

WESTERN ENERGY IMBALANCE MARKET

Enhancing the flexible ramping product to better address net load uncertainty

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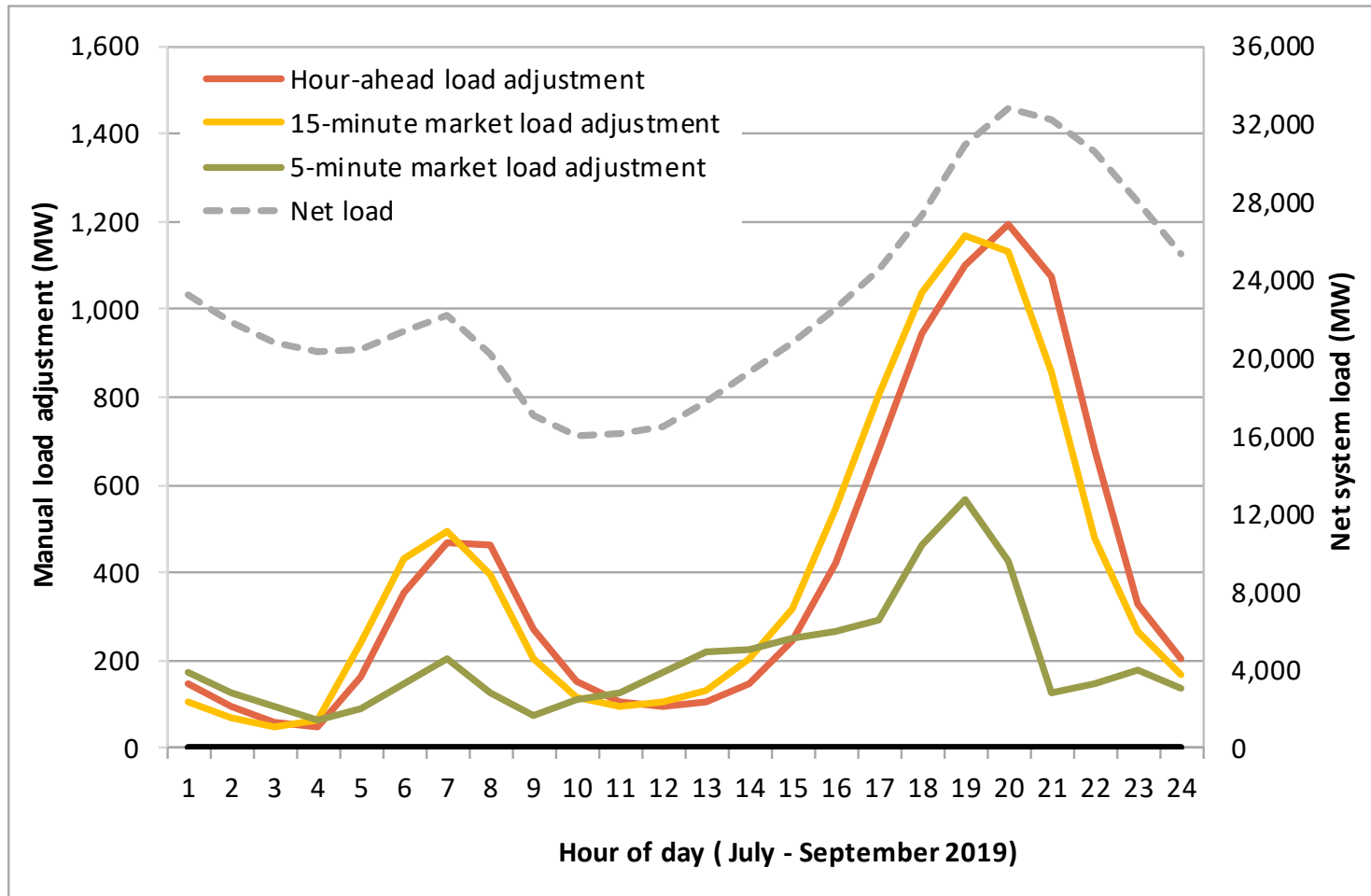
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DMM has made 3 major recommendations for improving initial flexible ramping product design

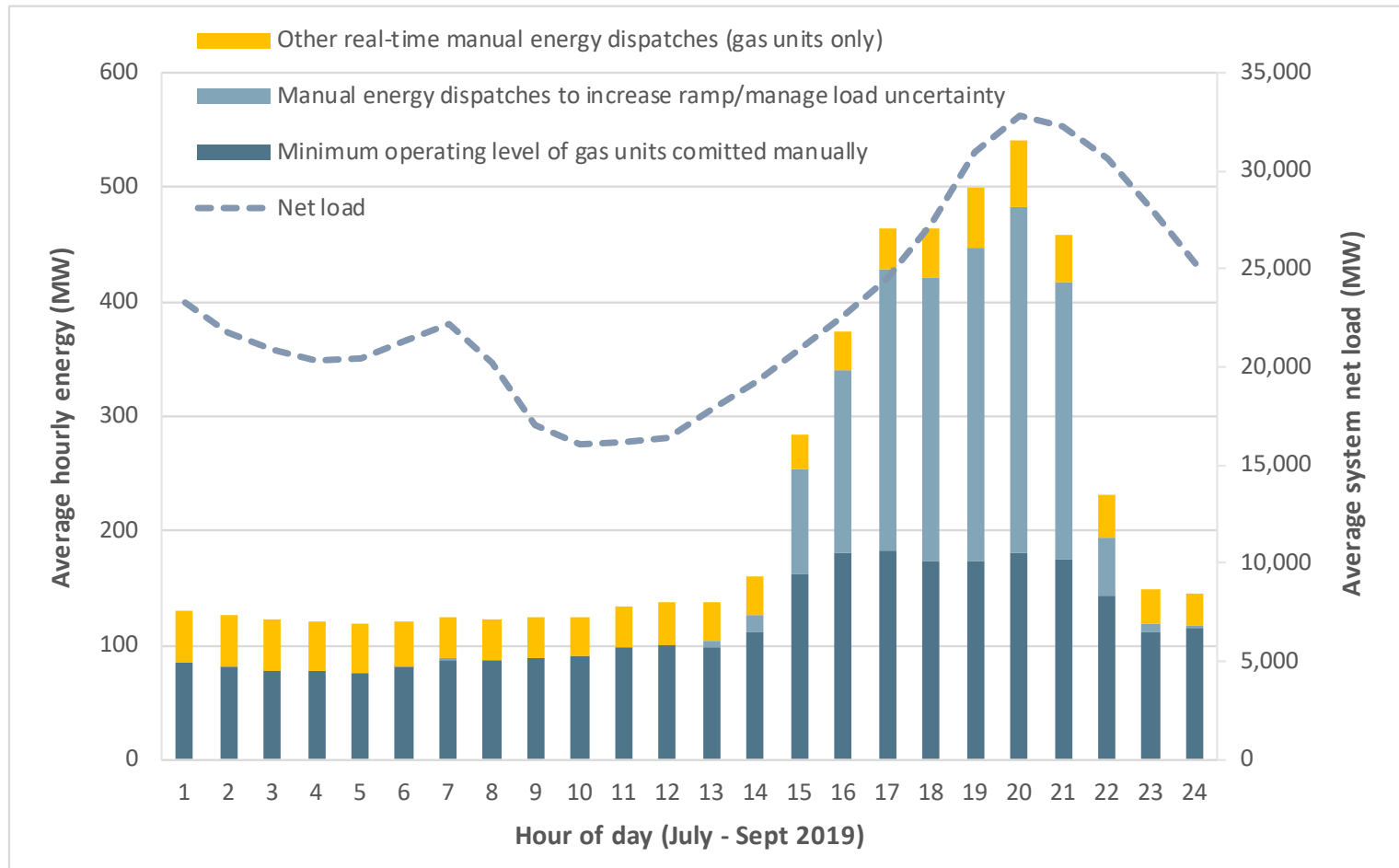
1. Locational → account for transmission constraints
 - ✓ Being addressed in current FRP initiative
 - ✓ DMM supports the most recent proposal
2. Procure flexible capacity in day-ahead market
 - ✓ CAISO is developing design in day-ahead market enhancements initiative
3. Incorporate uncertainty about what net load will be 1 to 4 hours out from current real-time market run
 - Purpose of today's talk: Explain this recommendation

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.

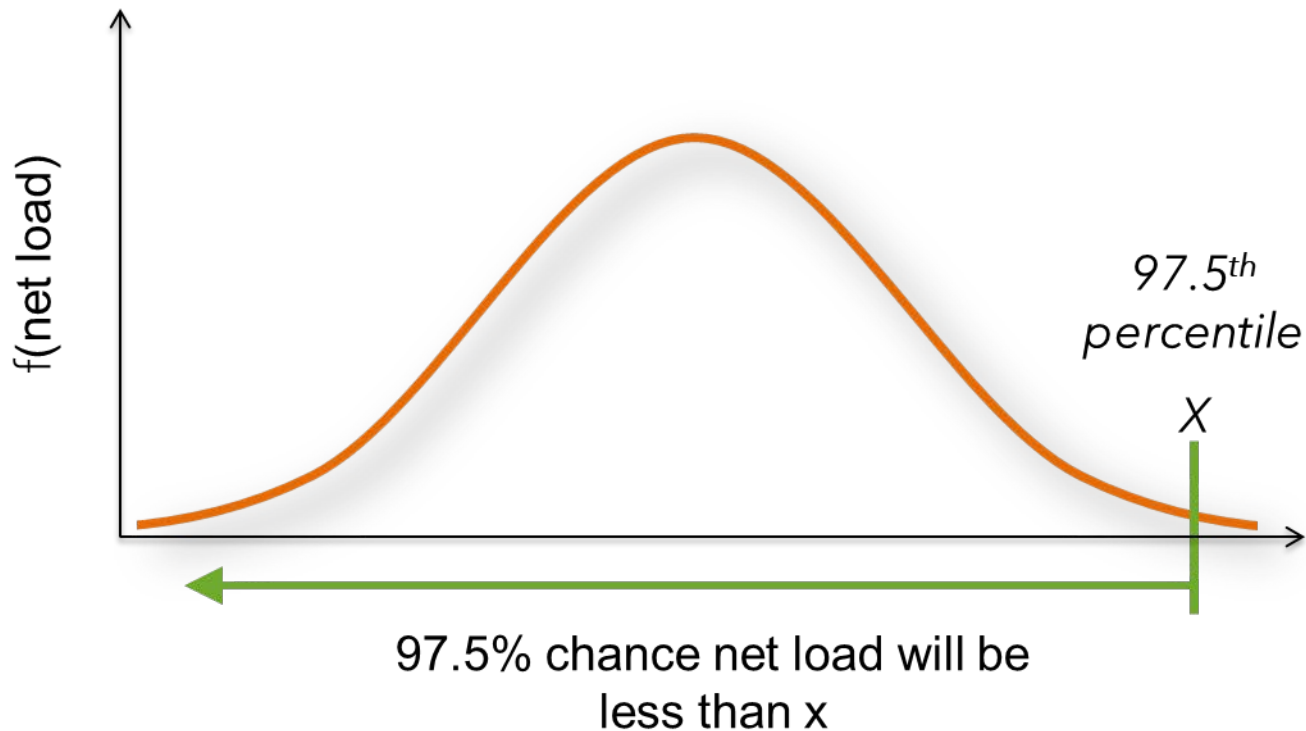


CAISO operators also commit extra gas-fired capacity after day-ahead market and ramp units up in real-time to create more upward ramping capacity.

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

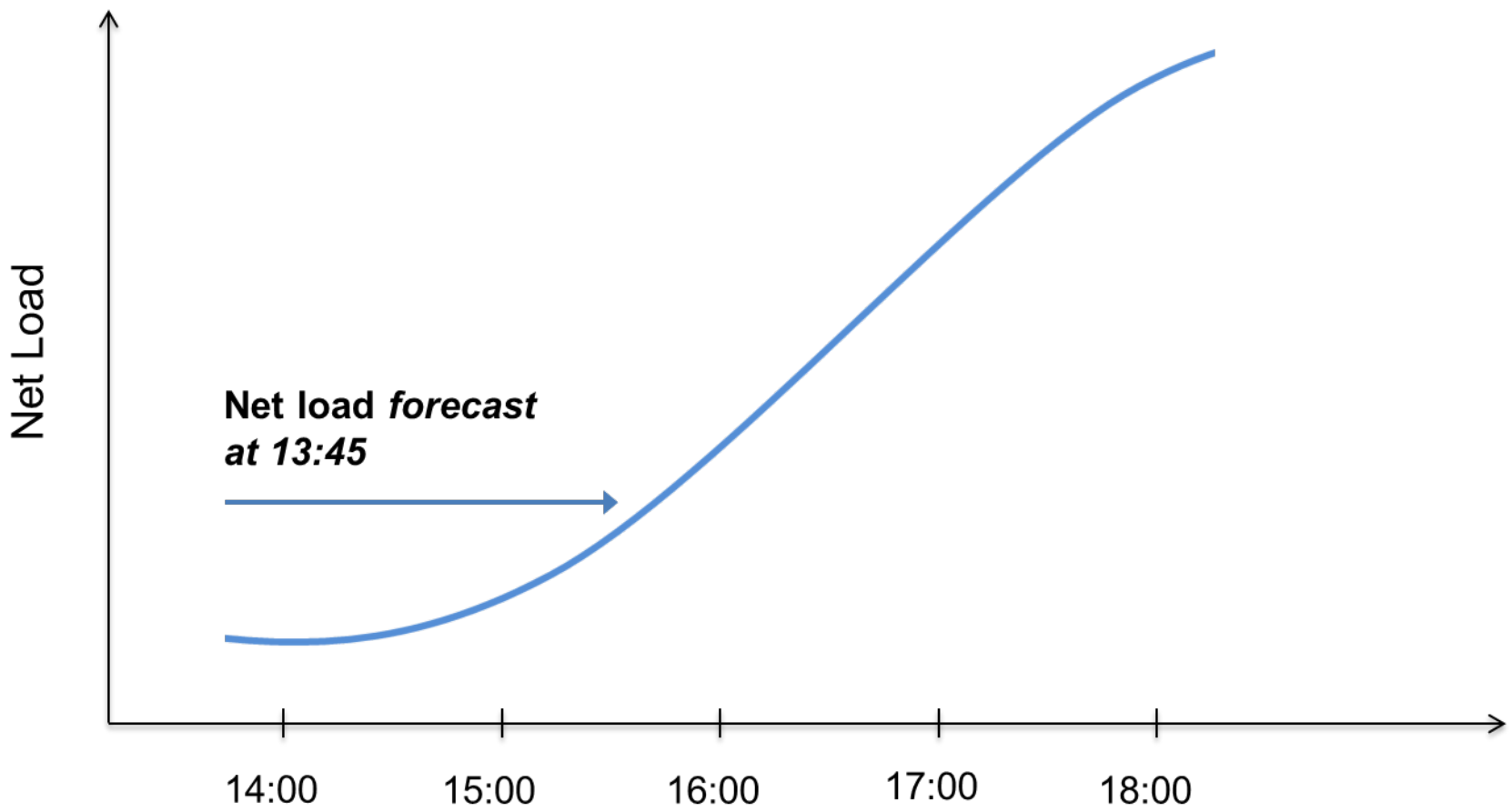


Picturing uncertainty: *probability density functions*

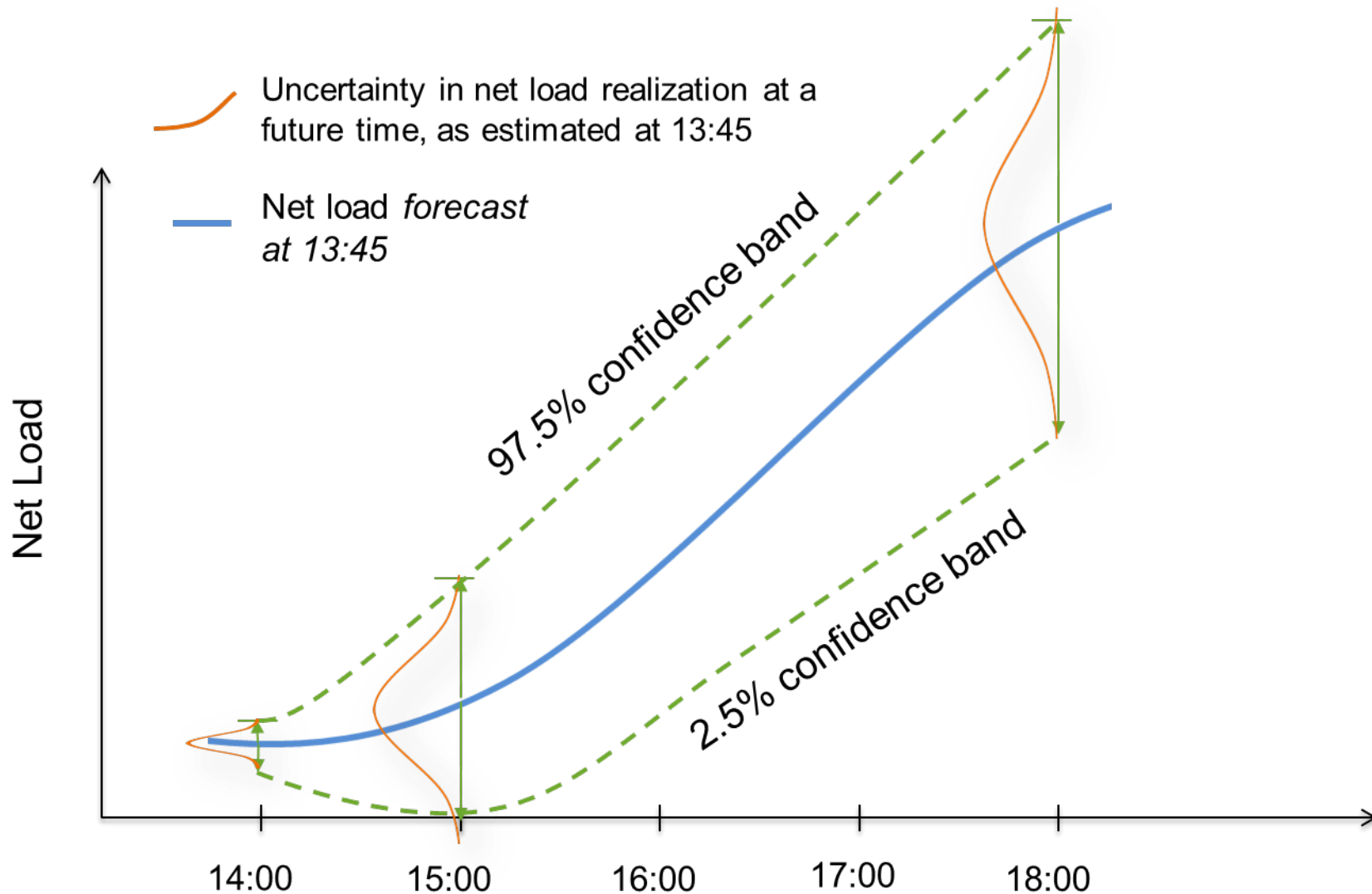


- At a given point in time, net load at a time in the future is a random variable with a range of uncertainty that can be characterized by a *probability density function*.
- A wider probability density function indicates wider range of uncertainty.
- CAISO characterizes upper end of range of possible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

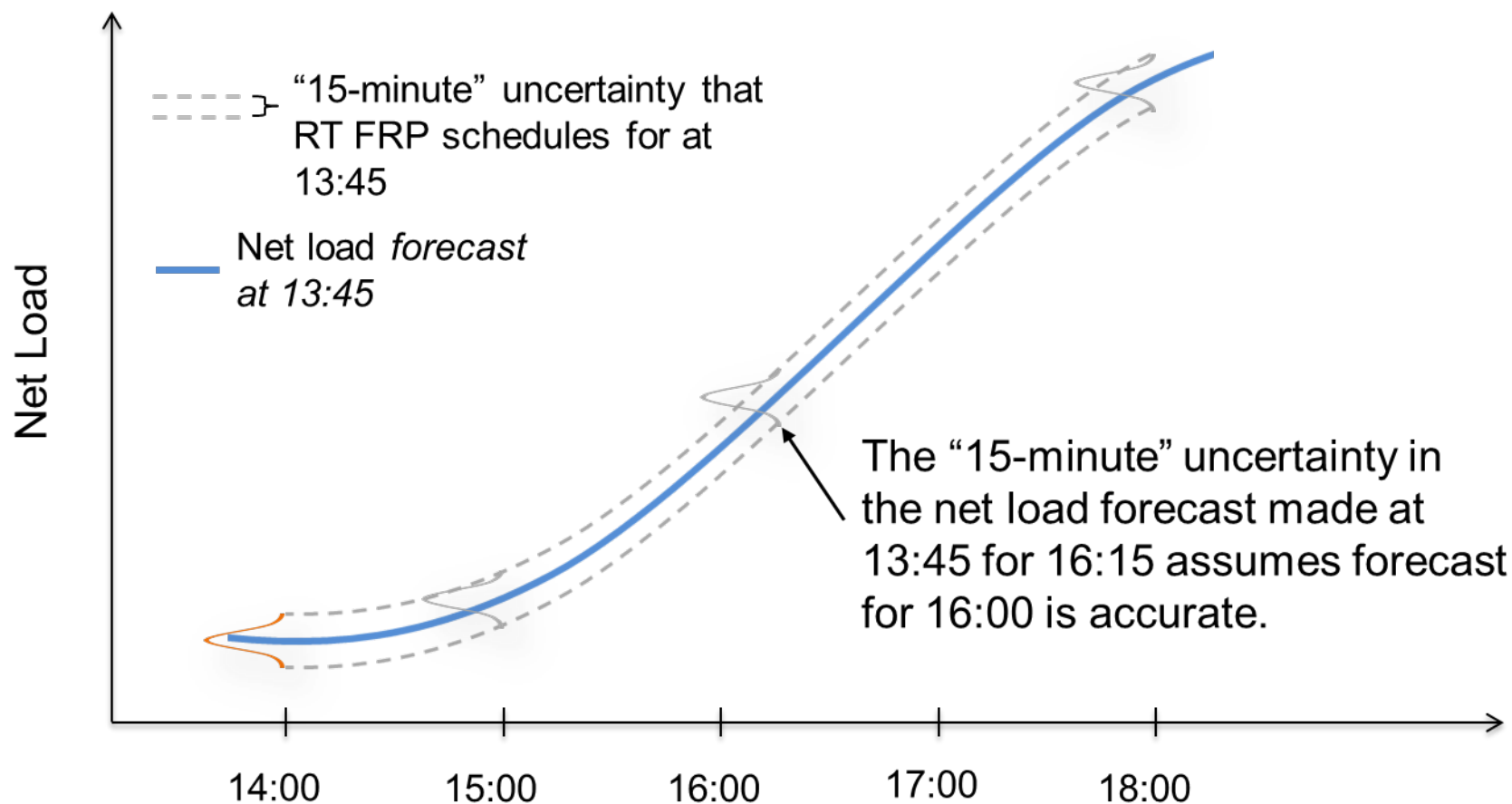
In real-time, the market software uses net load forecast for every interval up to 4.5 hours in future to determine optimal schedules at the current interval (e.g. 13:45 in this example).



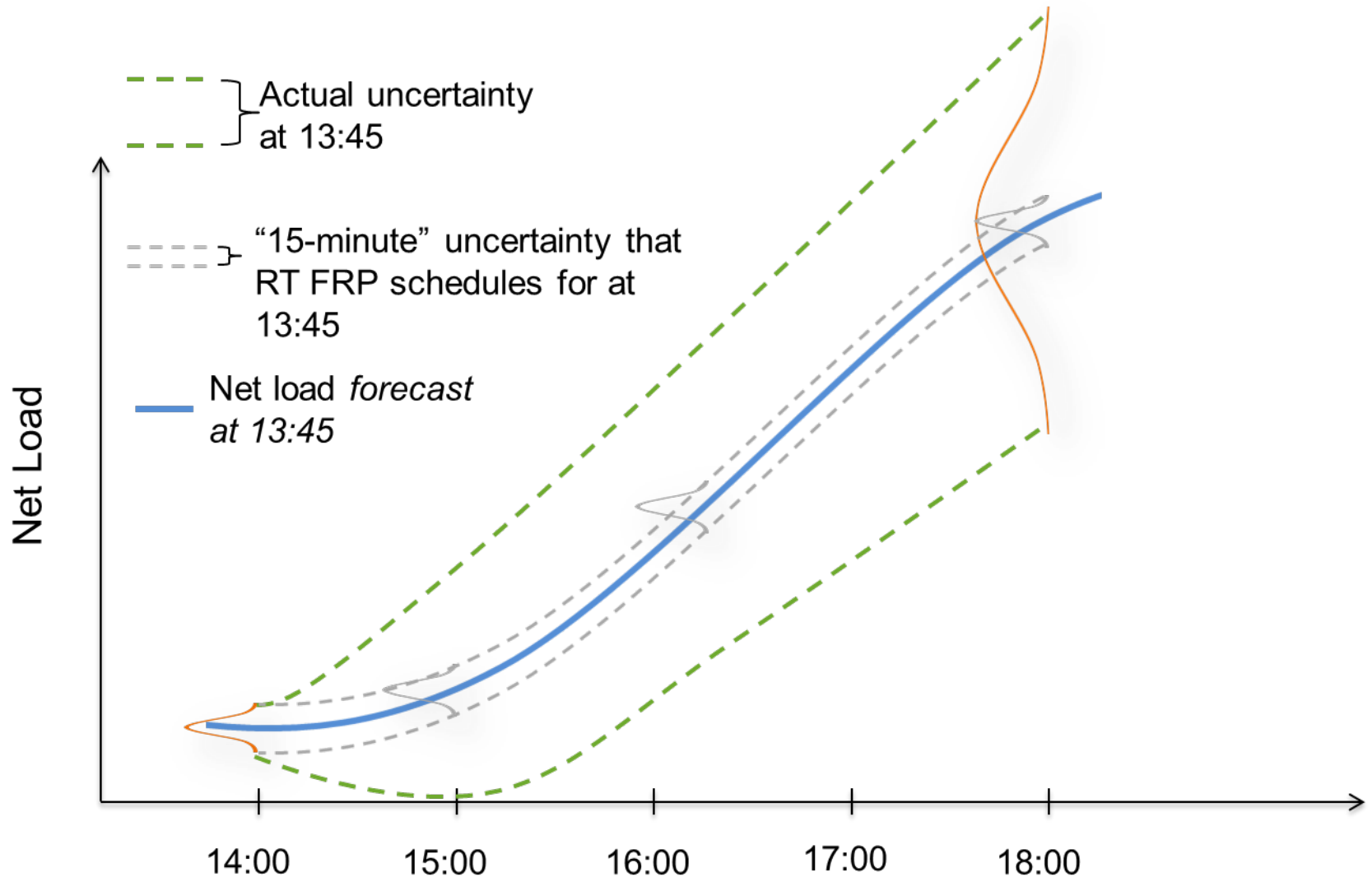
At 13:45 the uncertainty over what net load may actually be at each point in time over the next 4.5 hours grows further out in the future.



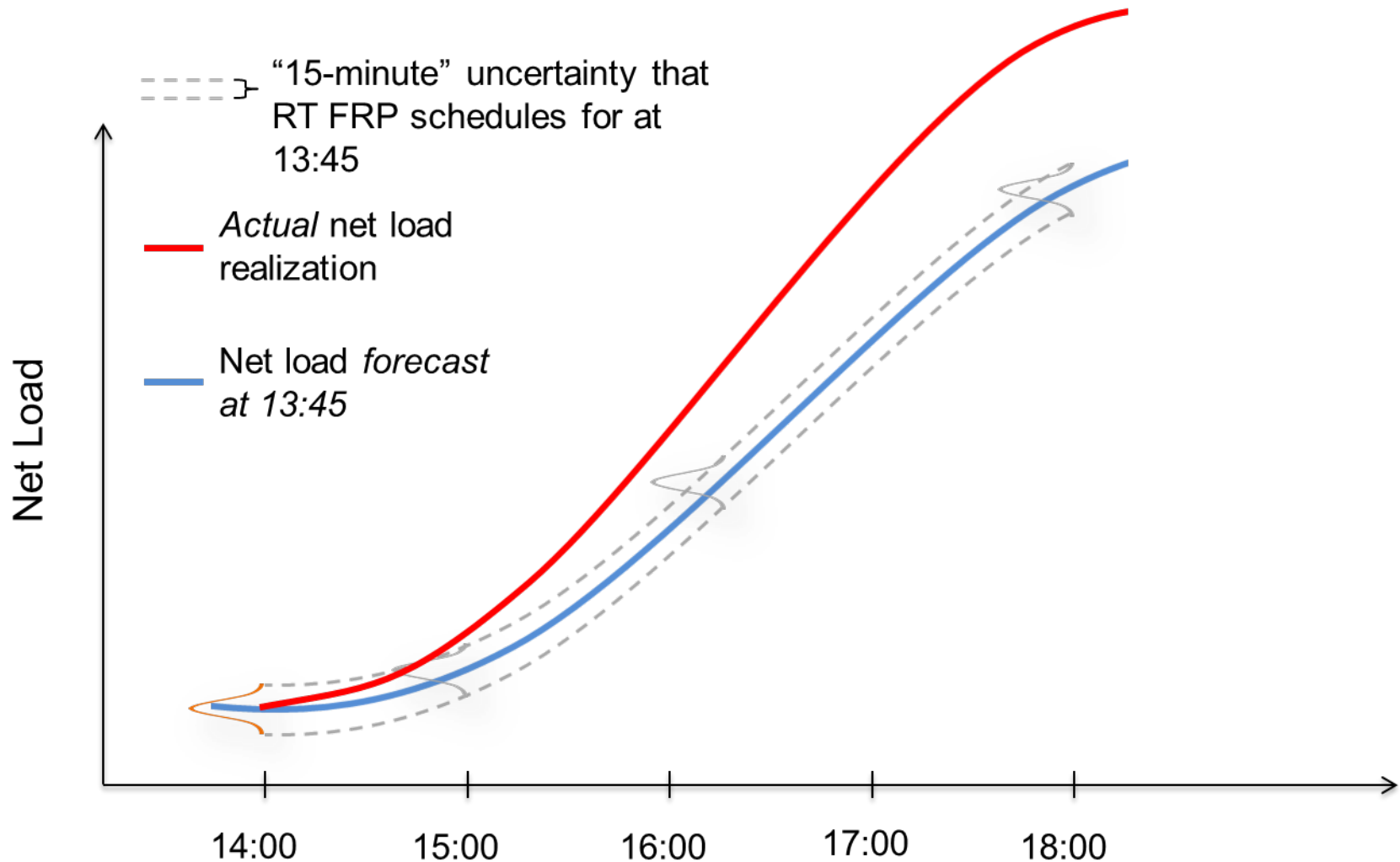
Flexible ramping product has improved real-time software by considering some uncertainty around the net load forecast for every interval 4.5 hours in future used to determine optimal schedules at the current interval.



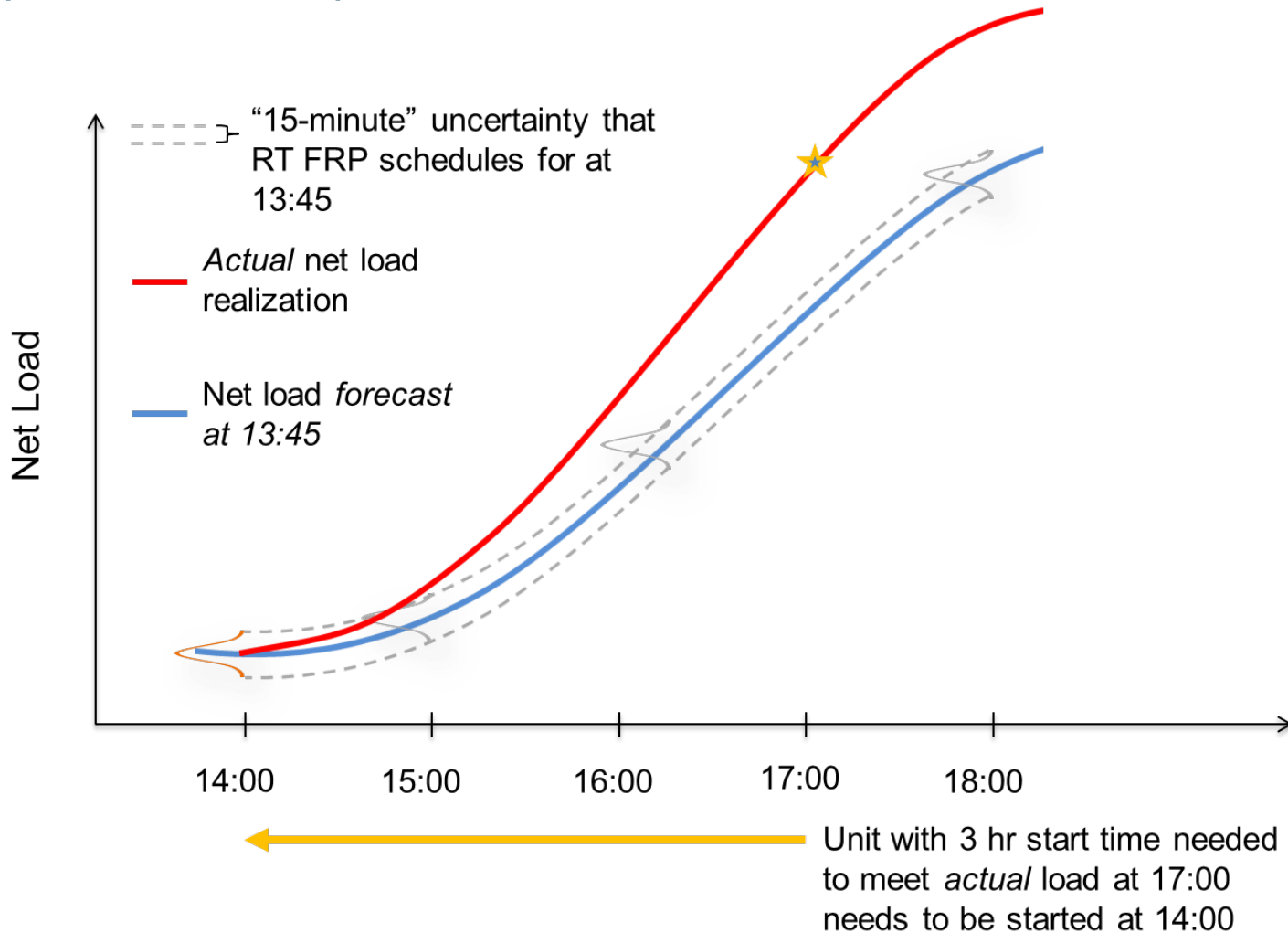
The “15 minute” uncertainty used by FRP is substantially less than actual uncertainty over what net load forecast may be 1 to 4 hours in future



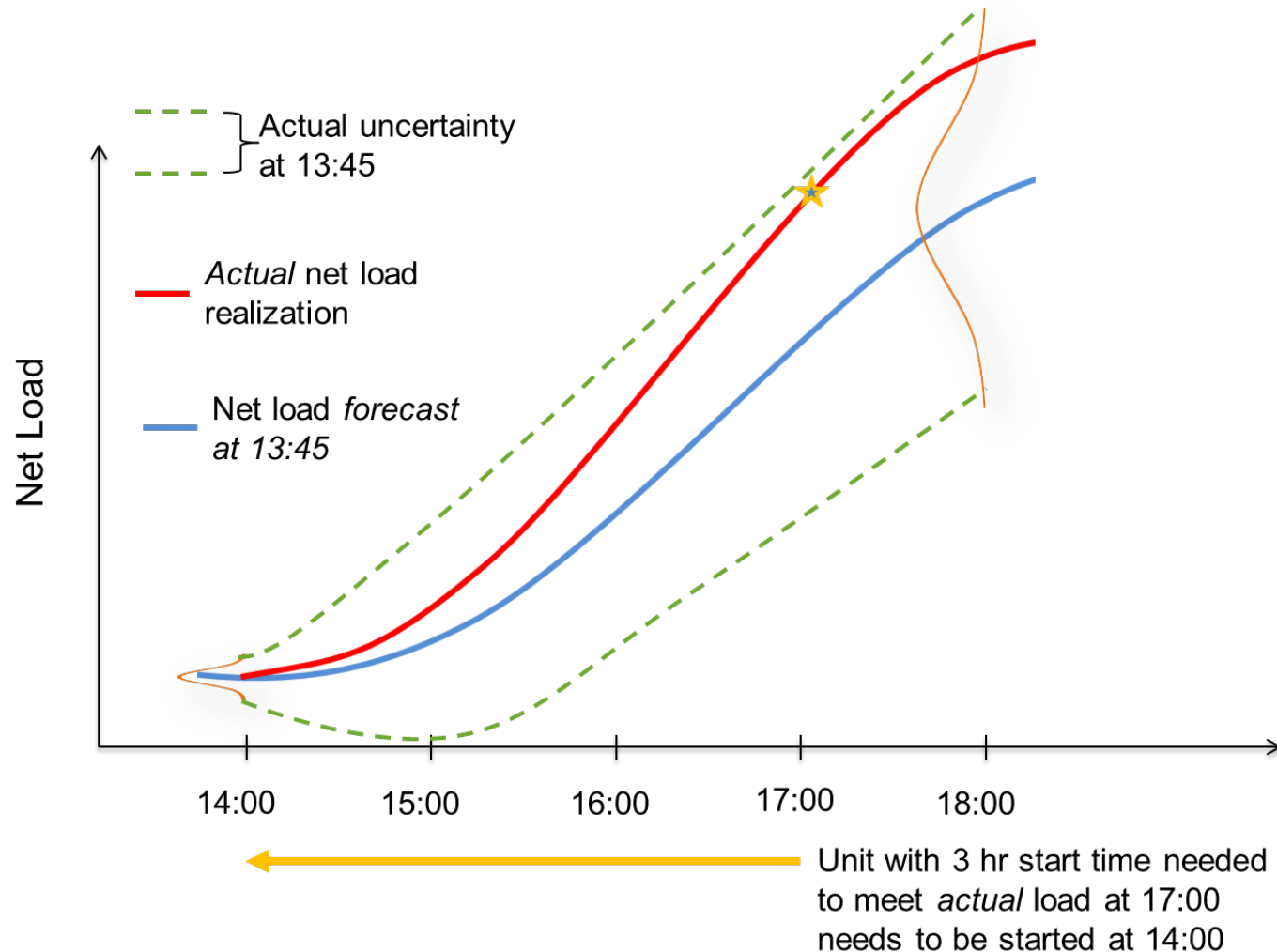
The real-time market software does not optimally position resource fleet to meet potential high net load outcomes 1 to 4 hours in the future.



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



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.



For questions, comments, or more information:

- Department of Market Monitoring website:
 - <http://www.caiso.com/market/Pages/MarketMonitoring/Default.aspx>
- DMM quarterly and annual reports
 - <http://www.caiso.com/market/Pages/MarketMonitoring/AnnualQuarterlyReports/Default.aspx>
- DMM comments on 2020 market design initiatives
 - <http://www.caiso.com/Pages/documentsbygroup.aspx?GroupID=E0E702C8-DC83-4625-98E2-36230535B44A>
- Email for Ryan Kurlinski
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