



Day-ahead market enhancements discussion

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Market Surveillance Committee Meeting

General Session

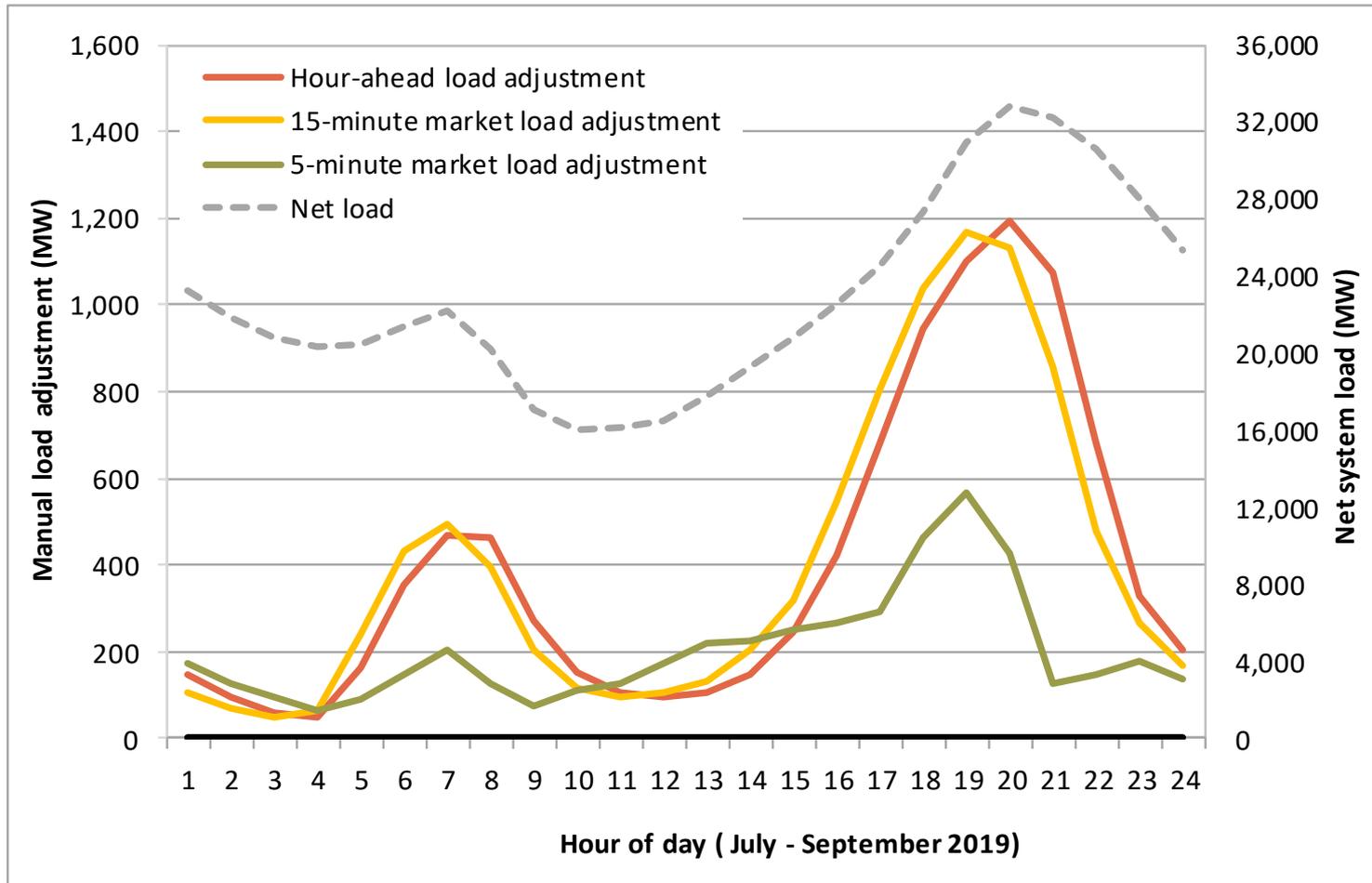
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ISO PUBLIC

CAISO real-time flexible ramping product overview

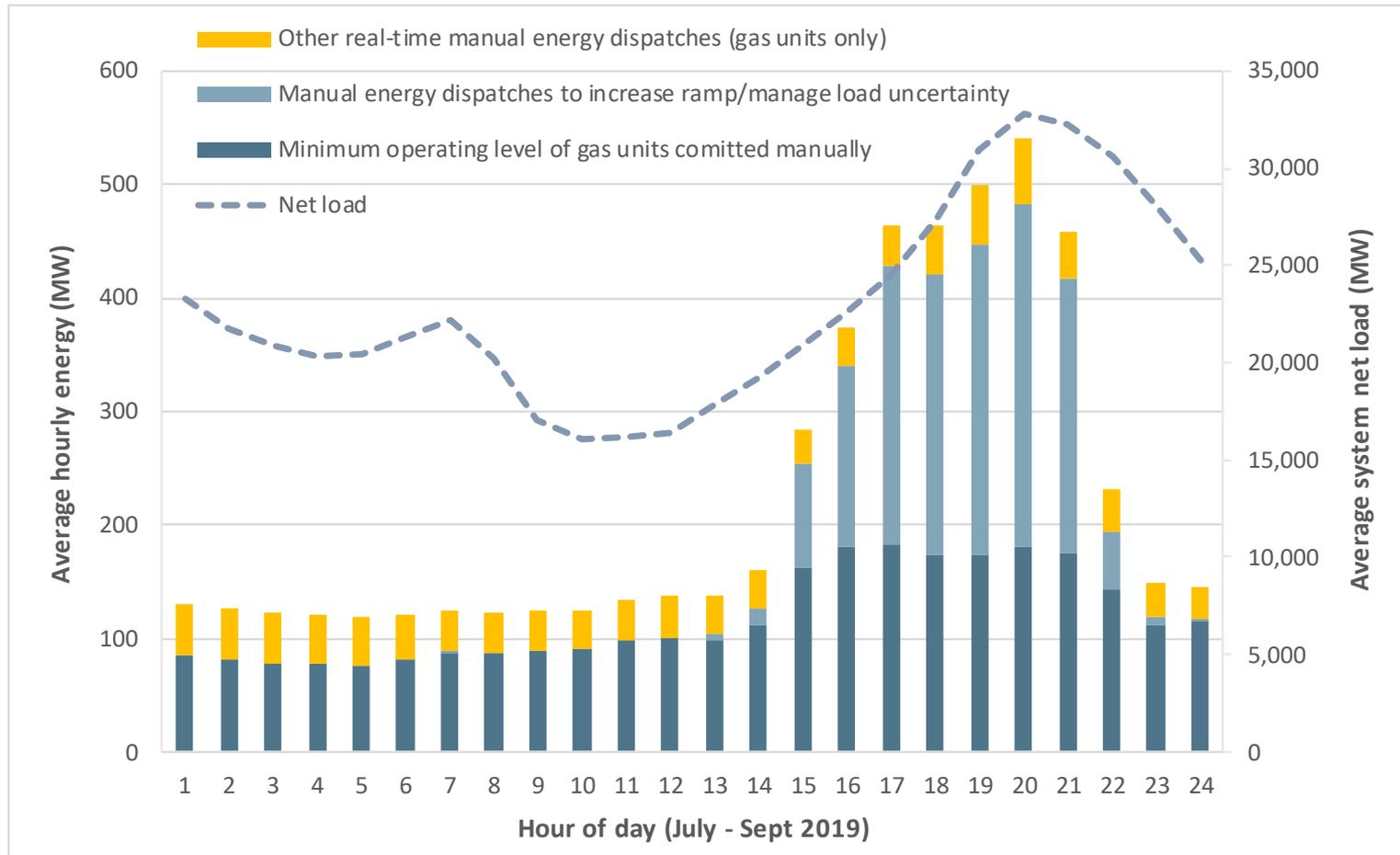
- Commits and dispatches resources to position fleet to meet uncertainty over what net load will be “15 minutes” from current interval
 - Flexible capacity paid marginal cost to objective function of making capacity available
- Design enhancements are needed:
- Locational procurement
 - Aimed at reducing “stranded flex ramp” in areas that cannot be used due to transmission limits.
 - CAISO addressing in current stakeholder initiative.
- Incorporate uncertainty about what net load will be 1 to 4 hours out from current real-time market run
 - This presentation explains this recommendation and implications for imbalance reserves product

To increase upward ramping capacity, CAISO grid operators make significant upward adjustments to the demand for energy used by the real-time market software to dispatch bids.

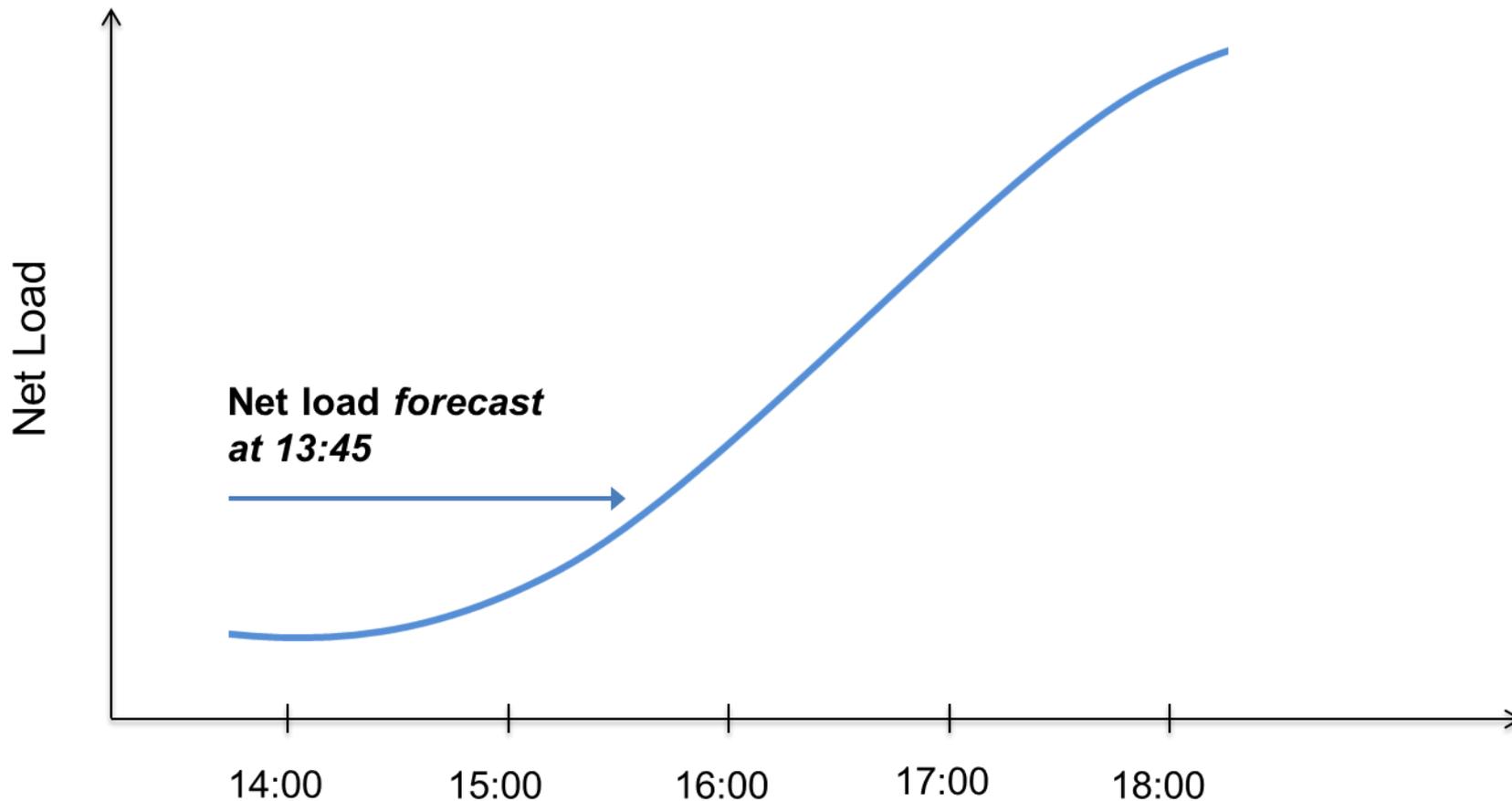


CAISO operators also commit extra gas-fired capacity after day-ahead market and ramp units up in real-time to create more upward ramping capacity.

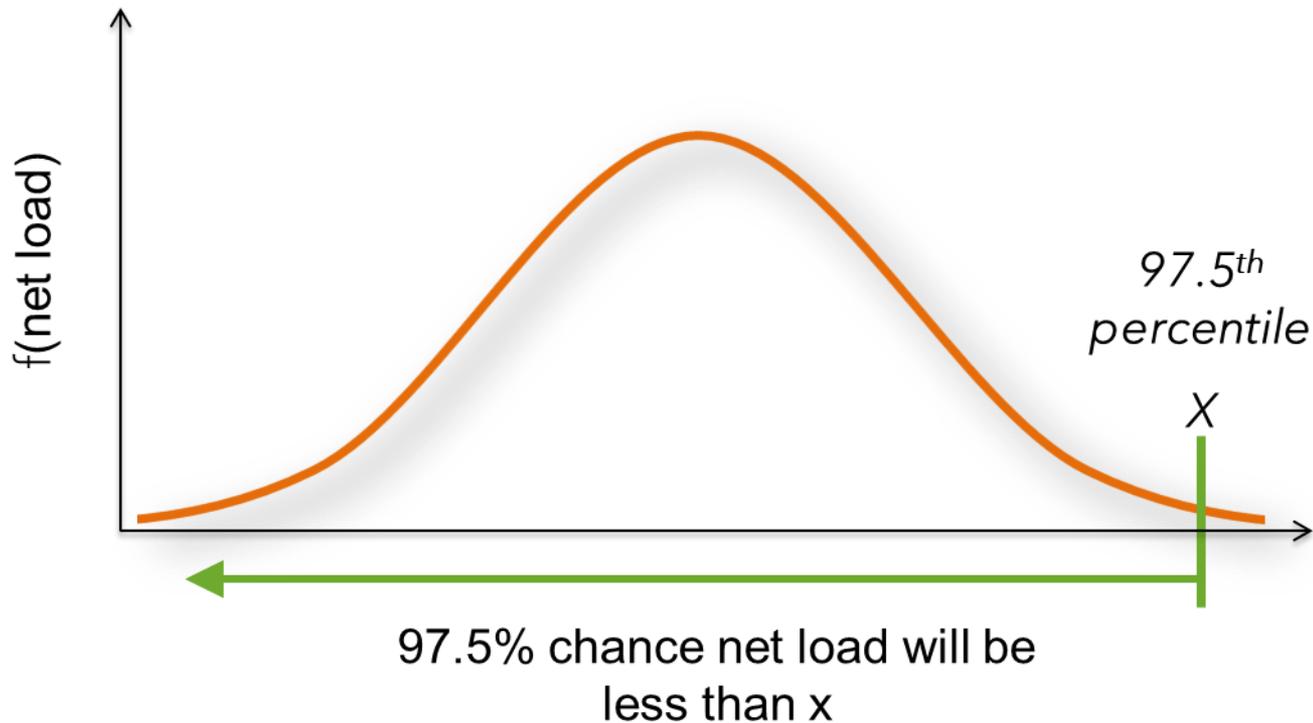
These are referred to as ***out-of-market*** or ***exceptional dispatches***.



In real-time, the market software uses net load forecast for every interval up to 4.5 hours in future to determine optimal schedules at the current interval (e.g. 13:45 in this example).

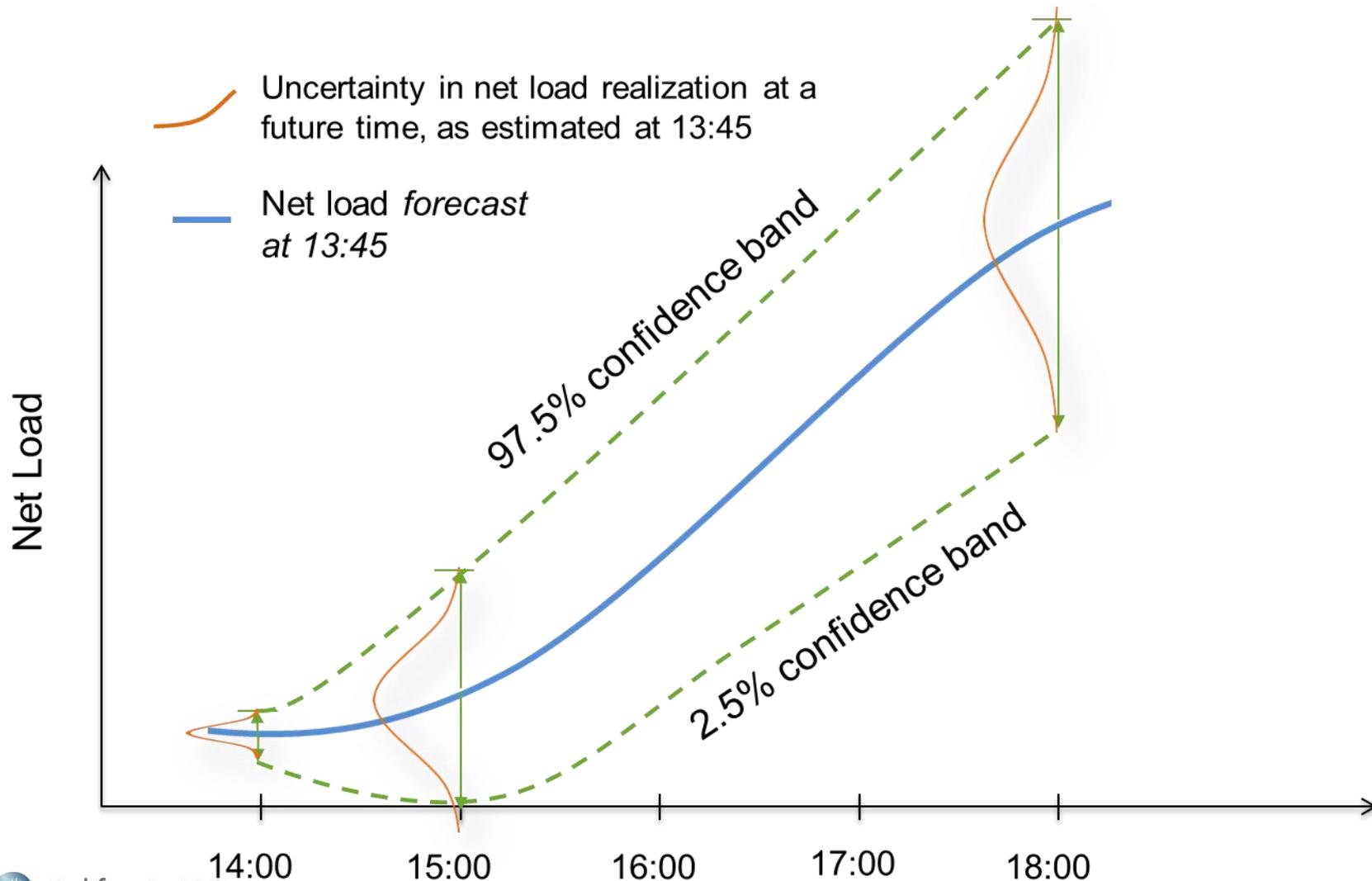


Picturing uncertainty: *probability density functions*

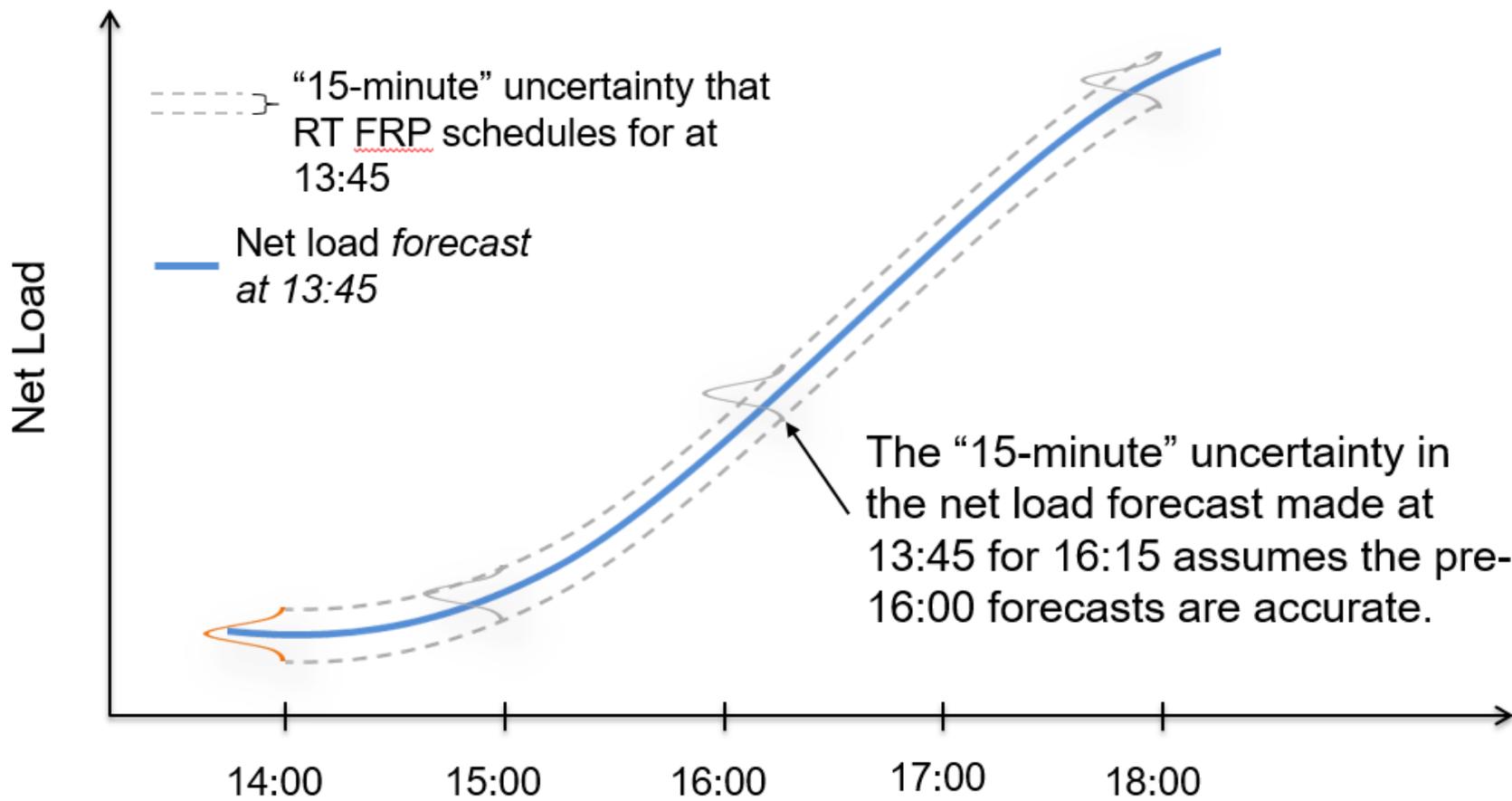


- At a given point in time, net load at a time in the future is a random variable with a range of uncertainty that can be characterized by a *probability density function*.
- A wider probability density function indicates wider range of uncertainty.
- CAISO characterizes upper end of range of possible outcomes using 97.5th percentile.

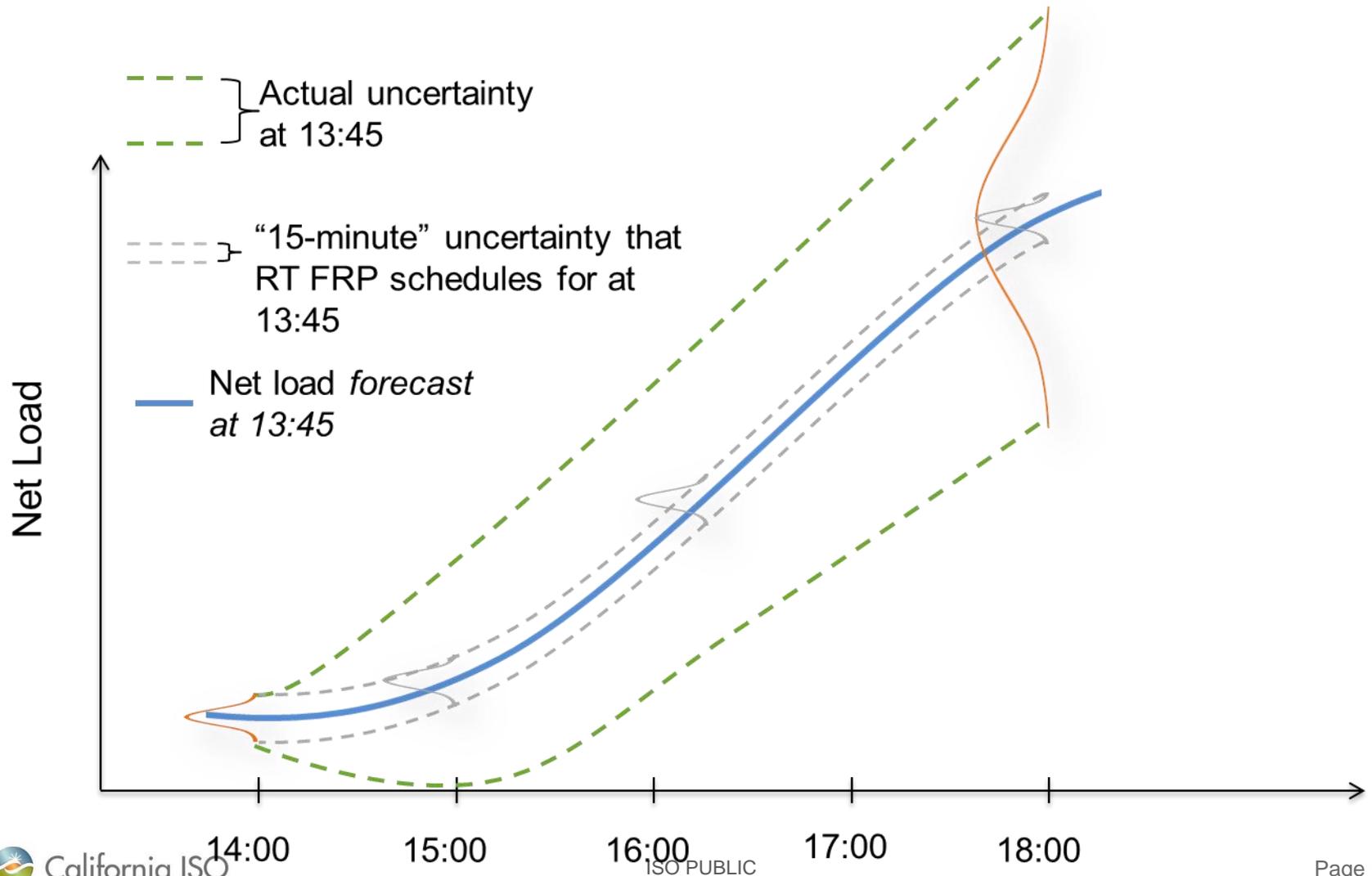
At 13:45 the uncertainty over what net load may actually be at each point in time over the next 4.5 hours grows further out in the future.



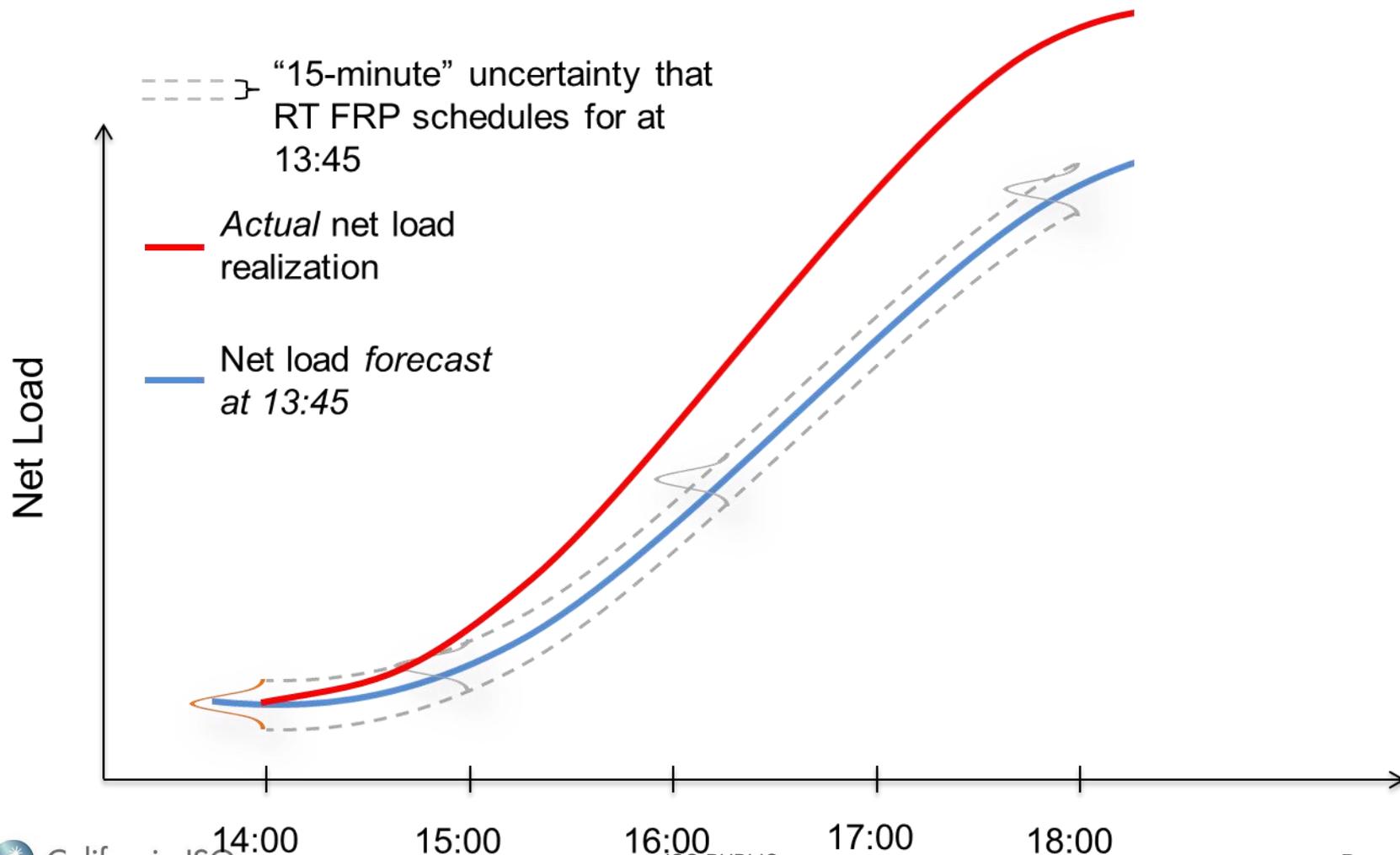
Flexible ramping product has improved real-time software by considering some uncertainty around the net load forecast for every interval 4.5 hours in future used to determine optimal schedules at the current interval.



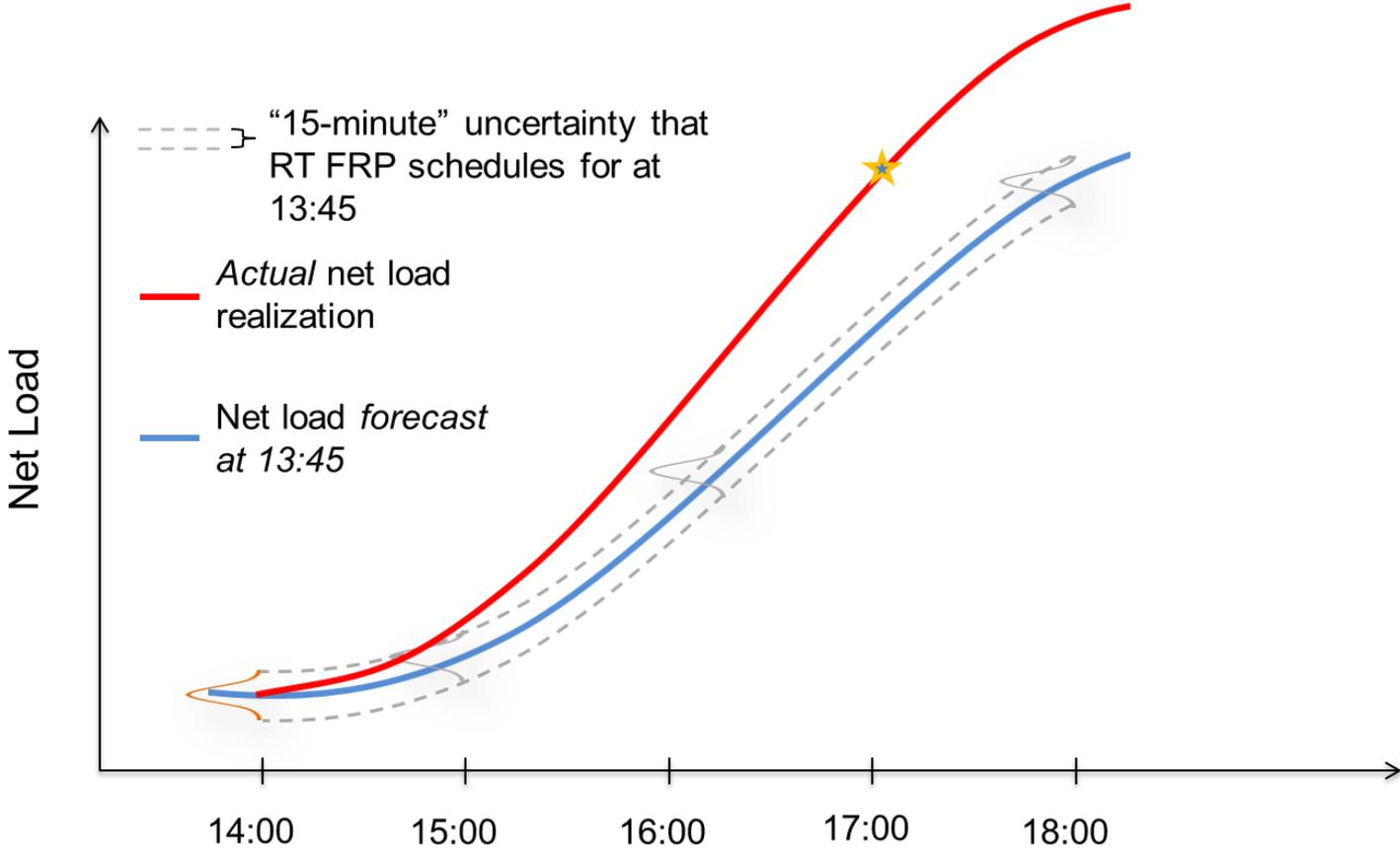
The “15 minute” uncertainty used by FRP is substantially less than actual uncertainty over what net load forecast may be 1 to 4 hours in future



The real-time market software does not optimally position resource fleet to meet potential high net load outcomes 1 to 4 hours in the future.

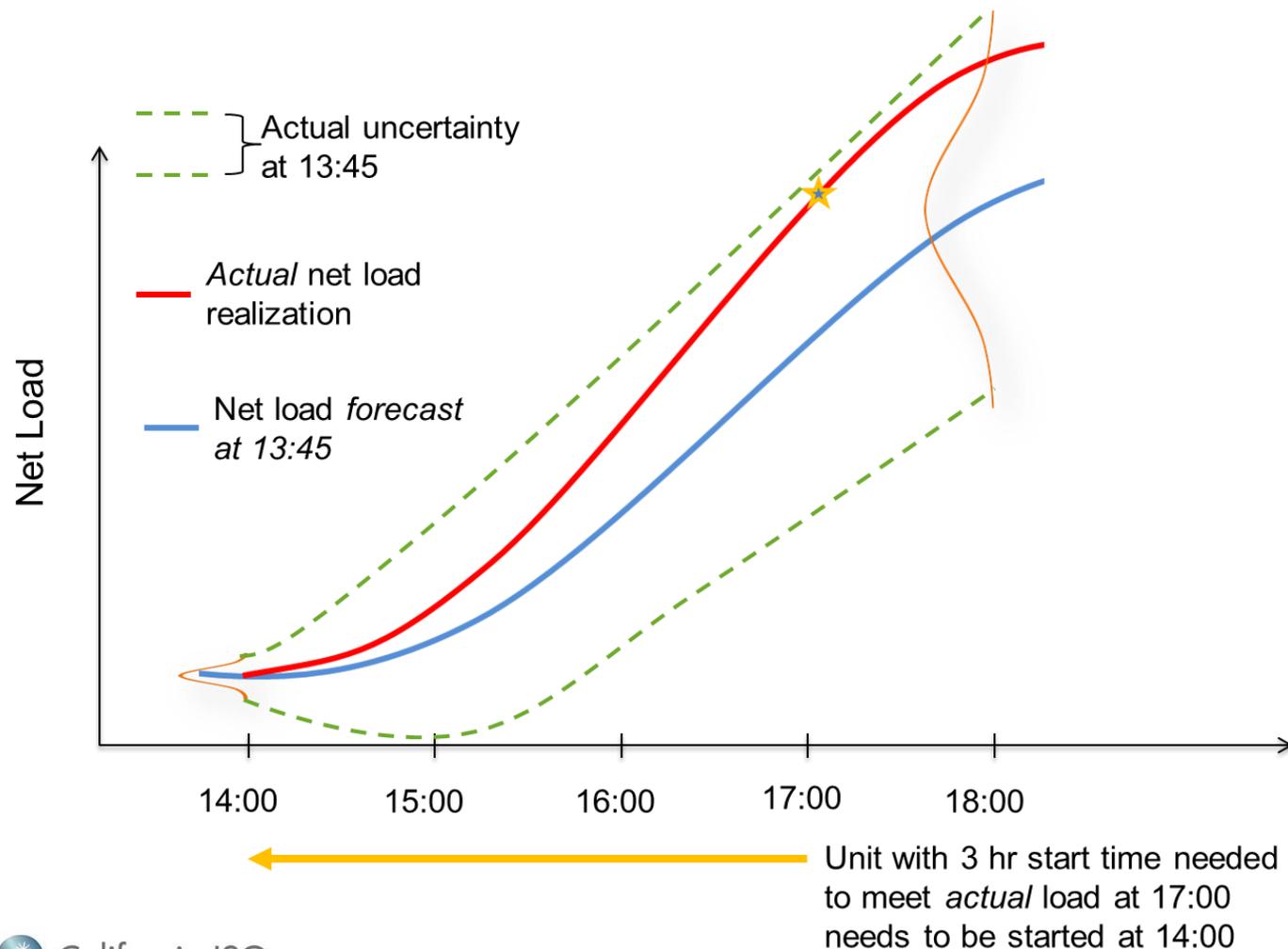


For example, software will miss opportunity to start units with 3 hour start times that are needed by 17:00 to meet potential high net load outcomes—requires manual operator interventions



← Unit with 3 hr start time needed to meet actual load at 17:00 needs to be started at 14:00

Considering actual net load uncertainty 1 to 4 hours in future would allow the real-time software to position resources to meet higher potential net load outcomes.



Procuring flexible capacity in day-ahead market does not solve problem

- CAISO is currently designing “imbalance reserves” product—ramping capacity in day-ahead market to address uncertainty in net load between day-ahead and real-time.
- Real-time market re-optimizes DAM schedules and most DAM commitments
- If real-time flexible ramping product is not enhanced to consider uncertainty 1 to 4 hours out, manual operator interventions still required in real-time.
- Regional day-ahead market: Real-time manual operator interventions in one BAA will be required to preserve imbalance reserves for another BAA.