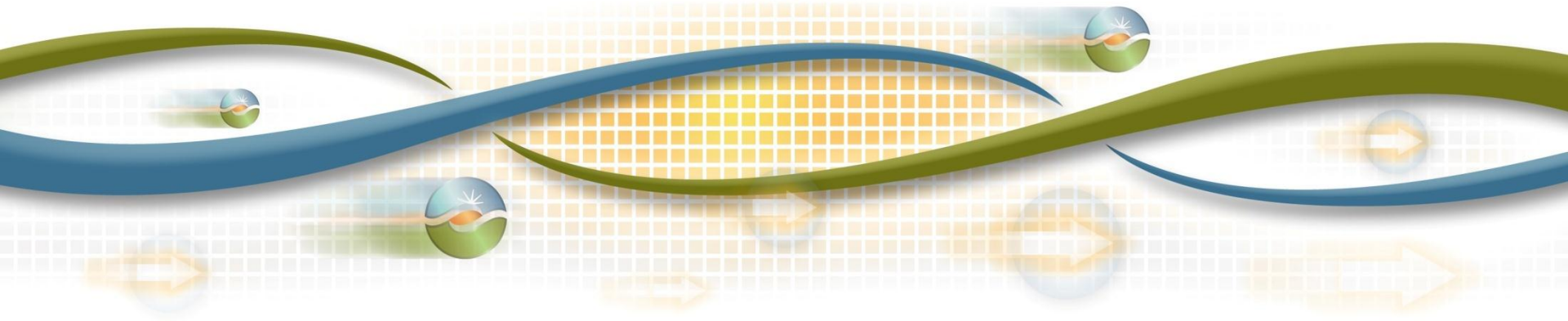


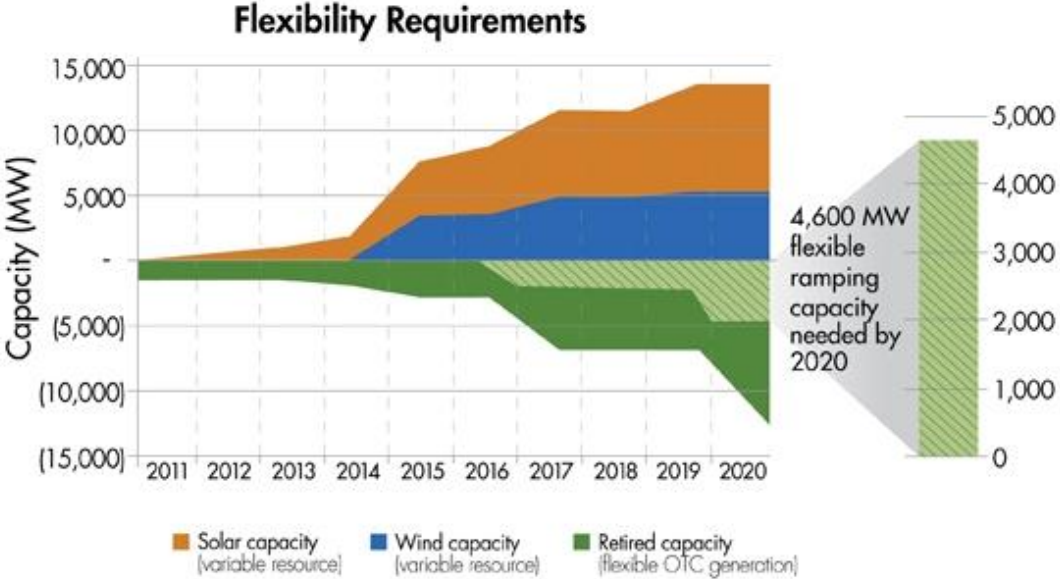
Market Surveillance Committee Operational Flexibility Study Update

Mark Rothleder, Executive Director Market Analysis and
Development

June 22, 2012



Supply variability and uncertainty will increase while the flexible capability of the fleet is decreases



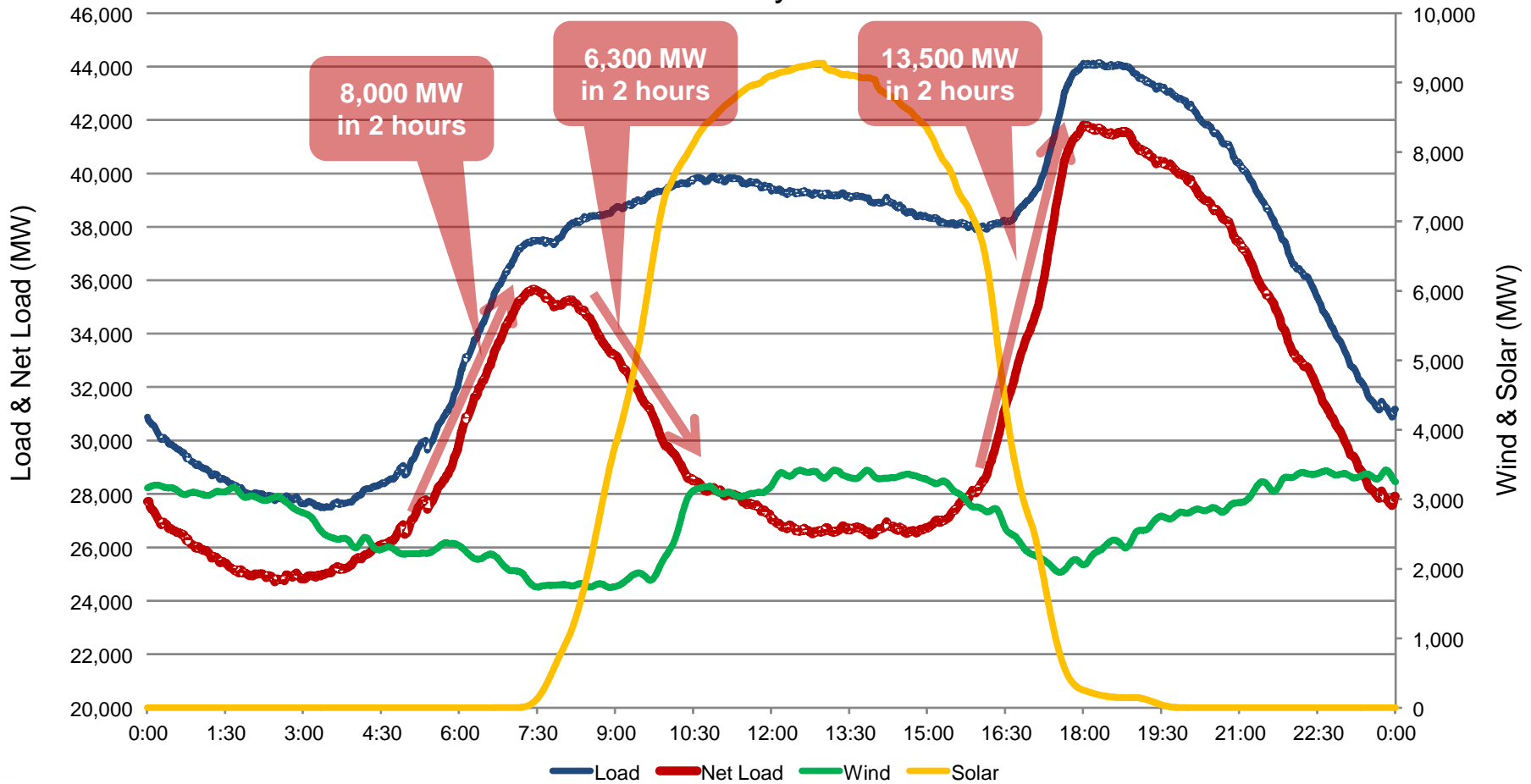
Flexible requirements increase

Flexible capacity reduce 15%

Changes in the fleet capacity results in potential need of 4,600 MW of flexible capacity by 2020 which represents about 38% of the OTC retired capacity.

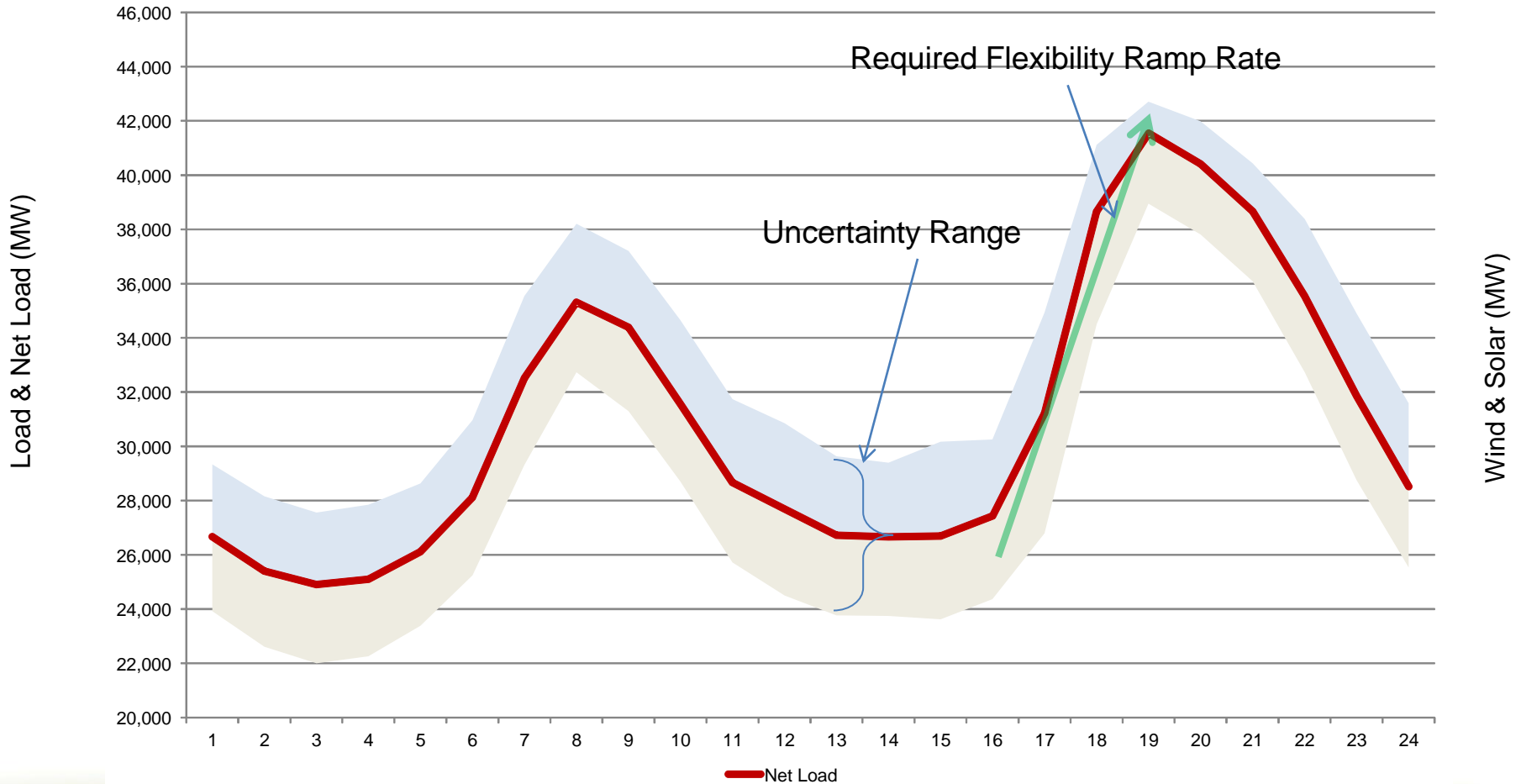
Conventional resources will be dispatched to the net load demand curve – High Load Case

Load, Wind & Solar Profiles – High Load Case
January 2020

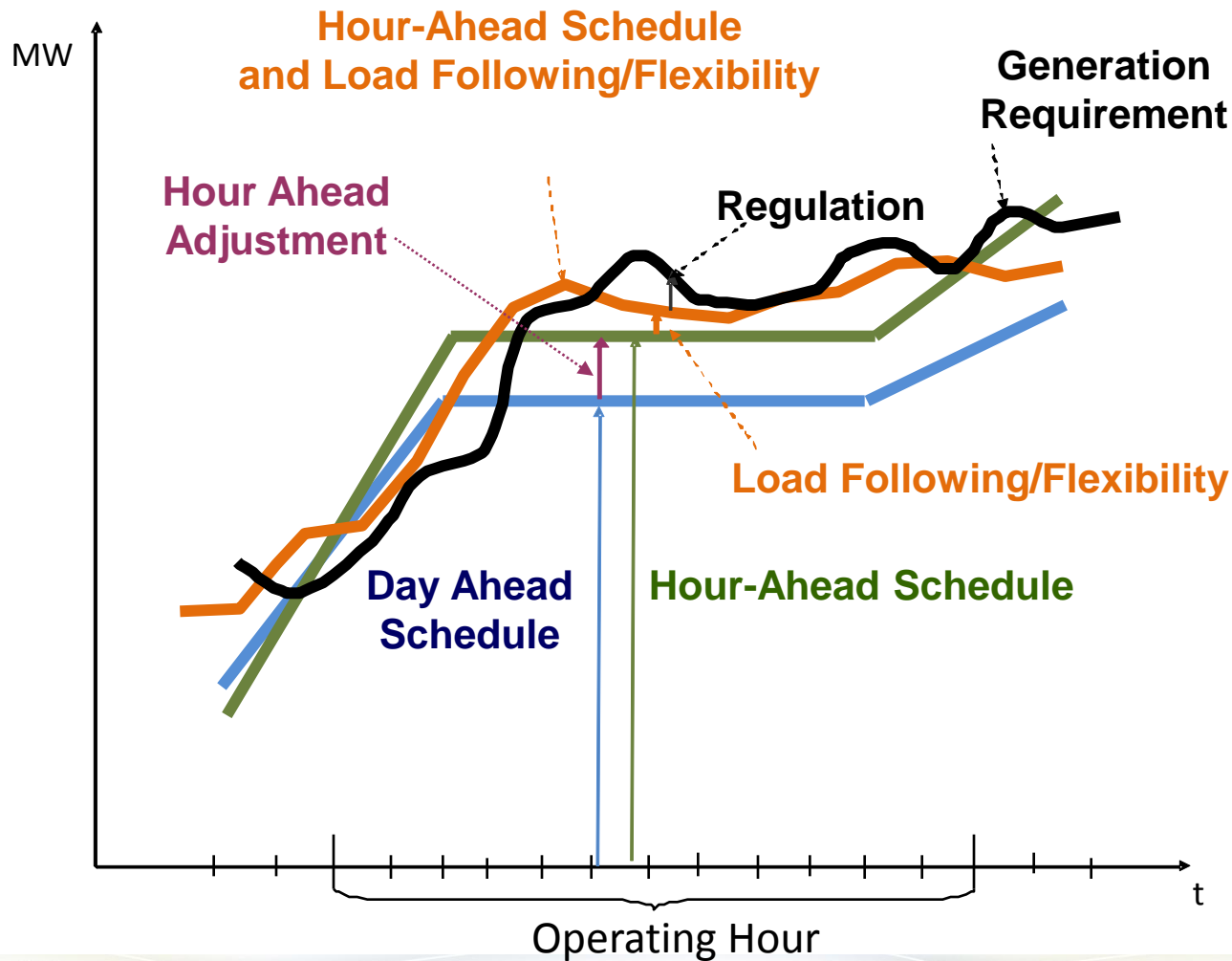


Uncertainty range around the net load demand curve – High Load Case

Load, Wind & Solar Profiles – High Load Case
January 2020



Intra hour need for flexibility and forecast uncertainty



The assessment of a balancing authority's control performance is based on three components

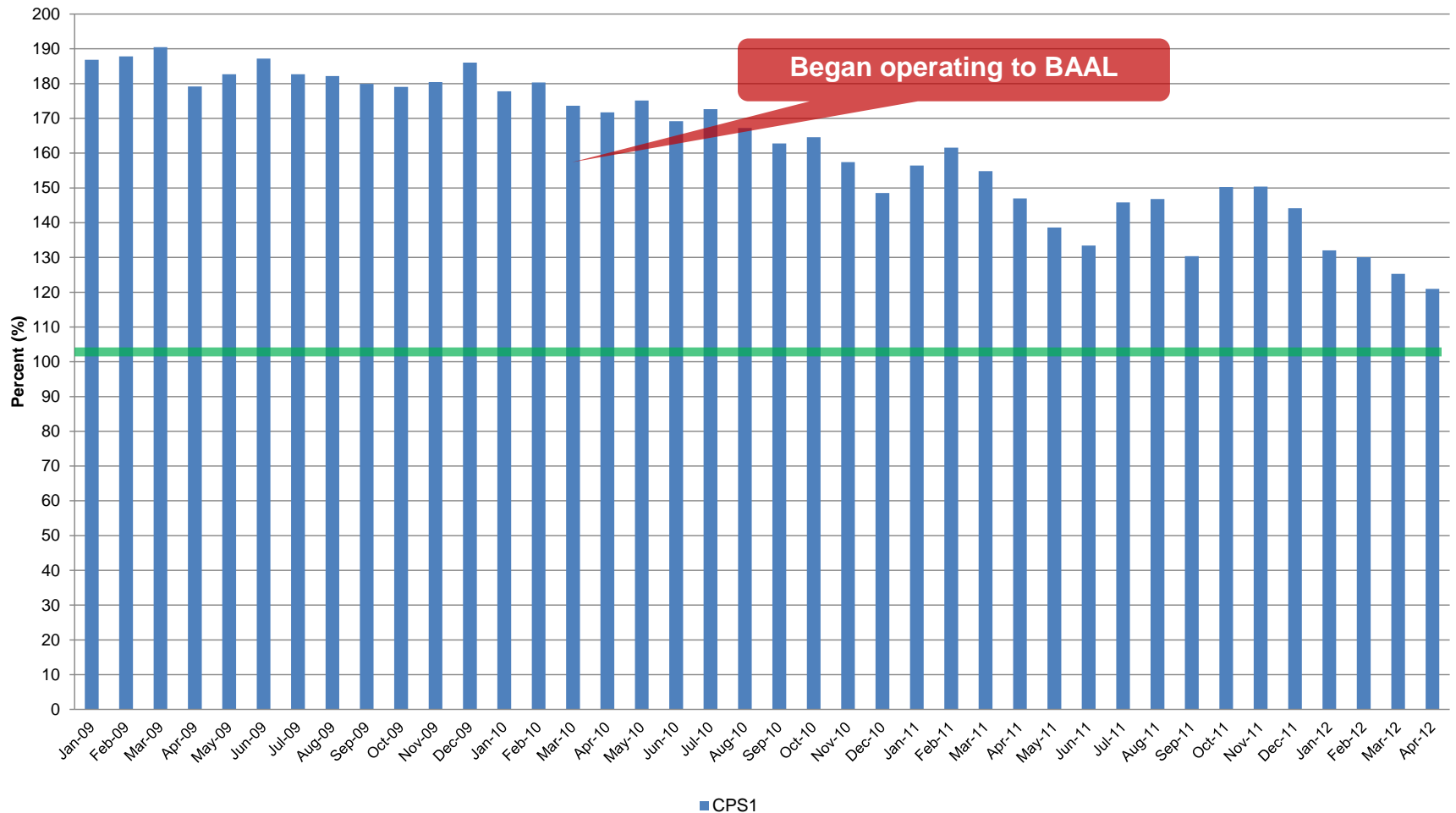
- **Control Performance Standard (CPS1)** - measures the control performance of a BA's by comparing how well its ACE performs in conjunction with the frequency error of the Interconnection
- **Balancing Authority Ace Limit (BAAL)** - is a real-time measure of Area Control Area and system frequency which cannot exceed predefined limits for more than 30-minutes
- **Disturbance Control Standard (DCS)** - is the responsibility of the BA following a disturbance to recover its ACE to zero if its ACE just prior to the disturbance was greater than zero or to its pre-disturbance level if ACE was less than zero - within 15 minutes

Control Performance Rating

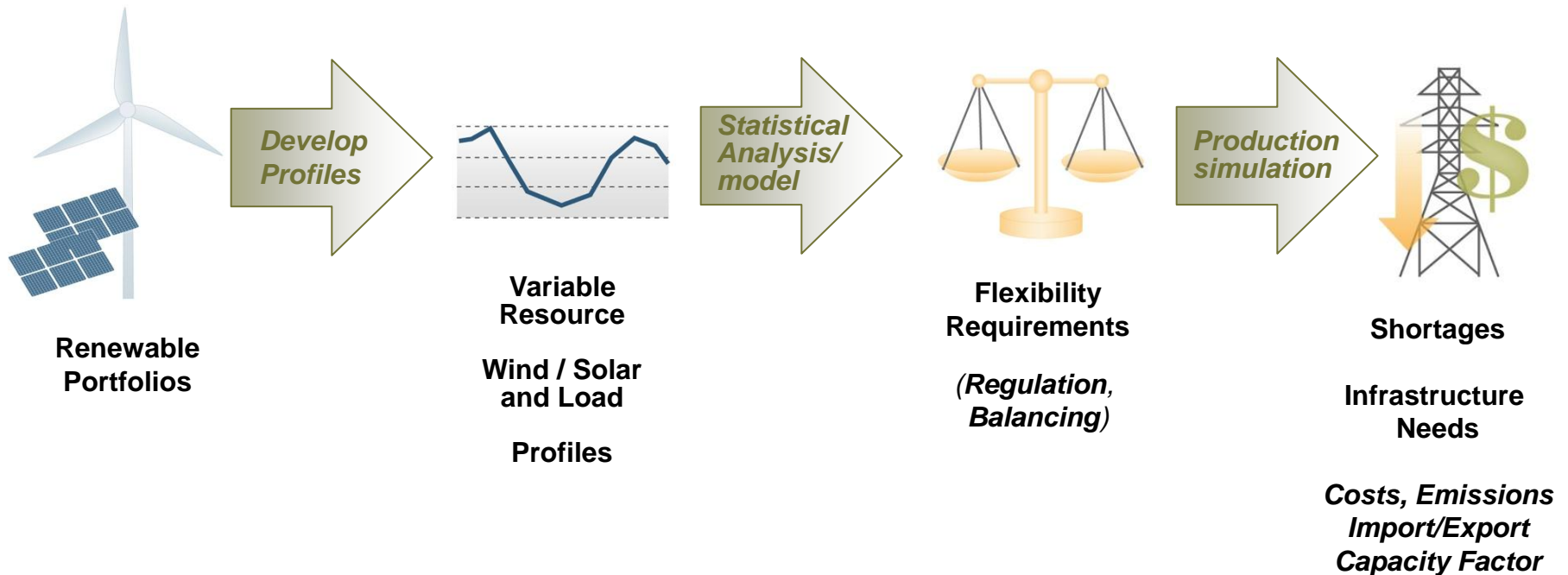
Pass is when $CPS1 \geq 100\%$; $BAAL_{Limit} \leq 30$ minutes & $DCS = 100\%$

Control Performance Standard Scores (CPS1) Scores January 2009 through April 2012

CPS 1 Scores – January 2009 through April 2012



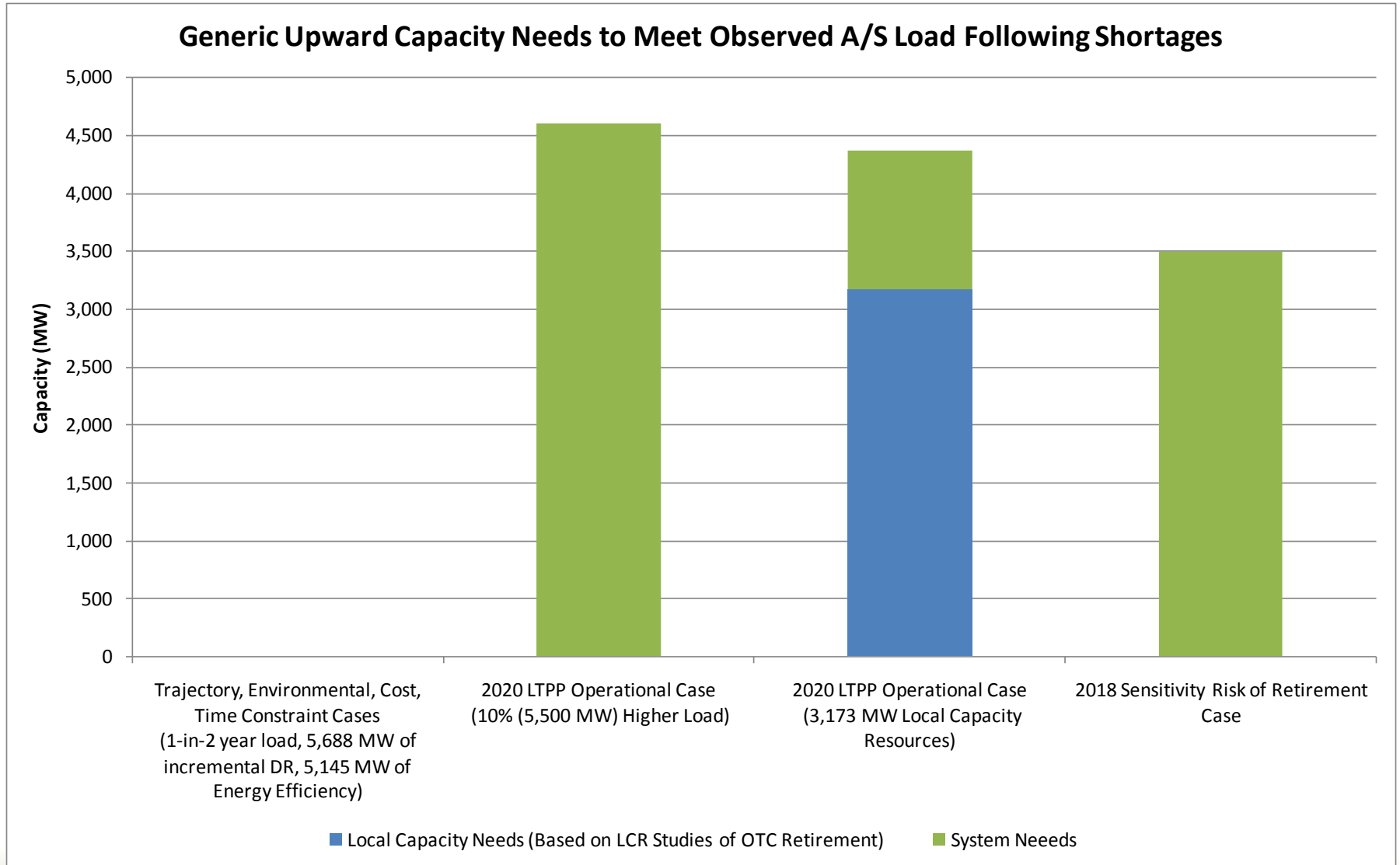
Study process quantifies operational requirements and evaluates fleets ability to meet operating requirements.



33% scenarios in 2020 cover range renewable and load conditions.

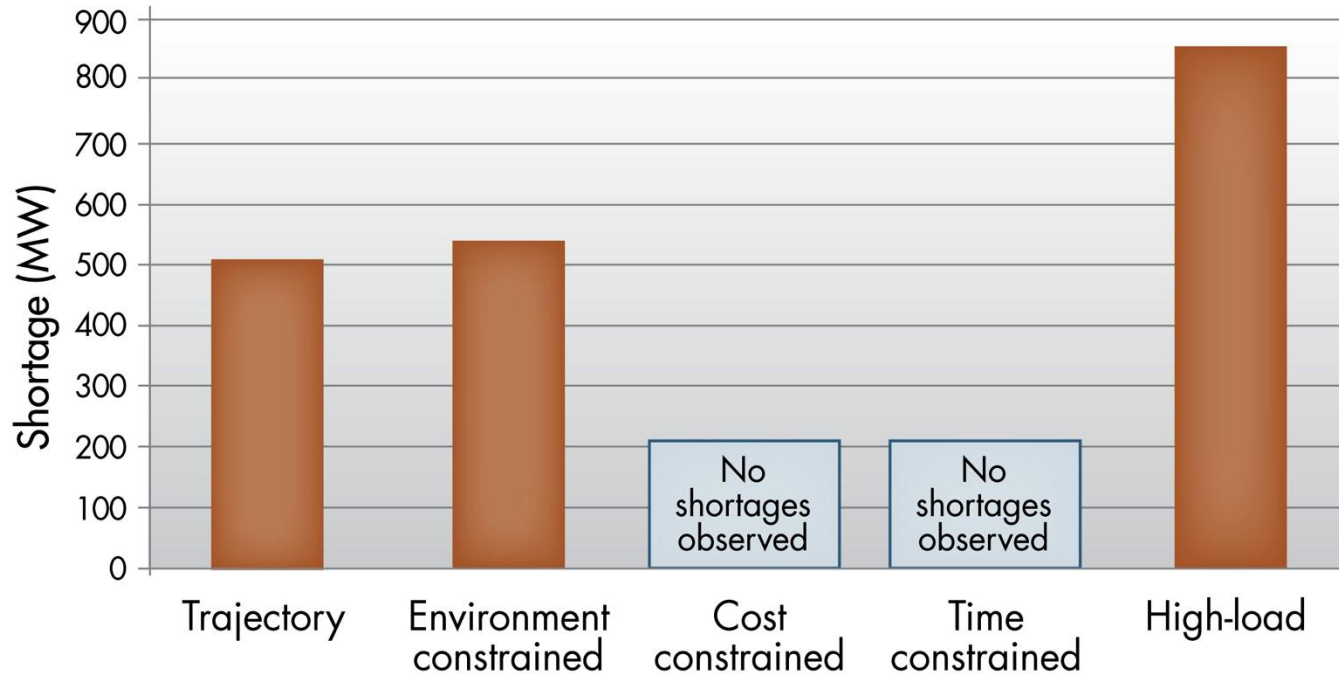
Case	Case Title	Description
1	33% Trajectory	Based on contracted activity
2	Environmental Constrained	High distributed solar
3	Cost Constrained	Low cost (wind, out of state)
4	Time Constrained	Fast development (out-of-state)
5	20% Trajectory	For comparison
6	33% Trajectory High Load	Higher load growth and/or energy program under-performance
7	33% Trajectory Low Load	Lower load growth and/or energy program over-performance

Potential need for 4,600MW of upward flexible resources observed in the high-load scenario using deterministic production simulation.



A few hours of potential shortages of downward flexibility were observed using deterministic production simulation

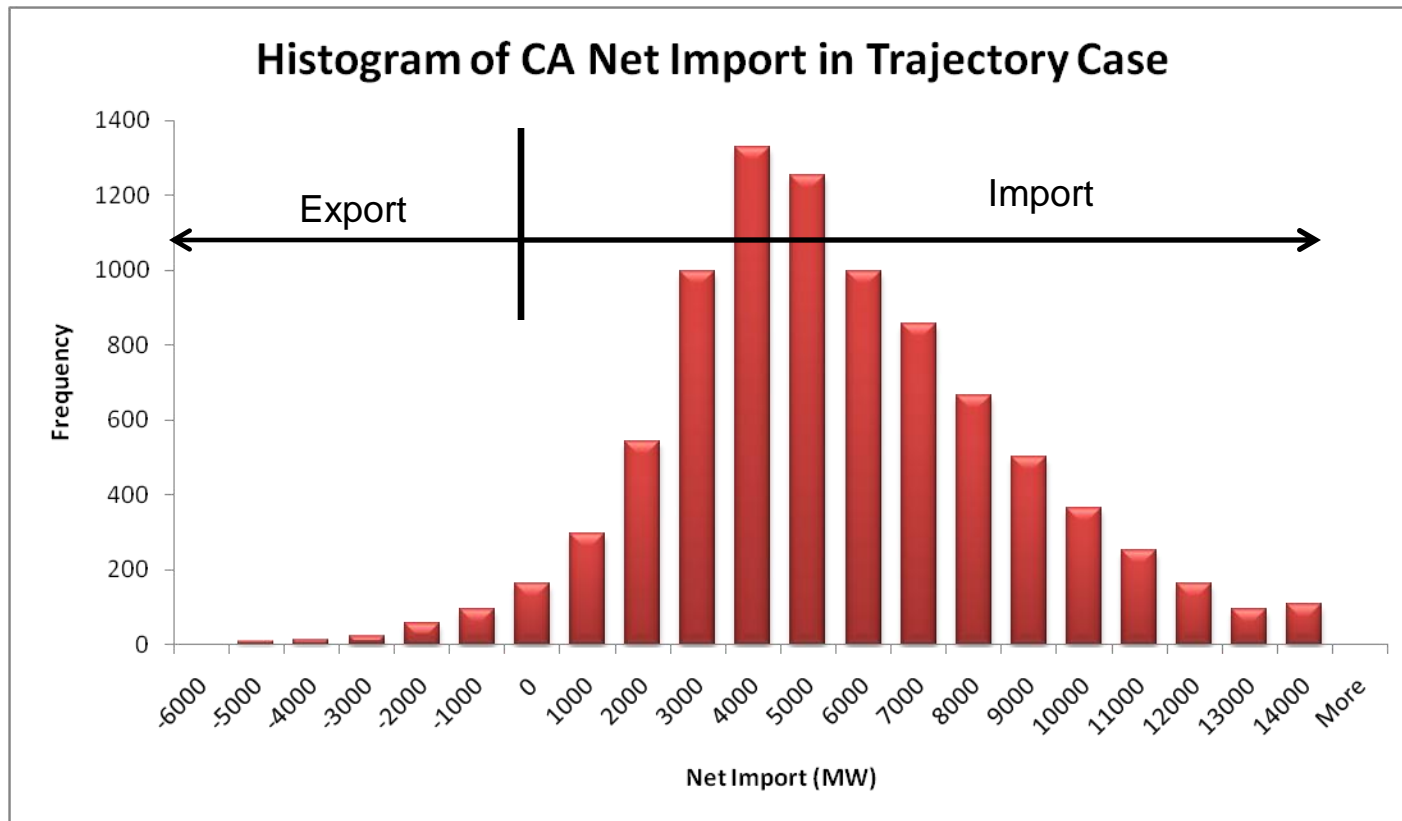
Downward balancing shortage



Note 1: Downward balancing may be more effectively and efficiently managed using curtailment or storage rather than less economic dispatch of flexible resources to higher level to maintain downward flexibility.

Note 2: High volume of net exports observed that require further review

Large quantity of net export observed in the cases need to be reviewed.

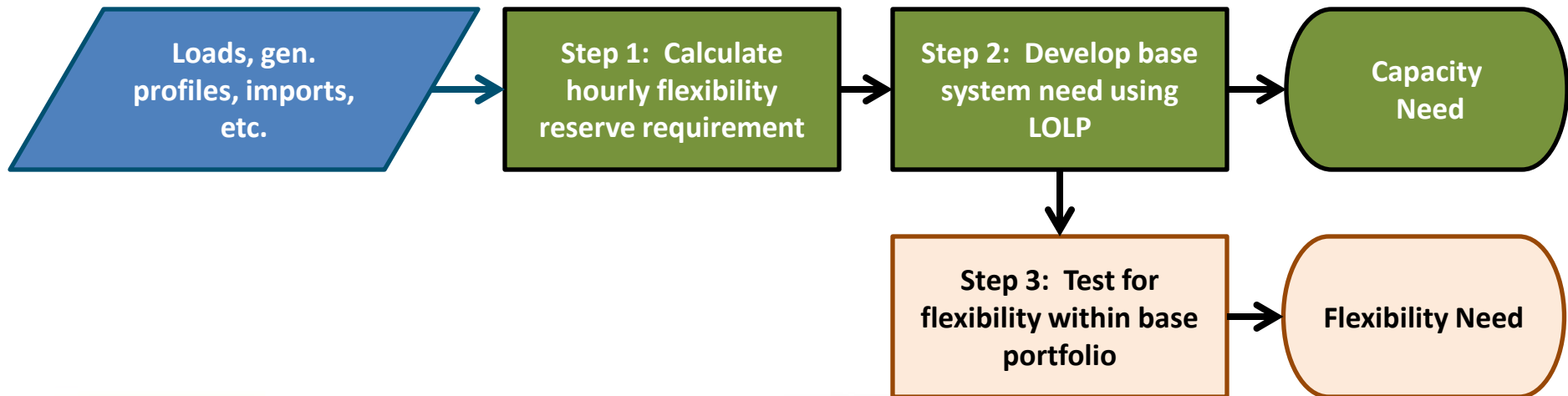


CAISO Proposed Approach Determine Need Based on Probability of Shortage

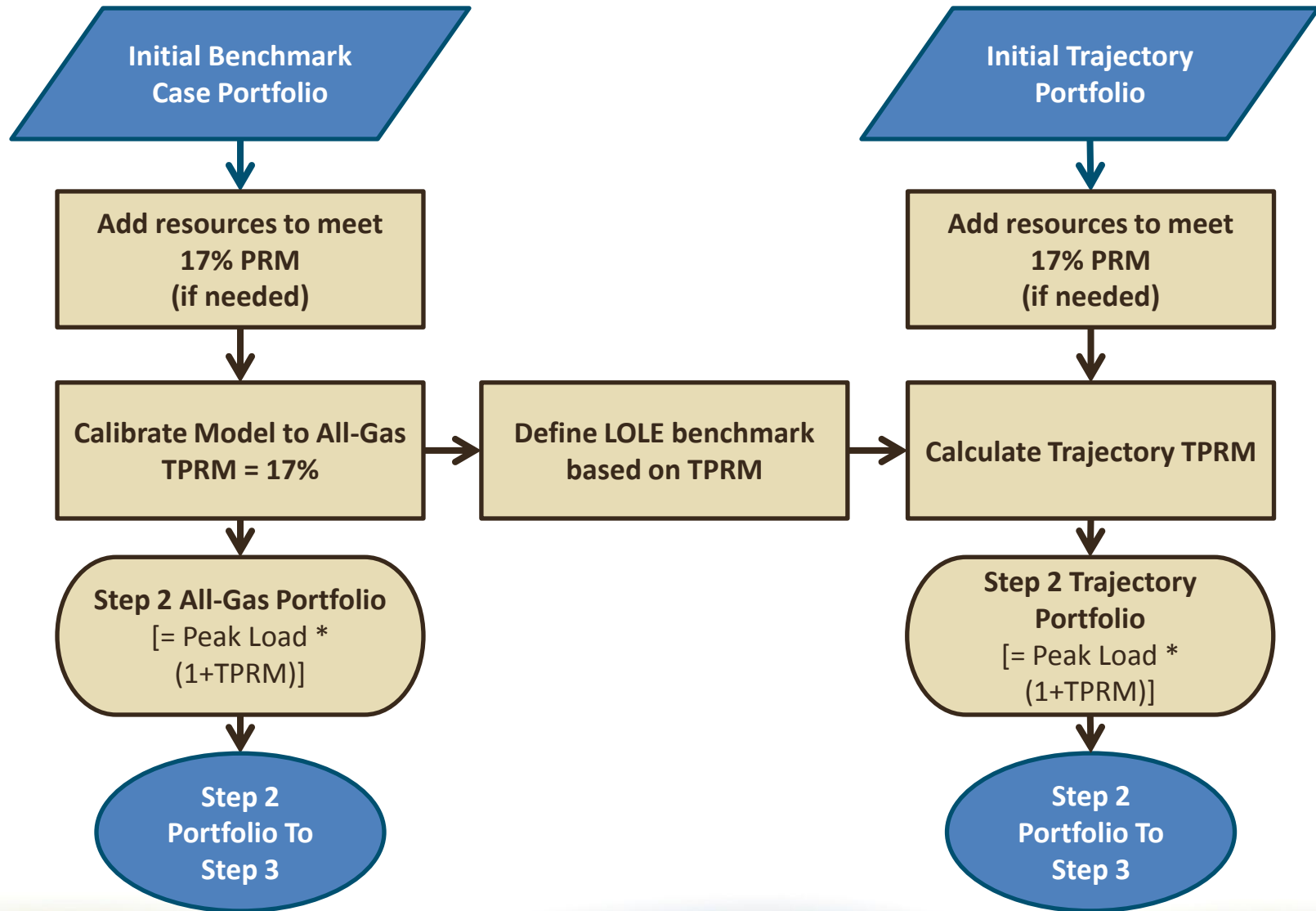
Previous Deterministic Methodology



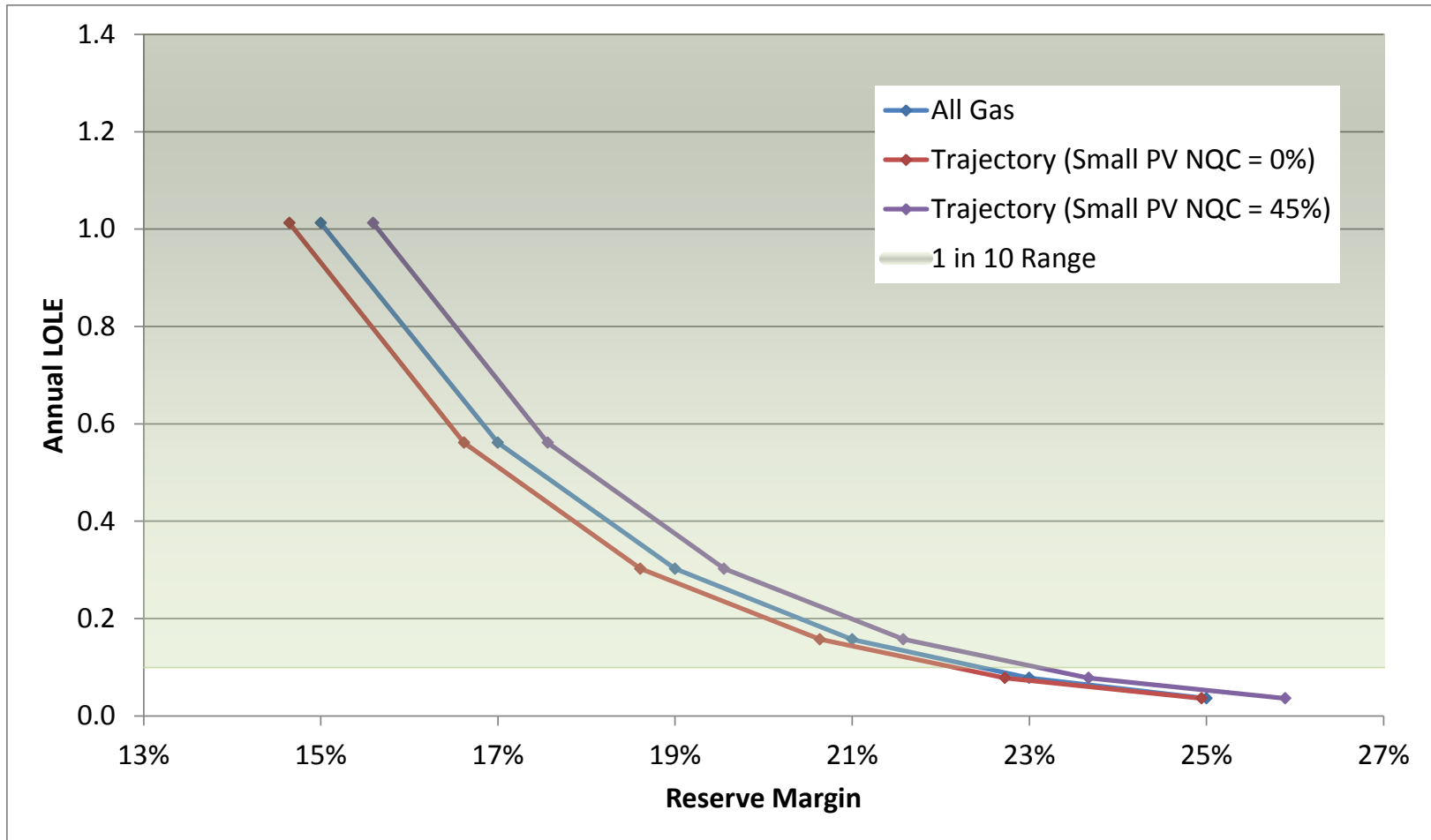
Proposed Stochastic Methodology



Step 2: Benchmark LOLP Performance

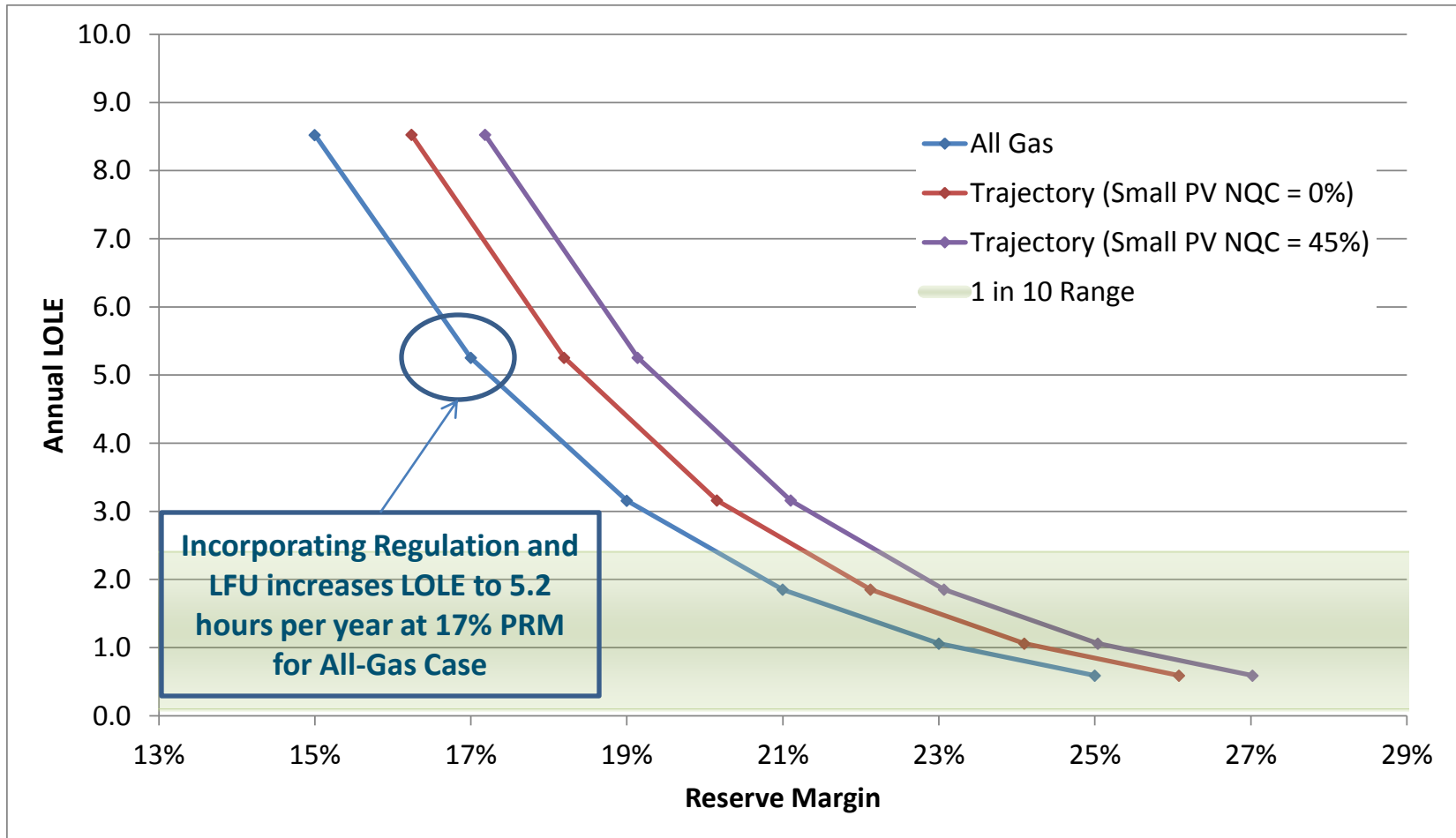


Preliminary LOLE Results without Load Following, Regulation, and 3% Operating Reserve using 1-in-2 Year Load*



• Note: Trajectory 1-in-2 year load adjusted up by 10% to account for underperformance of demand programs.
LOLE Analysis Performed by E3

Preliminary LOLE Results with Load Following, Regulation, and 3% Operating Reserve using 1-in-2 Year Load*



* Note: Trajectory 1-in-2 year load adjusted up by 10% to account for underperformance of demand programs.
 LOLE Analysis Performed by E3

Next Steps

- Complete stochastic analysis to determine probability of flexibility shortage and potential needs
- Review potential for over generation condition
- Evaluate alternatives to meet observed shortages