Alternative Methods for Determining LCRs

Rana Mukerji
Senior Vice President, Market Structures
Zachary Stines
Associate Market Design Specialist, ICAP Market Design

NYSRC – Executive Committee
August 11, 2017

DRAFT – FOR DISCUSSION PURPOSES ONLY

Agenda

- **Methodology**
- **Initial Sensitivities**
  - Stability
  - Reliability Metrics for Individual Zones
- **Next Steps**
  - Phase 2: Final Refined Methodology
  - Phase 3: Market Simulations
- **Questions**

Alternative Method for Determining LCRs: Economic Optimization

Least Cost Optimization

minimize Total Cost of Capacity in NYCA

subject to:

LOLE $\leq$ 0.1

IRM = 18.0% (NYSRC Approved IRM)

- Optimizes the LCRs of the localities while maintaining the NYSRC approved IRM
- Cost defined by Unit Net CONE used to develop each ICAP Demand Curves
- Optimization uses a Linear Approximation as computational method
  - Iterative process between Linear Program wrapper and MARS

Objective Function

$$Cost\ of\ Capacity\ Procurement = \sum_x Q_x \cdot P_x(Q_x) + \sum_y Q_y \cdot P_y\left(Q_y + \sum_z Q_z\right) +$$

$$\left[(Reserve\ Margin \cdot Pool\ Coincident\ Peak) - \left(\sum_x Q_x + \sum_y Q_y\right)\right] \cdot P_{ROP}(Q_{Pool})$$

X = Single Load Zone that is a Locality (i.e., Zone J and Zone K)

Y = Locality minus any Single Load Zone Locality located within it (i.e., GHI)

Z = Single Locality located within a larger Locality (i.e., Zone J)

ROP = Rest of Pool (i.e., Rest of State)

Base Case

Optimized Preliminary Base Case

Scenario	Zone J LCR (%)	Zone K LCR (%)	G-J LCR (%)	Cost (million)
Base Case (Current LCR)	81.4	103.2	91.3	$4,407.7
Optimized Preliminary Base Case (May 11, 2017)	77.5	107.0	91.0	$4,366.4
Final Optimized Base Case	~78.5	~105.5	~91.0	
Final Optimized Base Case with Transmission Security				

Case Descriptions

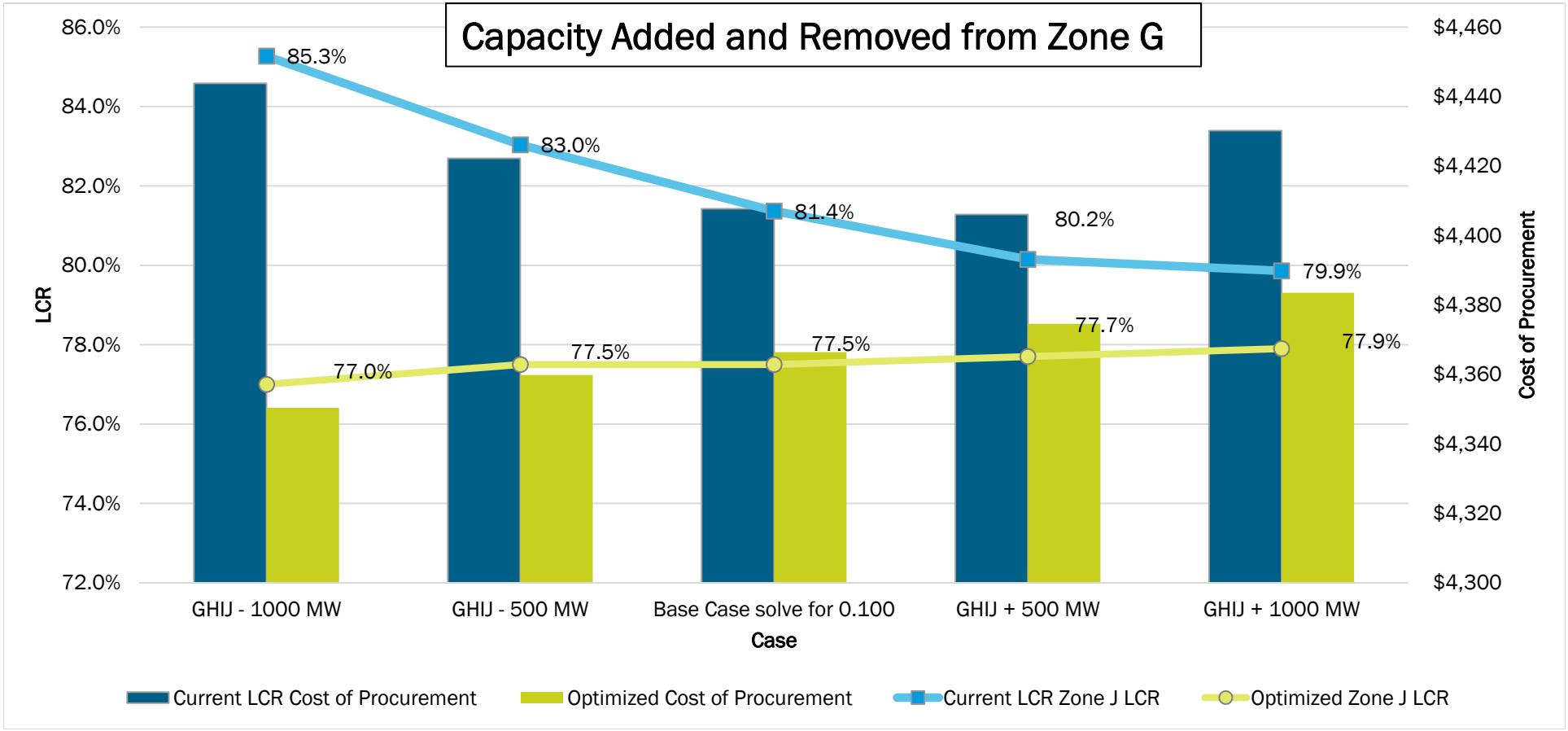
- **Current LCR Methodology Base Case**
  - The NYISO final 2017-2018 Capability Year LCR base case was solved to a LOLE of 0.1 days/year with the NYSRC approved IRM of 18.0%
  - The resulting base case will allow for a direct comparison with the optimized methodology and the simplified current LCR methodology
- **Optimized Preliminary Base Case**
  - Optimized preliminary base case uses the final 2017-2018 Capability Year LCR base case solved to a LOLE 0f 0.1 days/year with the NYSRC approved IRM of 18.0%
- **Final Optimized Base Case**
  - Final base case is currently being developed and incorporates small refinements to the optimization
- **Final Optimized Base Case with Transmission Security**
  - Final base case with transmission security limits applied to the LCRs

Initial Sensitivities

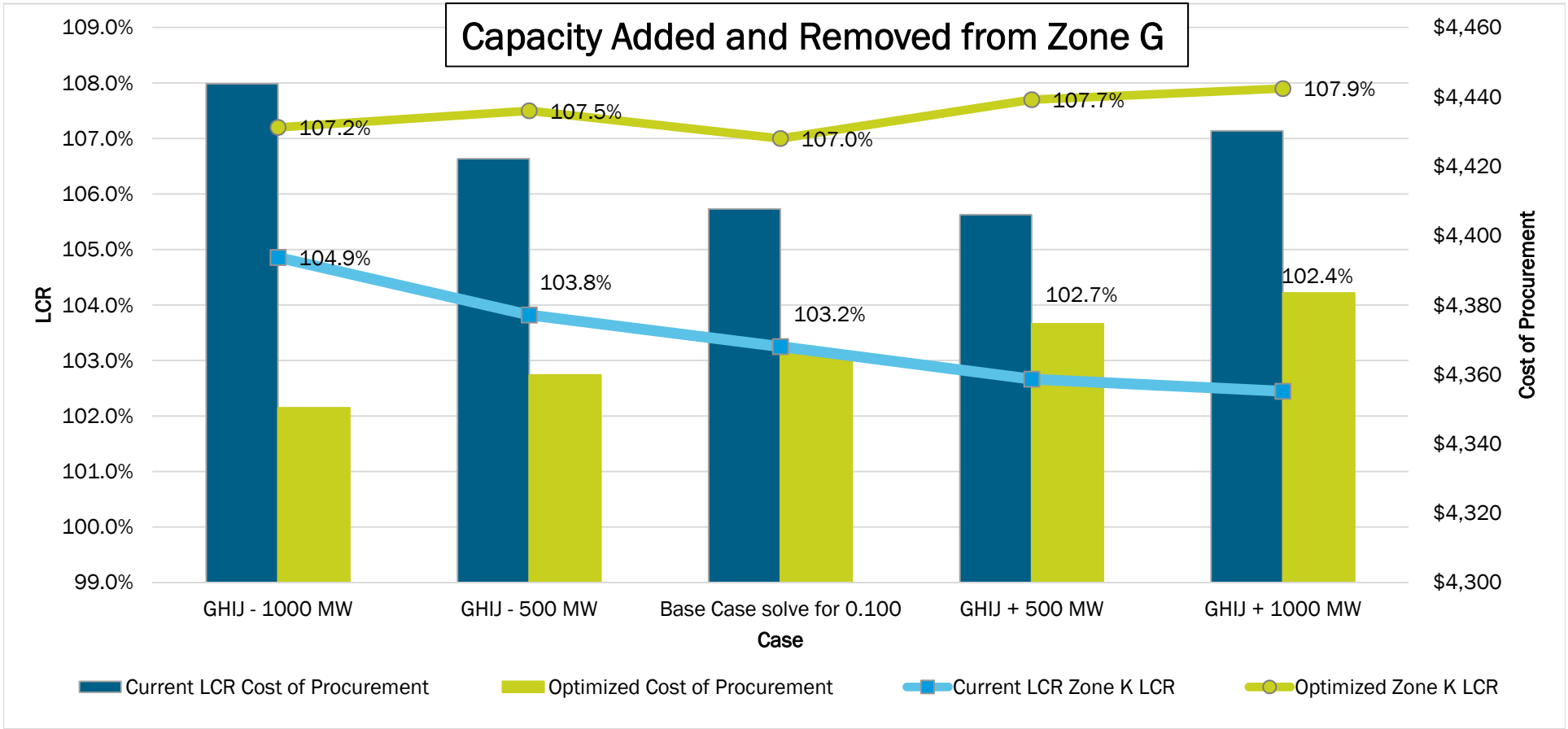
Initial Sensitivities

- **Entry/exit of Capacity**
  - Evaluate stability as generation enters and exits
- **Changes in Net CONE**
  - Evaluate impact of changes in cost
- **Changes in Transmission Capability**
  - Evaluate impact of an increase in transmission

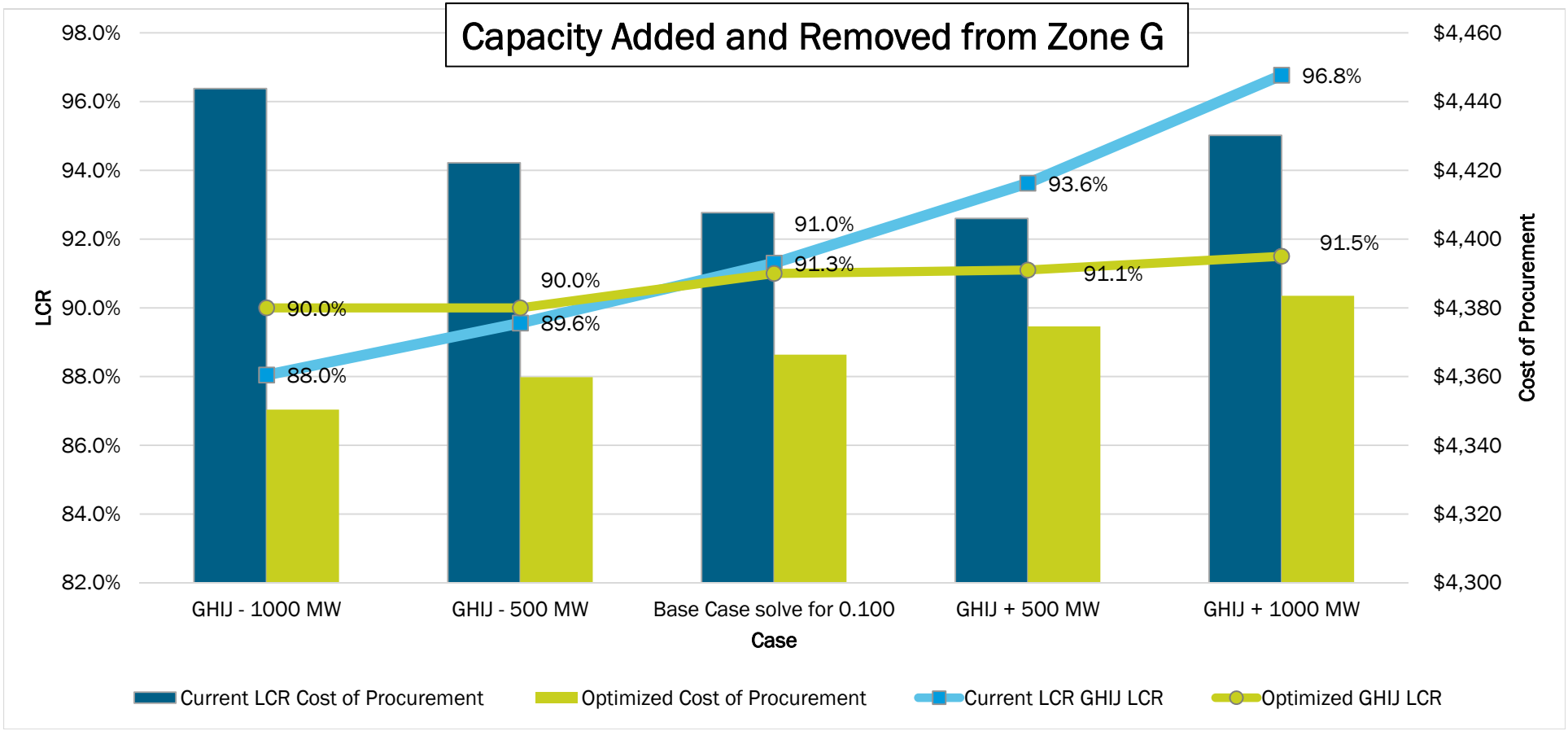
Changes to Capacity in GHIJ: Zone J LCR



Changes to Capacity in GHIJ: Zone K LCR



Changes to Capacity in GHIJ: GHIJ LCR



Changes in Capacity: Conclusions

- The optimized methodology reduces volatility in comparison to the current LCR methodology when there are changes in capacity

Changes in Net CONE: Conclusions

- The sensitivities tested extreme changes (i.e., between 30% and 55% change in Net CONE)
- The optimized LCR responded intuitively to the changes in Net CONE (i.e., increase in Net CONE in most instances causes a reduction in LCR)

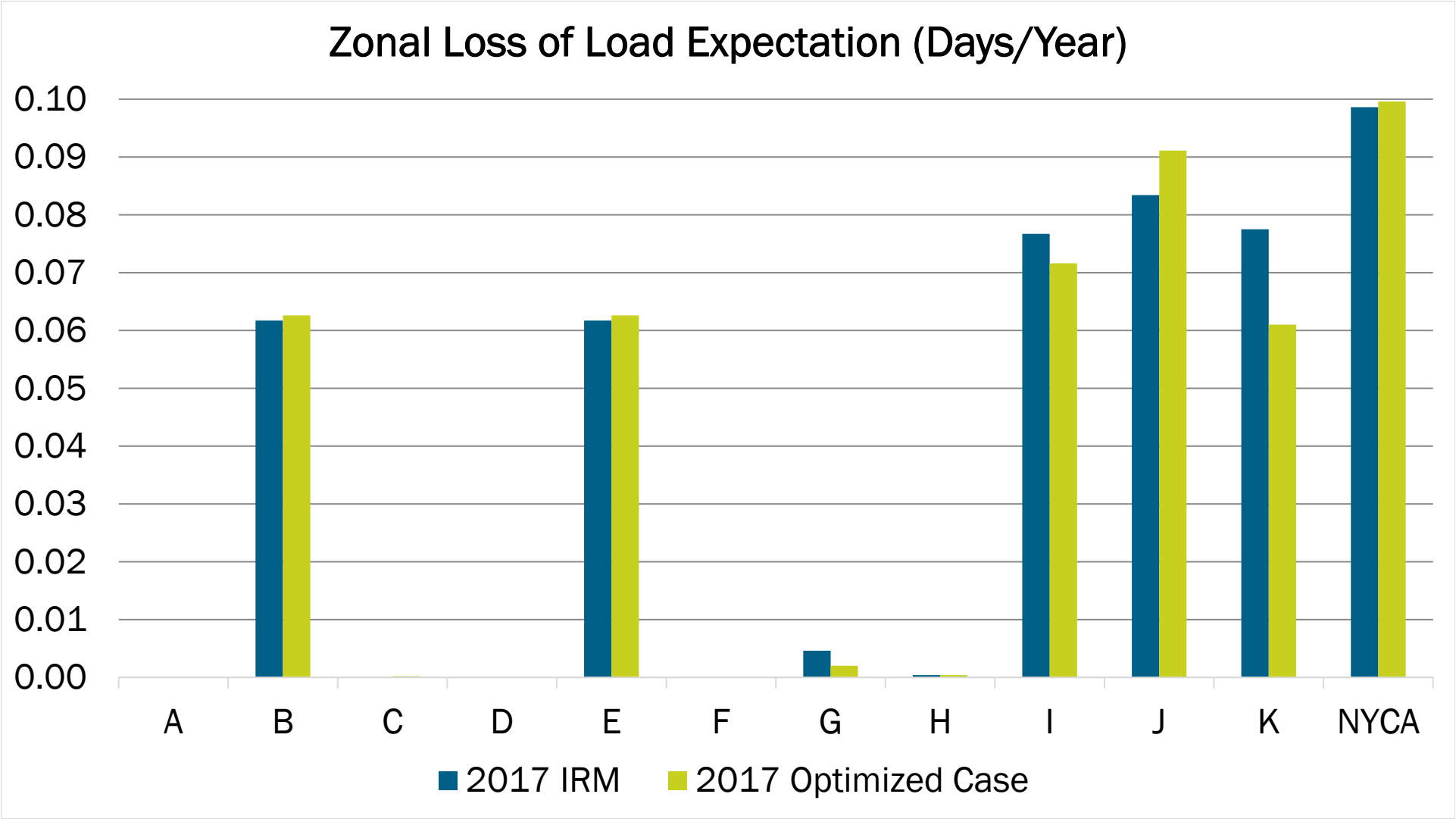
Changes in Transmission: Conclusions

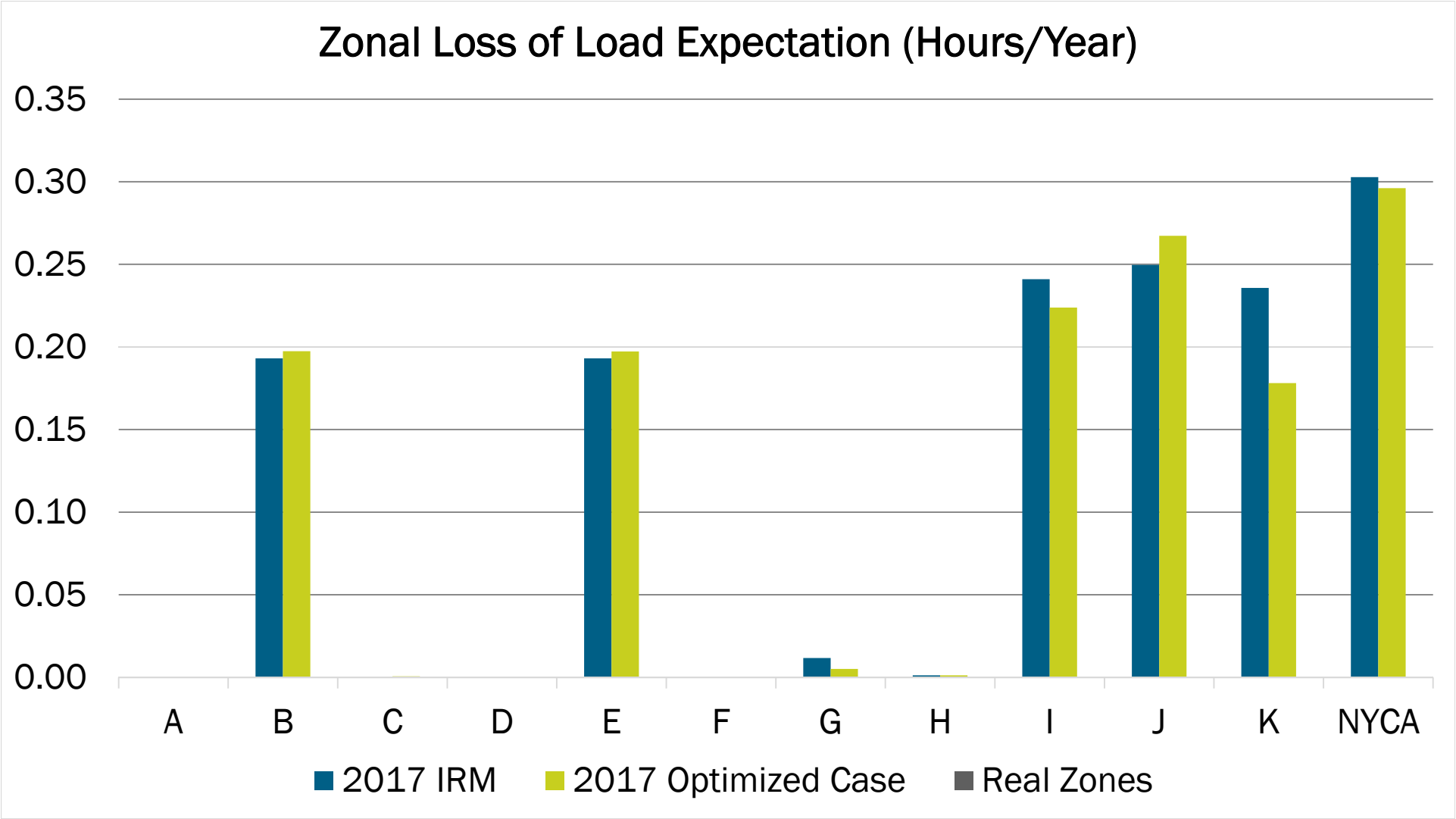
- **The conclusions based on the analysis presently are:**
  - UPNY-SENY reduces amount of optimal capacity required in the G-J Locality, but does not impact the amount required in Zone J (stand alone)
  - The Zone J LCR is minimized to its optimal level in the Base Case (as a result of constraints south of UPNY-SENY)

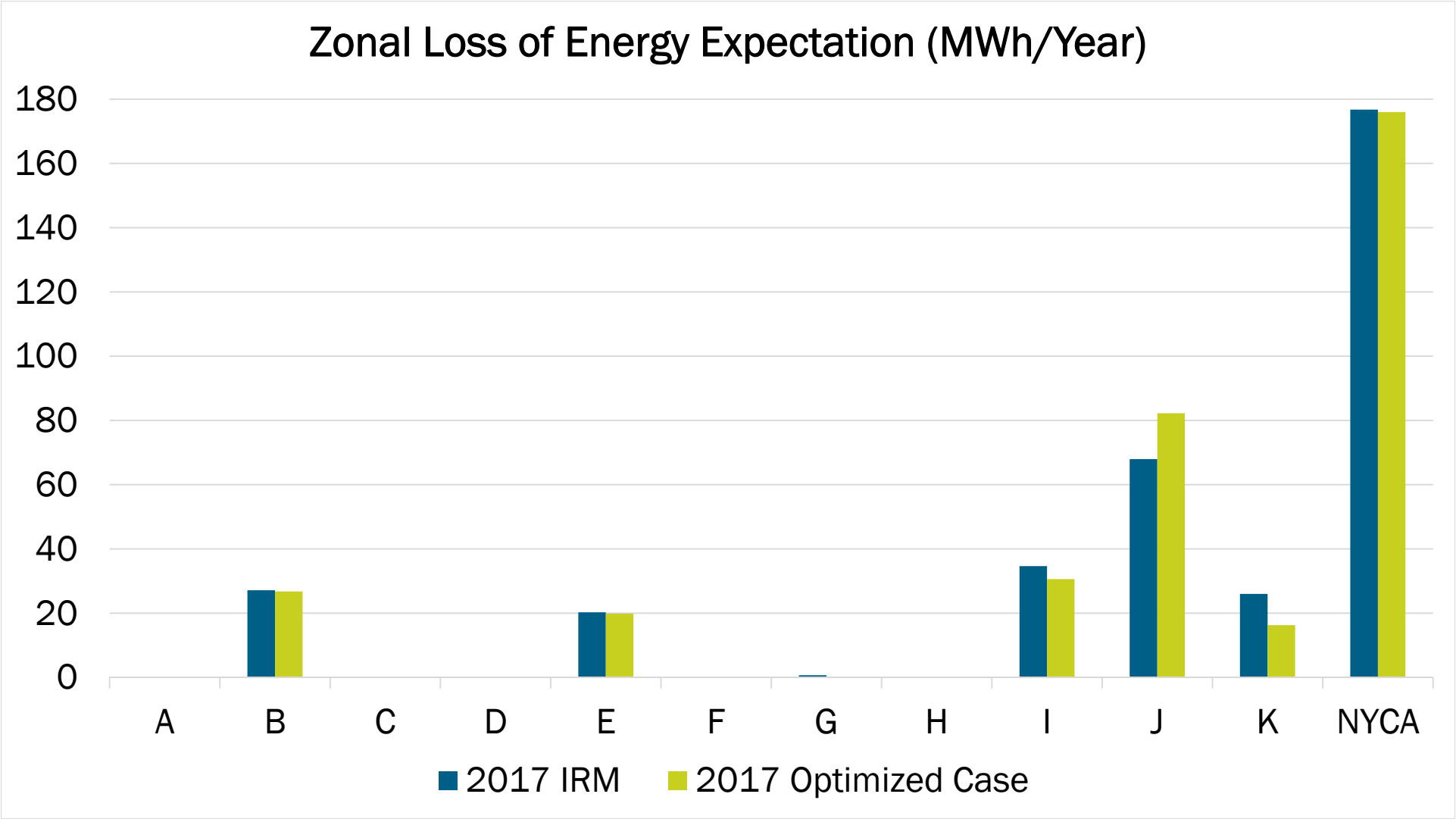
Reliability Analysis

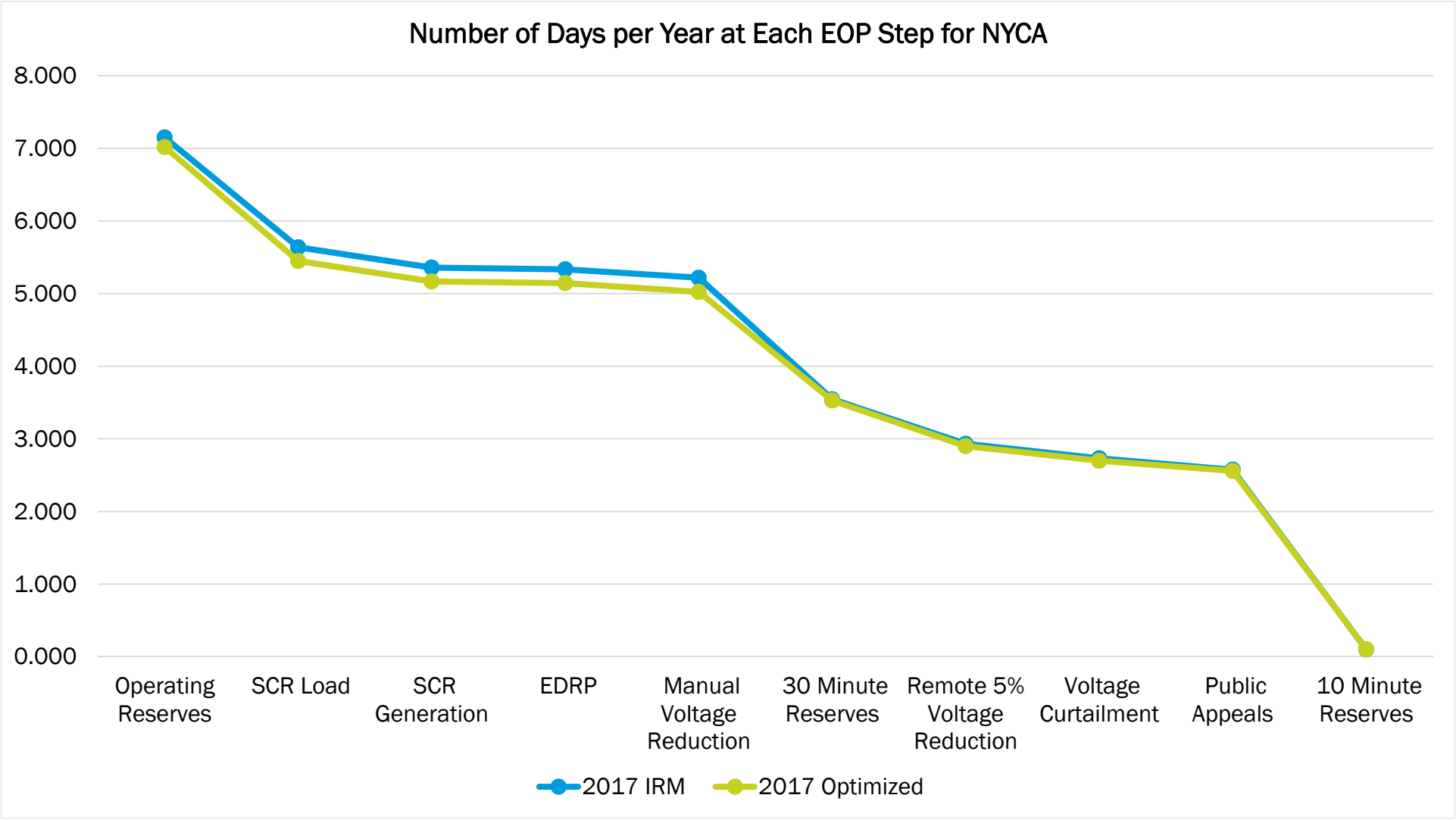
Reliability Metrics

- NYSRC – ICS requested the NYISO provide the LOLE and loss of energy expectation results at the zonal level for the optimized preliminary base case
- It was also requested that the NYISO indicate the frequency of EOP steps in the preliminary optimization base case


Zonal Loss of Load Expectation (Days/Year)
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
A
B
C
D
E
F
G
H
I
J
K
NYCA
2017 IRM
2017 Optimized Case


Zonal Loss of Load Expectation (Hours/Year)
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
A
B
C
D
E
F
G
H
I
J
K
NYCA
2017 IRM
2017 Optimized Case
Real Zones


Zonal Loss of Energy Expectation (MWh/Year)
180
160
140
120
100
80
60
40
20
0
A
B
C
D
E
F
G
H
I
J
K
NYCA
2017 IRM
2017 Optimized Case


Number of Days per Year at Each EOP Step for NYCA
8.000
7.000
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Operating Reserves
SCR Load
SCR Generation
EDRP
Manual Voltage Reduction
30 Minute Reserves
Remote 5% Voltage Reduction
Voltage Curtailment
Public Appeals
10 Minute Reserves
2017 IRM
2017 Optimized

Transmission Security

Transmission Security

- NYISO is working to develop transmission security limits for the Localities
- Transmission security limits would be incorporated as a constraint within the optimization and would ensure the optimized LCRs would not violate any transmission security floor
- Evaluation of the impact of the transmission security limits on the optimization and discussion on this process and analysis will be provided at future meetings

Next Steps

Stage 2: Refine Methodology

- Final methodology is currently being completed
- Present evaluation of transmission security

Stage 3: Market Simulations

- **Goal:** Simulate additional market scenarios to demonstrate performance of methodology
  - Perform sensitivities with multiple changes to the system
  - Evaluate how the process would be performed with full Tan45 followed by optimization

Other Next Steps

- The NYISO will consider input received during today's NYSRC-EC meeting
- Additional comments sent to zstines@nyiso.com will be considered

2017 Project Development

Stage	Objective	Specific Topics:
Proof of Concept	Demonstrate alternative methodology in relation to guiding principles (*i.e.*, least cost, stability, robust, predictability)	Generation +/- Unit net CONE +/- Transmission +/-
Refine Methodology	Modify the alternative method to ensure that all aspects have a purpose and are being performed as a result of sound market and engineering principles	Unit net CONE curves Potential Bounds Modeling methodology
Market Simulations	Simulate realistic market situations to demonstrate performance of methodology	Changes in resources Topological changes Locality configurations
Defining Process	Develop a process for the methodology that ensures guiding principles are being achieved over time	Develop process of method Process timeline Transition methods
Demonstrating Market Benefits	Demonstrate the methodology results in market benefits and resolve any issues that arise from its implementation	Consumer impact Multiyear simulation Cost allocation
Final Market Design	Summarize all findings and develop a final market design for implementation	Develop final market design

Questions?

The Mission of the New York Independent System Operator, in collaboration with its stakeholders, is to serve the public interest and provide benefits to consumers by:

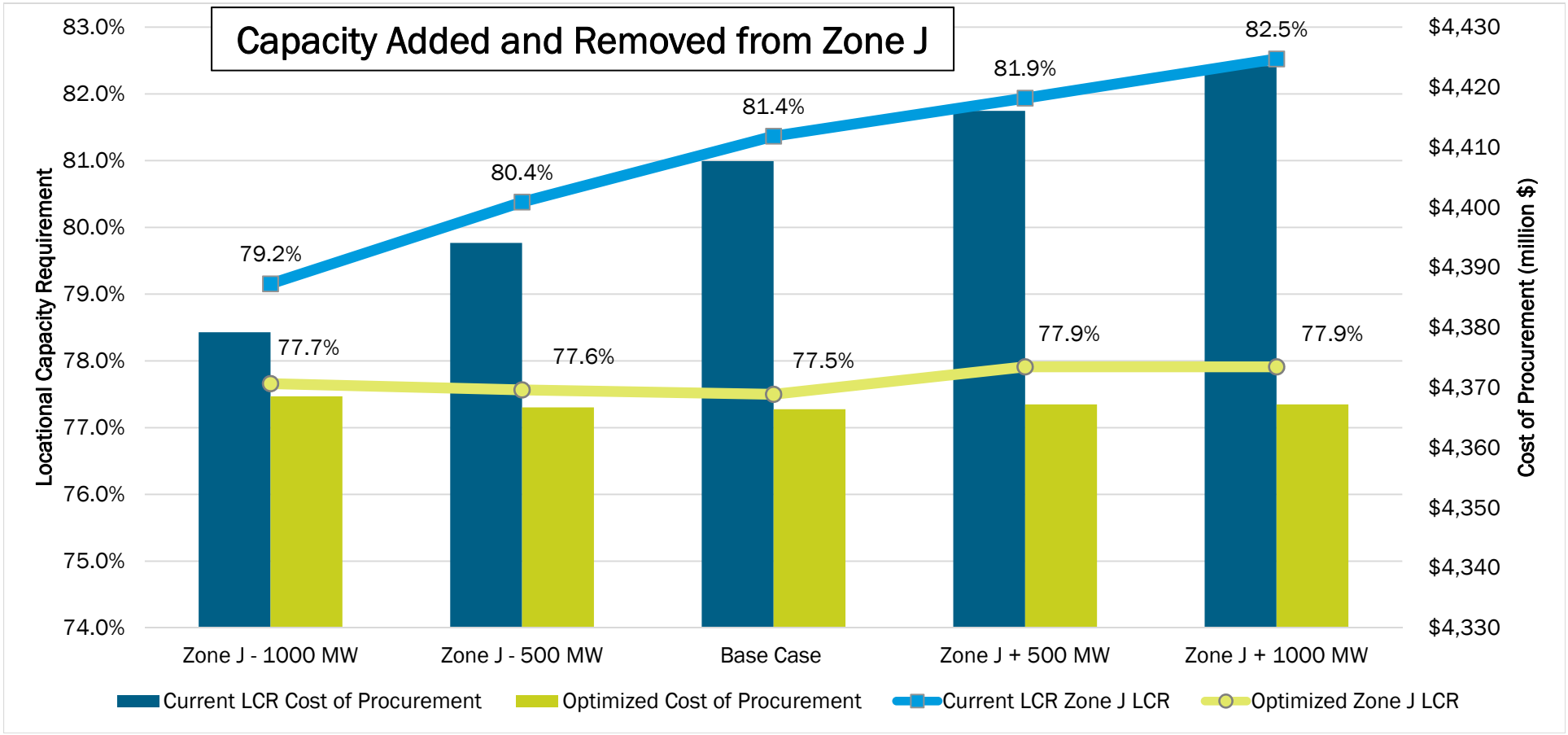
- Maintaining and enhancing regional reliability
- Operating open, fair and competitive wholesale electricity markets
- Planning the power system for the future
- Providing factual information to policy makers, stakeholders and investors in the power system

www.nyiso.com

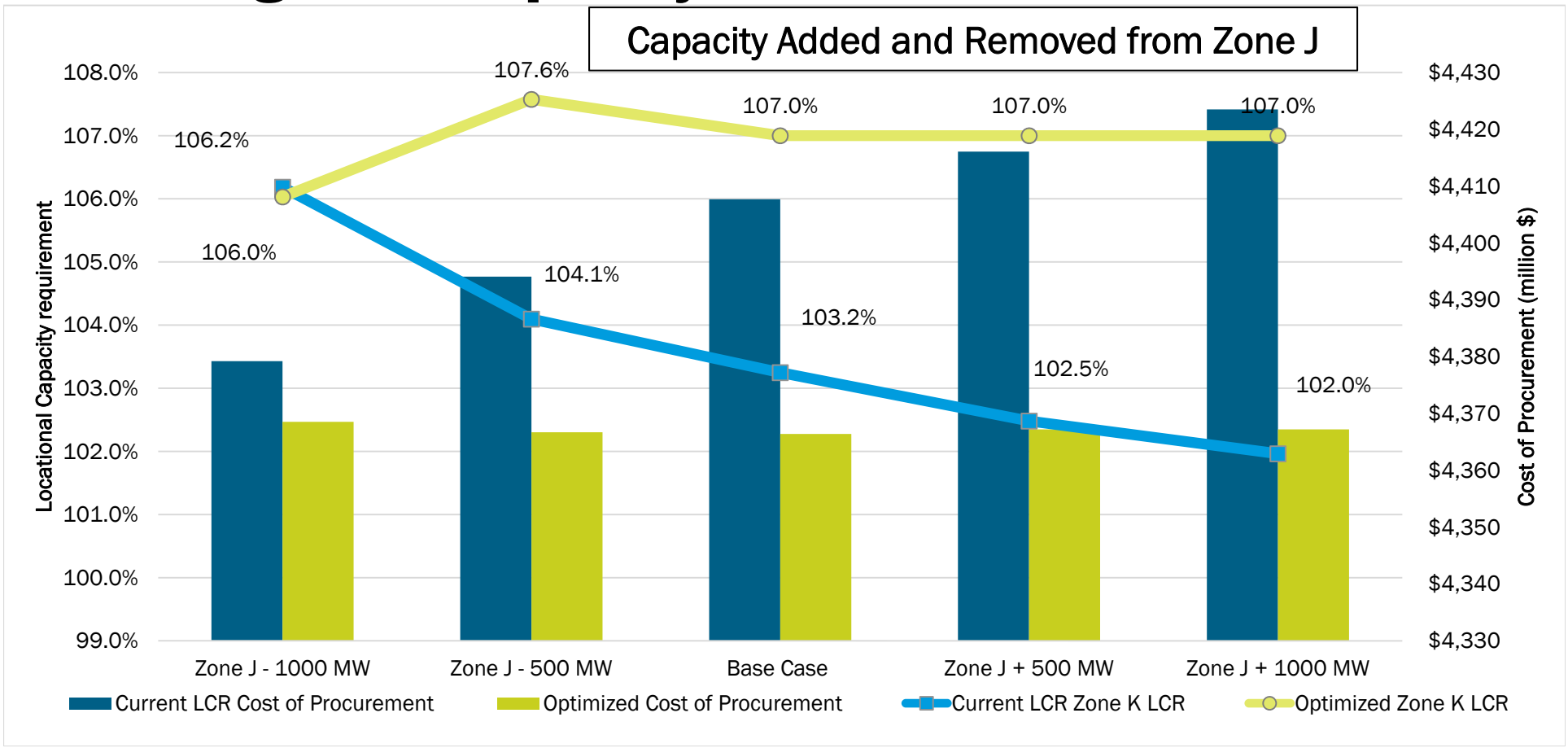
NEW YORK INDEPENDENT SYSTEM OPERATOR

Appendix

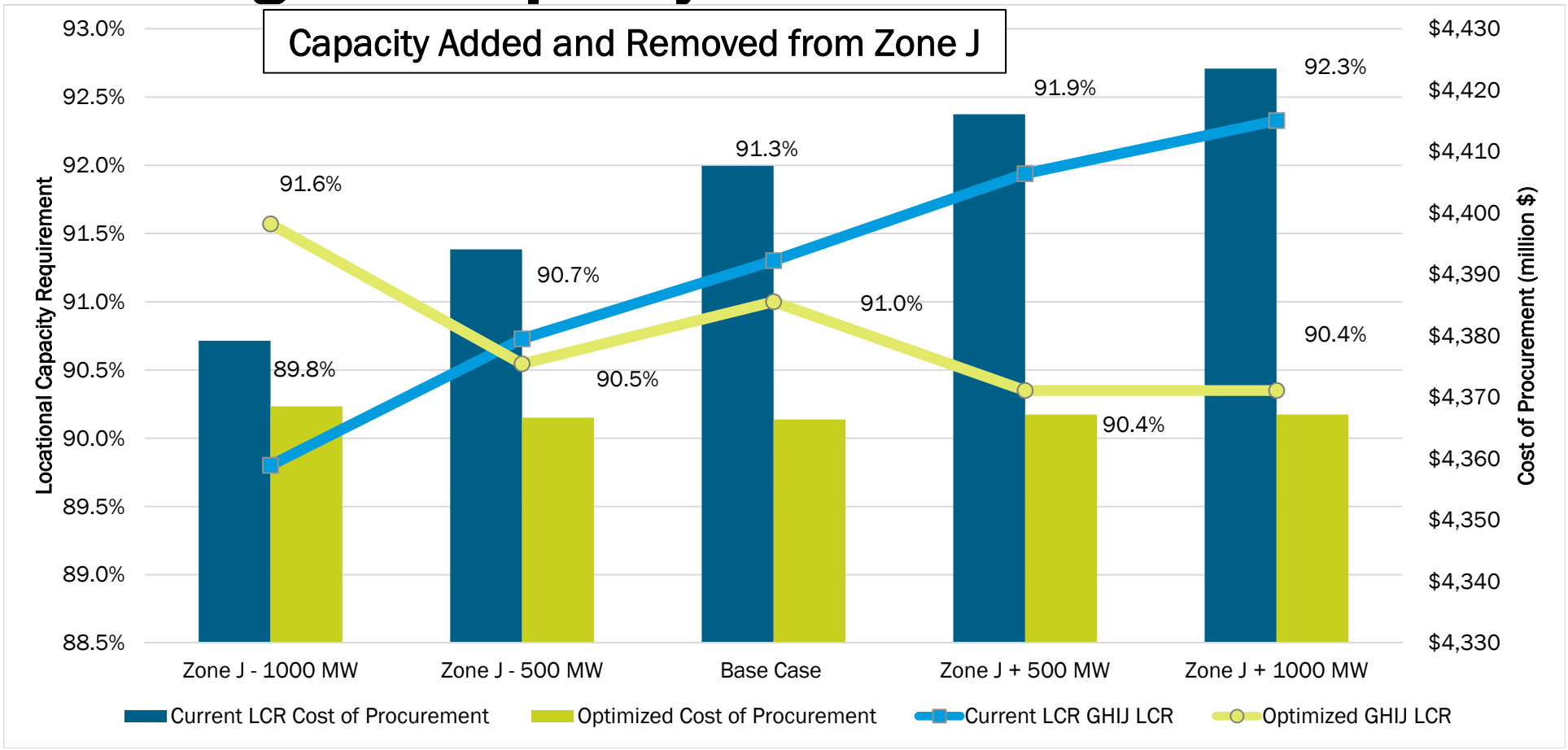
Changes to Capacity in J: Zone J LCR



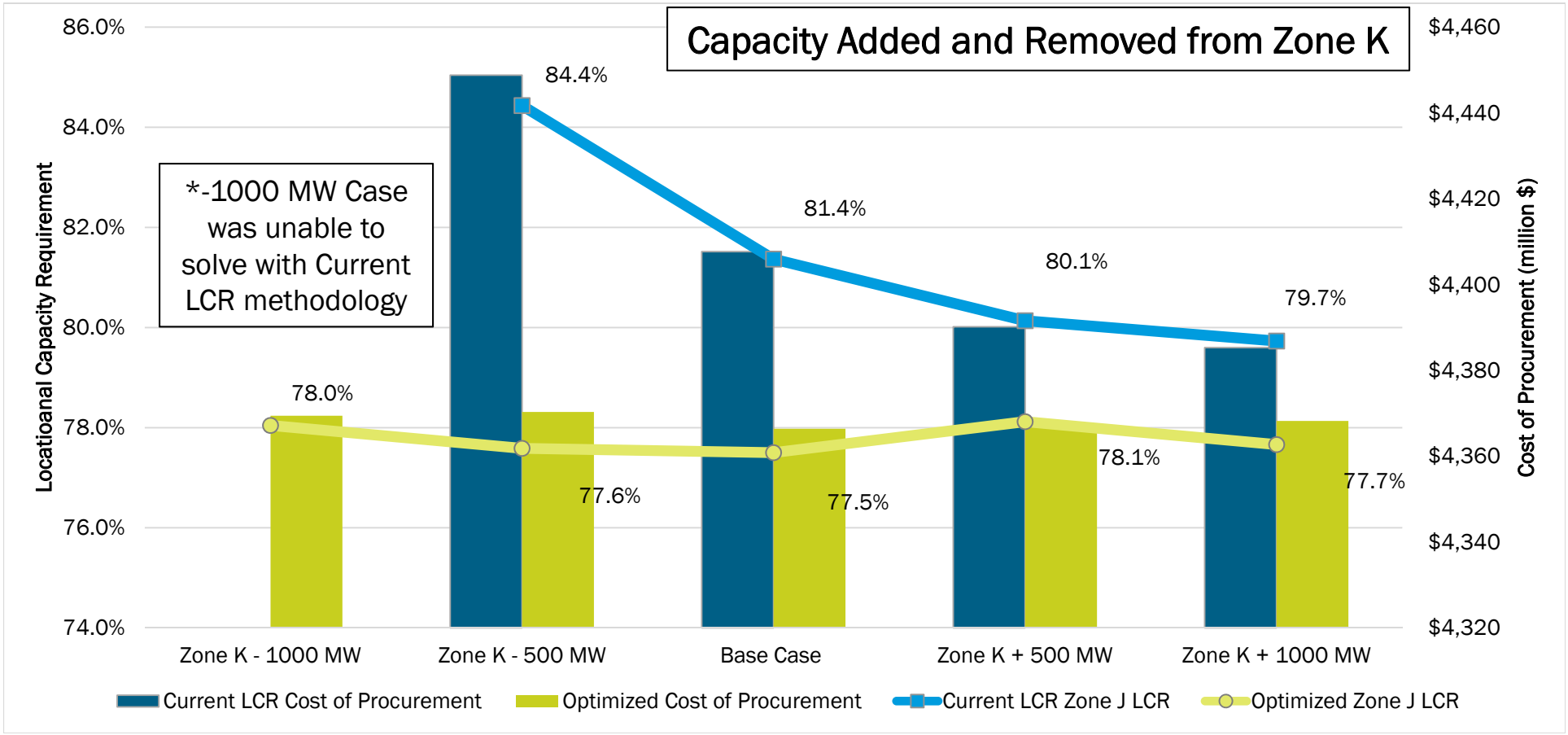
Changes to Capacity in J: Zone K LCR



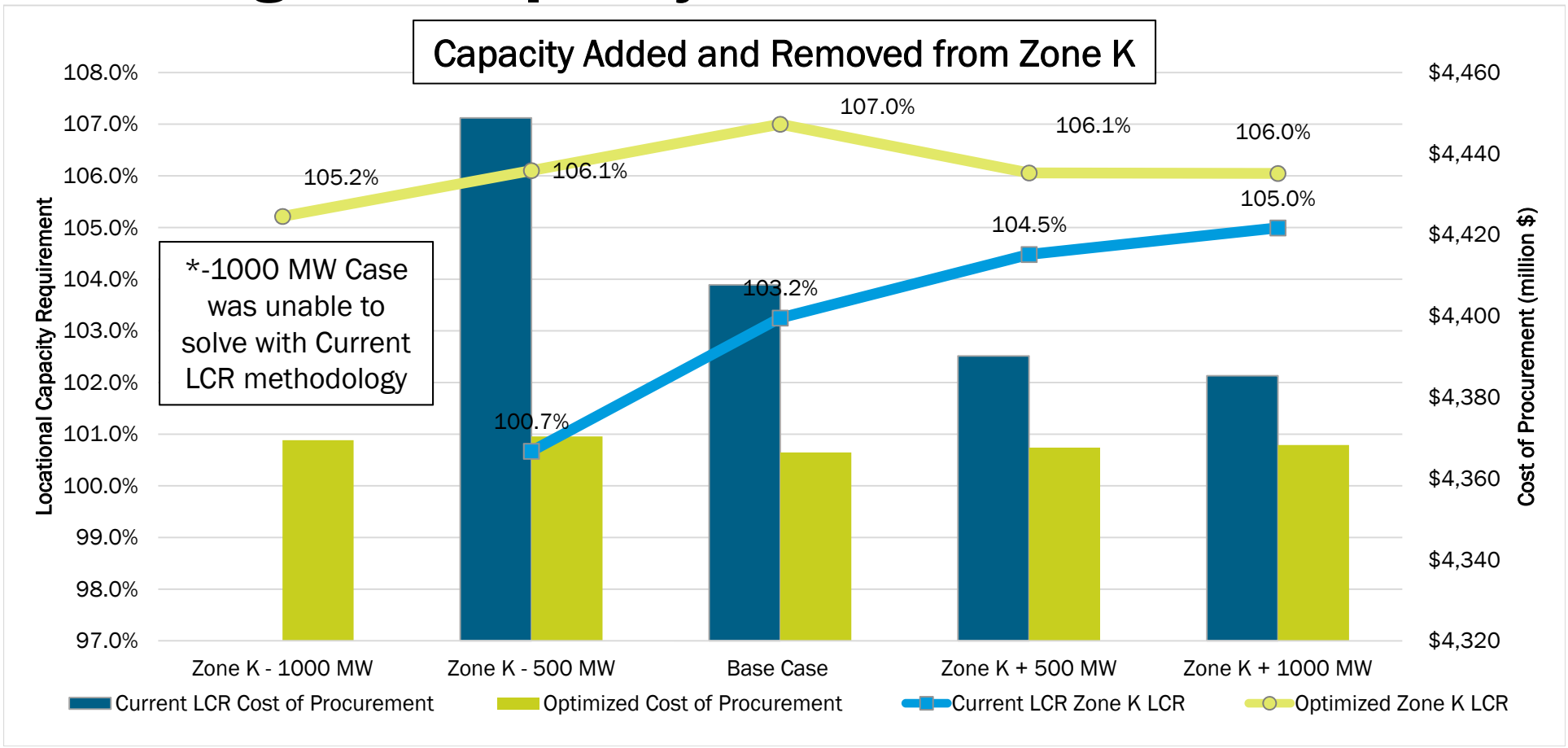
Changes to Capacity in J: GHIJ LCR



Changes to Capacity in K: Zone J LCR



Changes to Capacity in K: Zone K LCR



Changes to Capacity in K: GHIJ LCR