivity Testing

- Once the IRM base case is determined, a list of sensitivity cases is developed
- Sensitivities can be used to determine the value of an assumption
- Sensitivities can also be used to show a change in an assumption parameter

Topic 3:

Locational Minimum Installed Capacity Requirements (“LCRs”)

Amount of Capacity Required

- **NYISO establishes the following ICAP requirements based on the IRM determined by the NYSRC and the NYCA forecasted peak Load prepared by the NYISO**
 - NYCA Minimum Installed Capacity Requirement
 - Locational Minimum Installed Capacity Requirements (“LCRs”)
- **These ICAP requirements are used to determine the Unforced Capacity (“UCAP”) requirements each Capability Period**
 - Also used for individual LSE’s UCAP requirements with Transmission District shares
 - *Note: Locational exchange factors may alter locality and LSE UCAP requirements each month*
 - *See separate module on LSE requirements*

Amount of Capacity Required

- **NYCA Minimum ICAP Requirement = NYCA Forecasted Peak Load x (1 + IRM)**

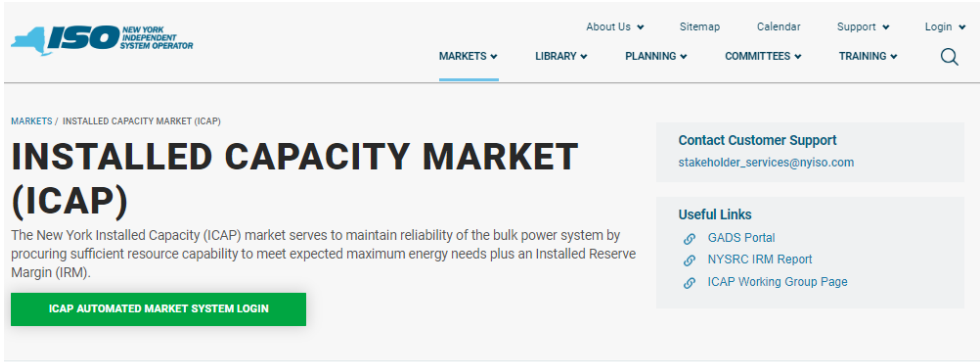
- **NYCA Minimum UCAP Requirement = NYCA Min ICAP Requirement x (1 – Derating Factor)**

Requirements (LCRs)

- NYISO establishes the Locational Minimum Installed Capacity Requirement for each Locality
 - G-J Locality
 - Long Island
 - NYC

- The NYISO determines the LCRs using the NYCA Minimum Installed Capacity Requirement and other information

- NYISO establishes each LSE's Unforced Capacity obligation based on the NYCA Minimum Unforced Capacity Requirement
 - LSEs in a Locality have an additional obligation based on the LCR



MARKETS / INSTALLED CAPACITY MARKET (ICAP)

INSTALLED CAPACITY MARKET (ICAP)

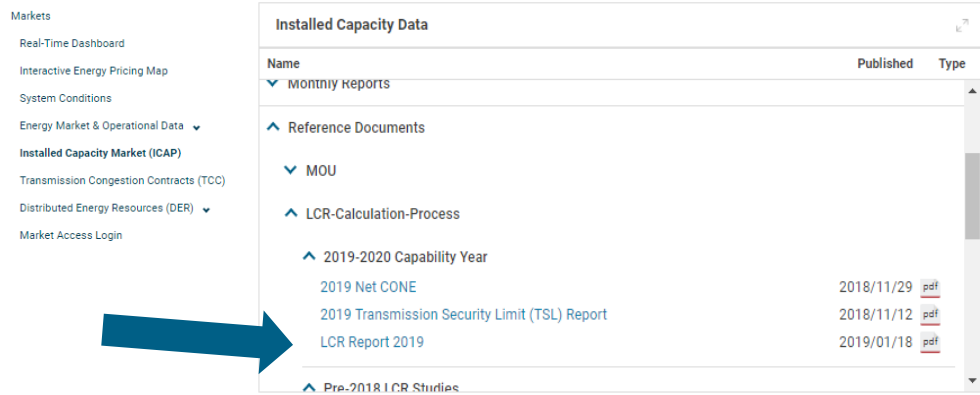
The New York Installed Capacity (ICAP) market serves to maintain reliability of the bulk power system by procuring sufficient resource capability to meet expected maximum energy needs plus an Installed Reserve Margin (IRM).

[ICAP AUTOMATED MARKET SYSTEM LOGIN](#)

Contact Customer Support
stakeholder_services@nyiso.com

Useful Links

- [GADS Portal](#)
- [NYSRC IRM Report](#)
- [ICAP Working Group Page](#)



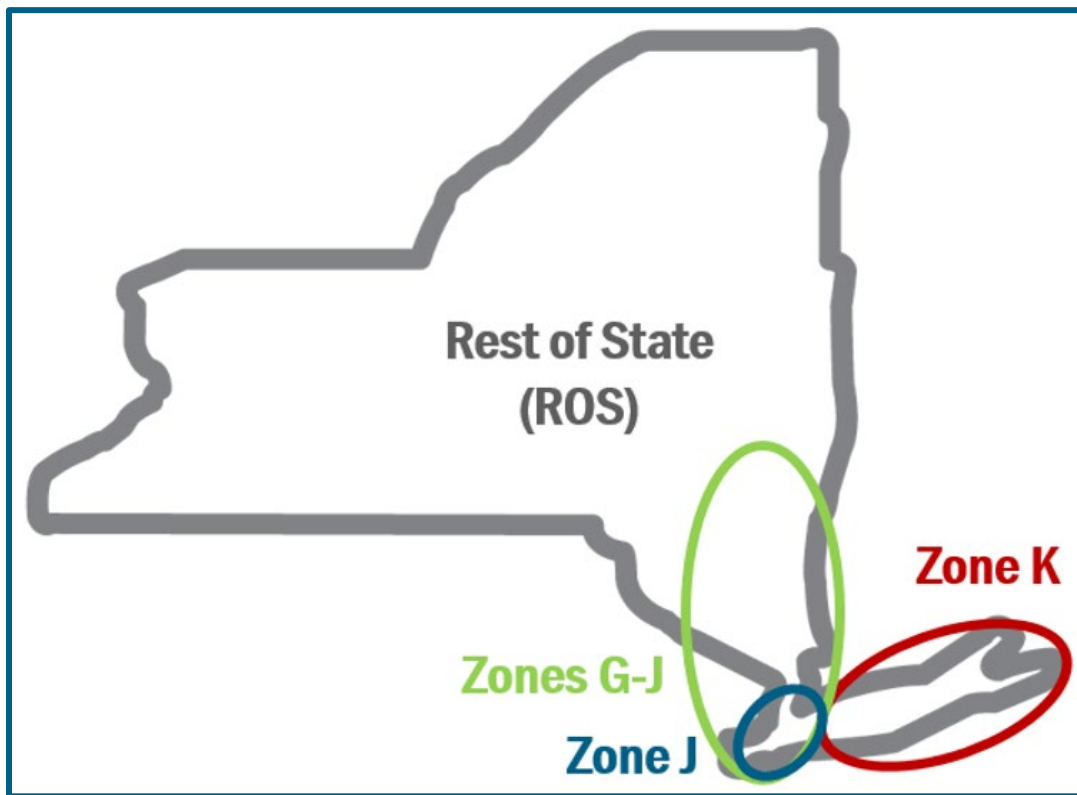
Markets

- Real-Time Dashboard
- Interactive Energy Pricing Map
- System Conditions
- Energy Market & Operational Data
- Installed Capacity Market (ICAP)**
 - Transmission Congestion Contracts (TCC)
 - Distributed Energy Resources (DER)
 - Market Access Login

Name	Published	Type
▼ Monthly reports		
▲ Reference Documents		
▼ MOU		
▲ LCR-Calculation-Process		
▲ 2019-2020 Capability Year		
2019 Net CONE	2018/11/29	pdf
2019 Transmission Security Limit (TSL) Report	2018/11/12	pdf
LCR Report 2019	2019/01/18	pdf
▲ Pre-2018 LCR Studies		

***NYISO responsibilities are further detailed in Services Tariff (MST) Section 5.11.4

NYCA Minimum Capacity Requirements



Capacity Requirement Percentages

2021/2022 Capability Year (May 1, 2021 – April 30, 2022)

NYCA	120.7% [based on IRM*]
G-J Locality Requirement	87.6% [LCR**]
Zone K (LI) Requirement	102.9% [LCR**]
Zone J (NYC) Requirement	80.3% [LCR**]

**Note: The NYCA requirements are established by the NYISO, based on the IRM which is set by NYSRC, and accepted by FERC and NYPSC*

***Note: Locality requirements are established by NYISO and approved by the NYISO Operating Committee*

Capacity Requirements (ICAP MW)

2021/2022 Capability Year (May 1, 2021 – April 30, 2022)

NYCA	$32,333.1 \times (1 + 0.207) = 39,026.1$
G-J Locality Requirement	$15,411.3 \times (.876) = 13,498.3$
Zone K (LI) Requirement	$5,248.6 \times (1.029) = 5,400.8$
Zone J (NYC) Requirement	$11,199.0 \times (0.803) = 8,992.8$

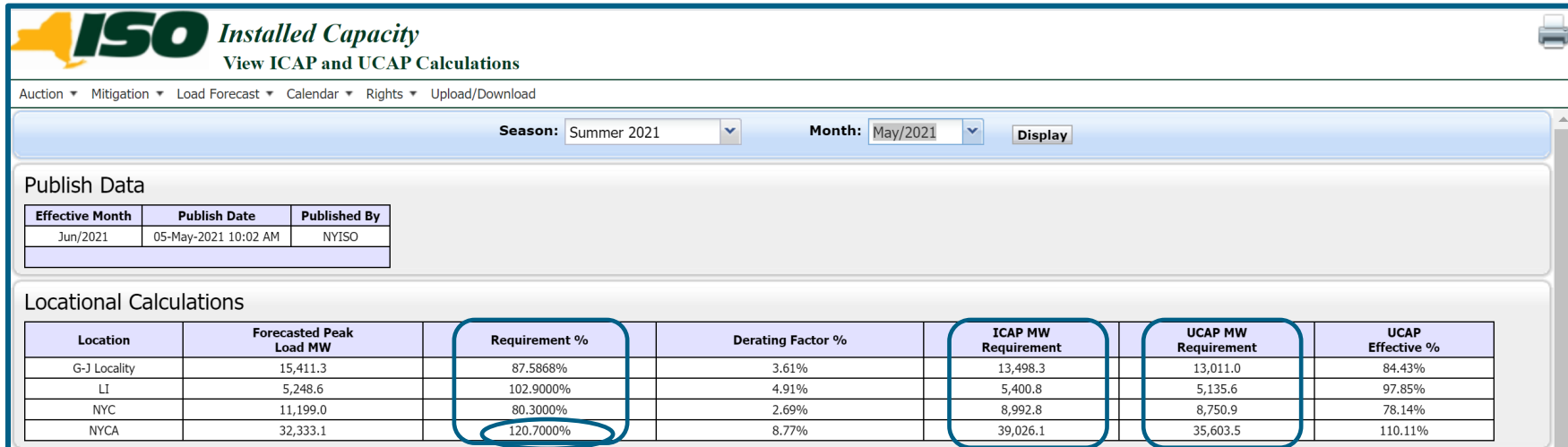
Capacity Requirements (UCAP MW)

2021/2022 Capability Year

(May 1, 2021 – April 30, 2022)

NYCA	$39,026.1 \times (1 - 8.77\%) = 35,603.5$
G-J Locality Requirement	$13,498.3 \times (1 - 3.61\%) = 13,011.0$
Zone K (LI) Requirement	$5,400.8 \times (1 - 4.91\%) = 5,135.6$
Zone J (NYC) Requirement	$8,992.8 \times (1 - 2.69\%) = 8,750.9$

ICAP and UCAP Values



ISO Installed Capacity
View ICAP and UCAP Calculations

Auction ▾ Mitigation ▾ Load Forecast ▾ Calendar ▾ Rights ▾ Upload/Download

Season: Summer 2021 ▾ Month: May/2021 ▾ Display

Publish Data

Effective Month	Publish Date	Published By
Jun/2021	05-May-2021 10:02 AM	NYISO

Locational Calculations

Location	Forecasted Peak Load MW	Requirement %	Derating Factor %	ICAP MW Requirement	UCAP MW Requirement	UCAP Effective %
G-J Locality	15,411.3	87.5868%	3.61%	13,498.3	13,011.0	84.43%
LI	5,248.6	102.9000%	4.91%	5,400.8	5,135.6	97.85%
NYC	11,199.0	80.3000%	2.69%	8,992.8	8,750.9	78.14%
NYCA	32,333.1	120.7000%	8.77%	39,026.1	35,603.5	110.11%

- NYISO also provides values at the Transmission District (TD) level and for each TD within each Locality

New York State Reliability Council (NYSRC)

Northeast Power Coordinating Council (NPCC)
Reliability Criteria

*Loss of Load Expectation (LOLE) not more than
0.1 days / year.*



Installed Reserve Margin

NYISO Planning:
NYCA Forecasted Peak Load (MW)

NYSRC establishes IRM for NYCA (%)



NYISO Sets: Minimum Installed Capacity Requirements

NYCA Minimum ICAP Requirement

Locational Minimum ICAP Requirements (LCRs)

Capacity Requirements Review

NYCA

ICAP & UCAP Capacity Requirements

Locational

ICAP & UCAP Capacity Requirements

Transmission District

ICAP & UCAP Capacity Requirements

Load Serving Entity

ICAP & UCAP Capacity Requirements

Summary

- Identified the components for calculating the annual NYCA Minimum ICAP Requirement
- Discussed the inputs to the NYCA forecasted peak Load
- Reviewed the process for determining the IRM
- Identified factors that affect the NYCA Minimum Installed Capacity Requirement
- Described the significance of the Locational Minimum Installed Capacity Requirements
- Reviewed the NYCA forecasted peak Load, the Installed Reserve Margin (IRM) and the NYCA Minimum ICAP Requirement for the 2019/2020 Capability Year

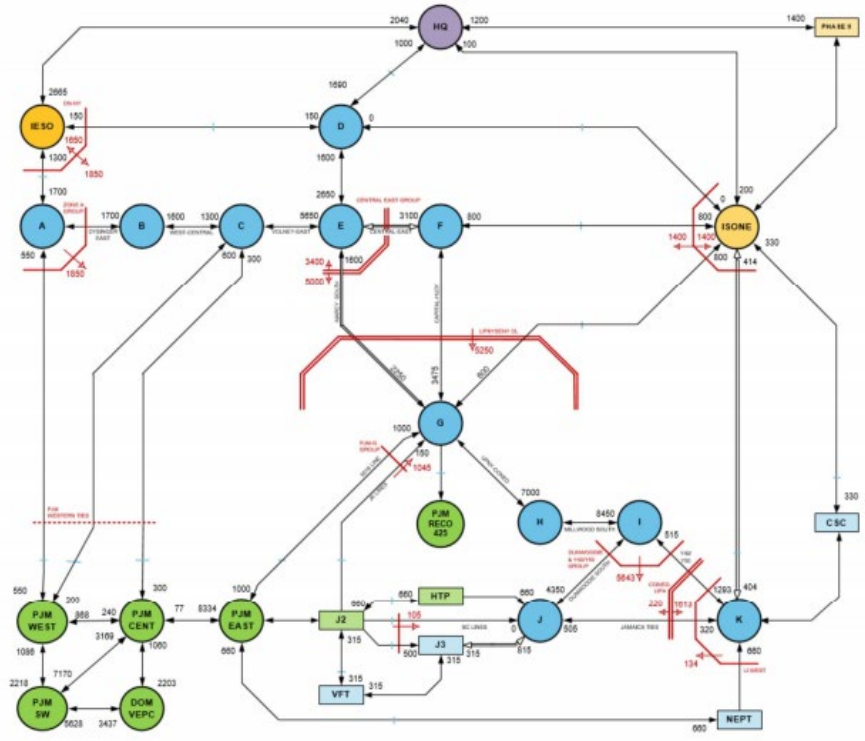
References

- **ICAP Manual**
- **Market Services Tariff**
- **Automated Market System (ICAP AMS)**
- **Planning documents/studies**
 - Resource Adequacy Documents
 - Reliability and Economic Planning Studies
 - IRM Study

Appendix

Figure A.11 2020 IRM Topology

Topology for 2021 IRM Study



Legend

- Interface
- Unidirectional Interface
- Interface w/ Dynamic Ratings
- Interface Group
- Interface Group w/ Dynamic Ratings
- Monitoring Interface Group
- NYCA EA Interface Group Marker
- 'Dummy Bubble' i.e. no load

NOTE: An interface is considered to not have a MW limitation if no number is specified