New York ISO
Independent System Operator

LCR Optimizer Enhancements - Kickoff

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Agenda

- Background
- LCR Optimization
- Problem Statement/Scope
- Next Steps

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Background

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Background

- Since 2019, the NYISO has utilized an economic optimization software ("LCR Optimizer") to establish the Locational Capacity Requirements (LCRs) for NYC, LI and G-J Locality. The LCR Optimizer is designed to produce least cost LCRs while maintaining the NYSRC's final IRM and the corresponding Resource Adequacy criterion for Loss of Load Expectation (or LOLE).
- Since implementing the LCR Optimizer, multiple concerns have been raised regarding the year over year stability of the LCRs and the transparency of the optimization function.
- Re-examining this process and the methodology could lead to improvements in the stability and transparency of the LCRs.

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LCR Optimization

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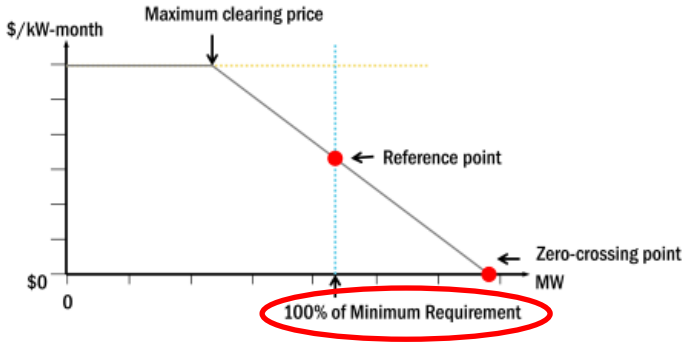
LCR Optimization

- For each Capacity Market capability year, Locational Capacity Requirements (LCRs) are set for the NYC, LI, and G-J locality capacity zones.

- The LCR values are representative of the amount of installed capacity that must be sourced from supply that is electrically within the capacity zone and is expressed as a fractional amount or percentage of that zone's non-coincident peak load.

- LCRs (and the IRM) tie capacity market signals back to resource adequacy requirements and the 1 day in 10 years Loss of Load Expectation (LOLE) reliability metric.

- The finalized LCRs are used in the capacity market as the 100% of Minimum Requirement value on the Locational Installed Capacity Demand Curves.



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LCR Optimization

- The process for determining LCRs begins after the Installed Reserve Margin (IRM) study is completed and the New York State Reliability Council (NYSRC) has approved the IRM value for the upcoming capability year.

- With the IRM and its corresponding LOLE value held constant, LCRs for capacity zone J, K and the G-J locality are optimized for the minimum cost to procure capacity, subject to the target LOLE and the Transmission Security Limits (TSLs) floors.

- The 'cost' that is minimized is based on the net Cost of New Entry (CONE) curves for NYCA and each locality, which express the $/kw-yr needed to support the fixed costs of the Demand Curve Reset (DCR) reference unit, less estimated Energy and Ancillary Service revenues.

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LCR Optimization

- The optimizer solves for the LCR values (shown as Q_j, Q_k, and Q_{G-J} here).
- Q_{NYCA} is effectively a static parameter, set to the NYSRC approved IRM determined beforehand.
- Level of excess (shown as LOE_J, LOE_K, LOE_{G-J}, and LOE_{NYCA} here) are the reference unit size as determined by the DCR process.
- Q quantities are representative of installed capacity in the 'at criteria' system, i.a.w. values that produce the target LOLE (e.g. 0.100 days/year).
- Q + LOE quantities (as used in this objective) are representative of the installed capacity in the 'level of excess' system.

$$\textit{Minimize:}$$

$$\textit{Cost of Capacity Procurement} = [Q_J + LOE_J] \times P_J(Q_J + LOE_J) + [Q_K + LOE_K] \times P_K(Q_K + LOE_K)$$

$$+[Q_{(G-J)} + LOE_{(G-J)} - Q_J - LOE_J] \times P_{(G-J)}(Q_{(G-J)} + LOE_{(G-J)})$$

$$+[Q_{NYCA} + LOE_{NYCA} - Q_{(G-J)} - LOE_{(G-J)} - Q_K - LOE_K] \times P_{NYCA}(Q_{NYCA} + LOE_{NYCA})$$

$$\textit{Subject to:}$$

$$NYCA\ system\ LOLE \leq target\ LOLE$$

$$Q_{NYCA} = NYCA\ system\ peak\ load\ forecast \times (1 + NYSRC\ approved\ IRM)$$

$$Q_J \geq Q_{TSL(J)}$$

$$Q_K \geq Q_{TSL(K)}$$

$$Q_{(G-J)} \geq Q_{TSL(G-J)}$$

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LCR Optimization

- The costs in the objective (P_J, P_K, P_{G-J}, and P_{NYCA}) use the net CONE curves which are piecewise linear functions of LCR and $/kw-yr, consisting of multiple points that are linearly interpolated.
- For a specific capacity zone, the procurement cost is:
  - Level-of-excess quantity receiving payment, times the price at the last MW of the level-of-excess quantity.
- TSL floors are determined in a separate process with inputs from load forecasts, bulk power transmission capability, and locality derating factors.
- TSL floors are input as constraints in the optimization.

$$\textit{Minimize:}$$

$$\textit{Cost of Capacity Procurement} = [Q_J + LOE_J] \times P_J(Q_J + LOE_J) + [Q_K + LOE_K] \times P_K(Q_K + LOE_K)$$

$$+[Q_{(G-J)} + LOE_{(G-J)} - Q_J - LOE_J] \times P_{(G-J)}(Q_{(G-J)} + LOE_{(G-J)})$$

$$+[Q_{NYCA} + LOE_{NYCA} - Q_{(G-J)} - LOE_{(G-J)} - Q_K - LOE_K] \times P_{NYCA}(Q_{NYCA} + LOE_{NYCA})$$

$$\textit{Subject to:}$$

$$NYCA\ system\ LOLE \leq target\ LOLE$$

$$Q_{NYCA} = NYCA\ system\ peak\ load\ forecast \times (1 + NYSRC\ approved\ IRM)$$

$$Q_J \geq Q_{TSL(J)}$$

$$Q_K \geq Q_{TSL(K)}$$

$$Q_{(G-J)} \geq Q_{TSL(G-J)}$$

The TSL Floor Calculation method was updated and presented on October 4th, 2022:
https://www.nyiso.com/documents/20142/33562316/22_10_04_ICAPWG_Transmission_Security_Limit_Calculation.pdf

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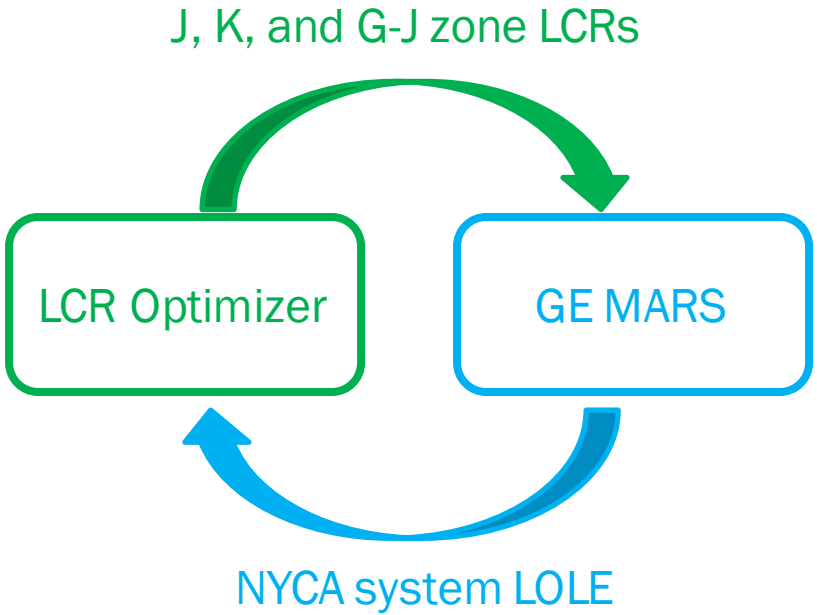
LCR Optimization

- LCR optimization is done in iteration with GE MARS runs to produce the minimum procurement cost solution for LCR values, while meeting all constraints.
- The GE Multi-Area Reliability Simulation (MARS) software calculates the NYCA system LOLE, which is provided to the Optimizer to compare against the targeted LOLE constraint when developing LCR results.
- This iteration is continued until convergence of a solution (~20-30 times)



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Problem Statement/ Scope

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Issues Identified by MMU

- In the 2021 State of the Market Report (SOM) from MMU, a number of considerations are listed in the section titled “Problems with the LCR-Setting Process”.

MMU’s considerations in the 2023 SOM Report can be categorized as potential issues with the…

- Cost curve (net CONE) – Is it in the right format to use as costs in the optimizer?
  - The piecewise linear form, in conjunction with the current objective formulation, may result in convergence on local minimums, i.e. the results produce minimum costs for specific zones, instead of minimum total costs for the system
  - Resulting LCRs are strongly influenced by changes in the cost curve.
  - Updates to the cost curve can cause LCRs to change when underlying reliability values are the same, making the year-over-year LCRs volatile with annual net CONE updates.
- Objective function – Are we calculating cost correctly and minimizing the right quantity?
  - Minimizing total procurement cost instead of marginal production costs
  - Potential misalignment with the capacity demand curves
  - Potential misalignment with the IRM process

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Scope

- **Deliverable: Q3 2023 – Market Design Complete**

- **Investigate the need for and develop and necessary modifications and enhancements to the LCR Optimizer to improve the stability and transparency of the LCRs, with the following two focuses:**
  - Reviewing the format of cost curves used in the LCR Optimizer
  - Reviewing the appropriateness of the objective function in the LCR Optimizer

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Next Steps

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Next Steps

- **Q1 2023 – ICAPWG/MIWG**
  - Updates on initial discovery work and external engagement
  - Discuss the issues in further detail

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Our mission, in collaboration with our stakeholders, is to serve the public interest and provide benefit to consumers by:

- Maintaining and enhancing regional reliability
- Operating open, fair and competitive wholesale electricity markets
- Planning the power system for the future
- Providing factual information to policymakers, stakeholders and investors in the power system

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