Alternative LCR Methodology

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01 August 2018

Objective

The Alternative Methodology for setting LCRs proposes an optimization of LCRs utilizing the Constrained Optimization by Linear Approximation method.[1] This method uses iterative linear approximations of the constraint and objective functions to find a least cost solution.

GE MARS is used to approximate the LOLE constraint function.

NYISO asked GE to provide the ICS with further explanation regarding how the 0.100 days/year LOLE constraint is respected in this optimization.

1 Powell M.J.D. (1994) A Direct Search Optimization Method That Models the Objective and Constraint Functions by Linear Interpolation. In: Gomez S., Hennart JP. (eds) *Advances in Optimization and Numerical Analysis. Mathematics and Its Applications, vol 275.* Springer, Dordrecht

Objective Function

Minimize:

$$\mathit{Cost\ of\ Capacity\ Procurement}$$

$$= \sum_{x} [Q_x + \ LOE_x] \cdot P_x(Q_x + LOE_x)$$

$$+ \sum_{y} \left[Q_y + LOE_y - \sum_{z} LOE_z \right] \cdot P_y \left(Q_y + LOE_y + \sum_{z} Q_z \right) +$$

$$+ \left[Q_{Pool} + LOE_{Pool} - \left(\sum_{x} (Q_x + LOE_x) + \sum_{y} (Q_y + LOE_y) \right) \right] \cdot P_{Pool}(Q_{Pool} + LOE_{Pool})$$

Objective Function

Where:

P = Price Elasticity Function (*i.e.*, Net CONE)

Q = Quantity of Capacity (*i.e.*, Peak Load * LCR)

LOE = Quantity Associated with the Level of Excess

x = Single Load Zones that are Localities (*i.e.*, Zone J, Zone K)

y = Locality which wholly contains another Locality (*i.e.*, GHIJ)

z = Single Locality located within another Locality (*i.e.*, Zone J)

Pool = New York Control Area

Constraints

Subject to:

$$\log_{10}(Reference\ LOLE) - \log_{10}(Current\ LOLE) \geq 0$$

And, if specified:

$$Transmission\ Security\ Limit\ or\ other\ Lower\ Bound \leq LCR$$

$$LCR \leq Upper\ Bound$$

These are hard constraints and must be maintained for the solution to be optimal

Capacity Adjustment

NYCA

1. Calculate the amount of ICAP that needs to be removed from NYCA to meet the IRM
2. Remove ICAP from zones of excess west of Total East (A, C, D) proportional to their UCAP excess until the IRM is met
3. Convert to UCAP using each area’s 5 year EFORd

Zone J

1. Calculate the amount of ICAP that needs to be removed from Zone J to meet the Zone J LCR and remove from Zone J
2. Add to zones of excess west of Total East (A, C, D) proportional to their UCAP excess to maintain IRM
3. Convert to UCAP using each area’s 5 year EFORd

Zone K

1. Calculate the amount of ICAP that needs to be removed from Zone K to meet the Zone K LCR and remove from Zone K
2. Add to zones of excess west of Total East (A, C, D) proportional to their UCAP excess to maintain IRM
3. Convert to UCAP using each area’s 5 year EFORd

GHIJ

1. Calculate the amount of ICAP that needs to be removed from GHIJ to meet the GHIJ LCR
2. Adjust for the ICAP which has already been removed from Zone J
3. Remove from Zone GHI Proportional to UCAP
4. Add to zones of excess west of Total East (A, C, D) proportional to their UCAP excess to maintain IRM
5. Convert to UCAP using each area’s 5 year EFORd

Potential reasons for differing results

For the Alternative LCR Analysis GE used:

- The 2018 IRM Base Case
- MARS Version 3.21.10 on a Linux Operating System
- The NYCA Loss of Load Expectation aggregated without loss of load events in the dummy areas
- The LCRs exactly as output from the tool without rounding:
  - Zone J: 79.7%
  - Zone K: 107.5496%
  - GHIJ: 90.82415%