



# Recommendation to increase the FRP uncertainty horizon

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## DMM has recommended extending FRP uncertainty time horizon since 2018

*“ISO could reduce the need for manual load adjustments and more efficiently integrate distributed and variable energy resources by designing a real-time flexible ramping product that could procure and price the appropriate amount of ramping capability to account for uncertainty over longer time horizons than the current product design considers.*

*—Recommendation from DMM’s 2018 annual report*

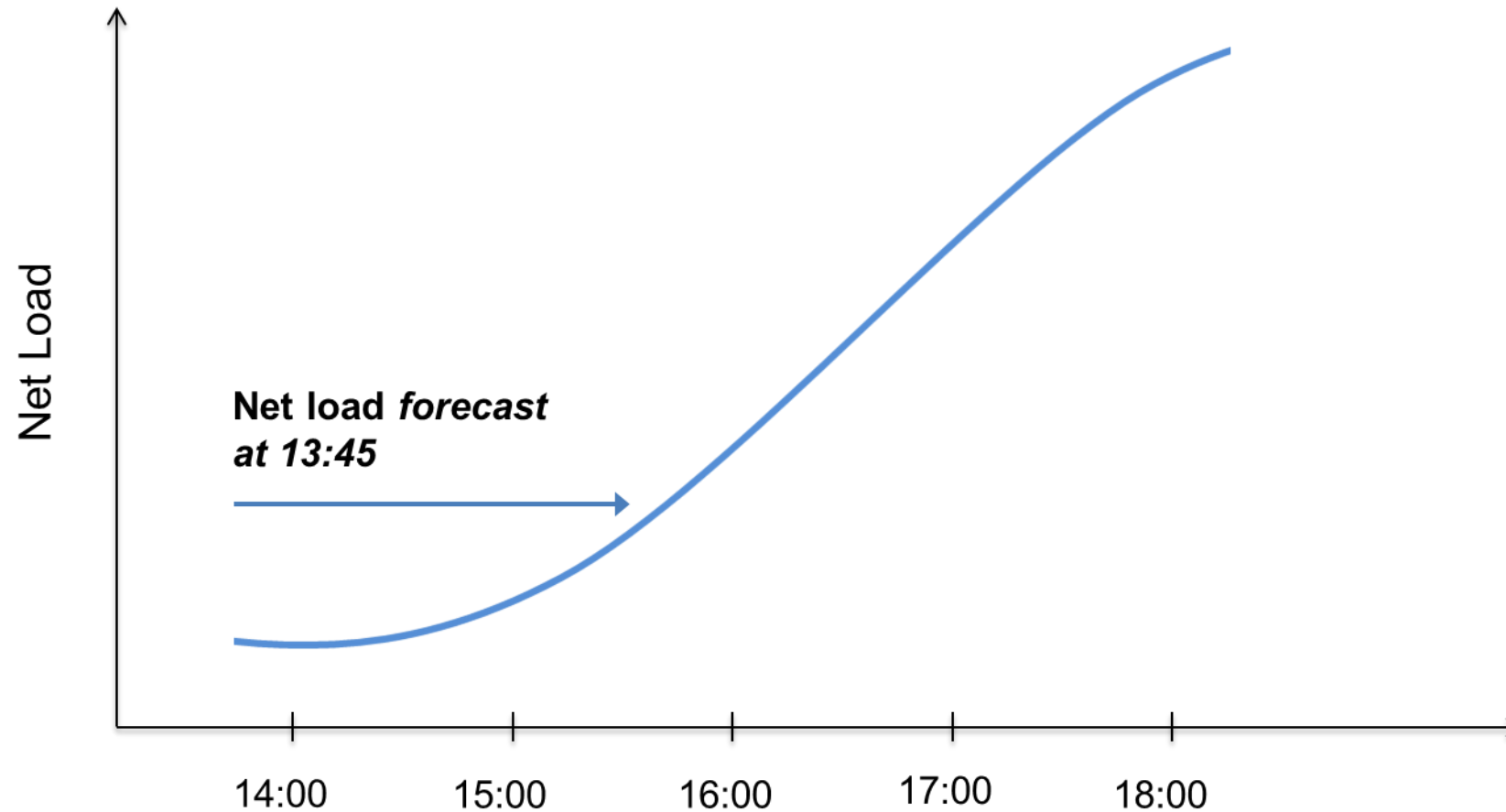
*“DMM continues to recommend that the California ISO develop an approach for extending the time horizon of the flexible ramping product to account for uncertainty over longer time horizons. The current product is designed to address uncertainty between both the 15-minute and 5-minute markets. In real time, grid operators face significant uncertainty about loads and resources over a longer timeframe (e.g., 30, 60, and 120 minutes from the current market interval). The range of uncertainty increases over longer time horizons.”*

*—Recommendation from DMM’s 2021 annual report*

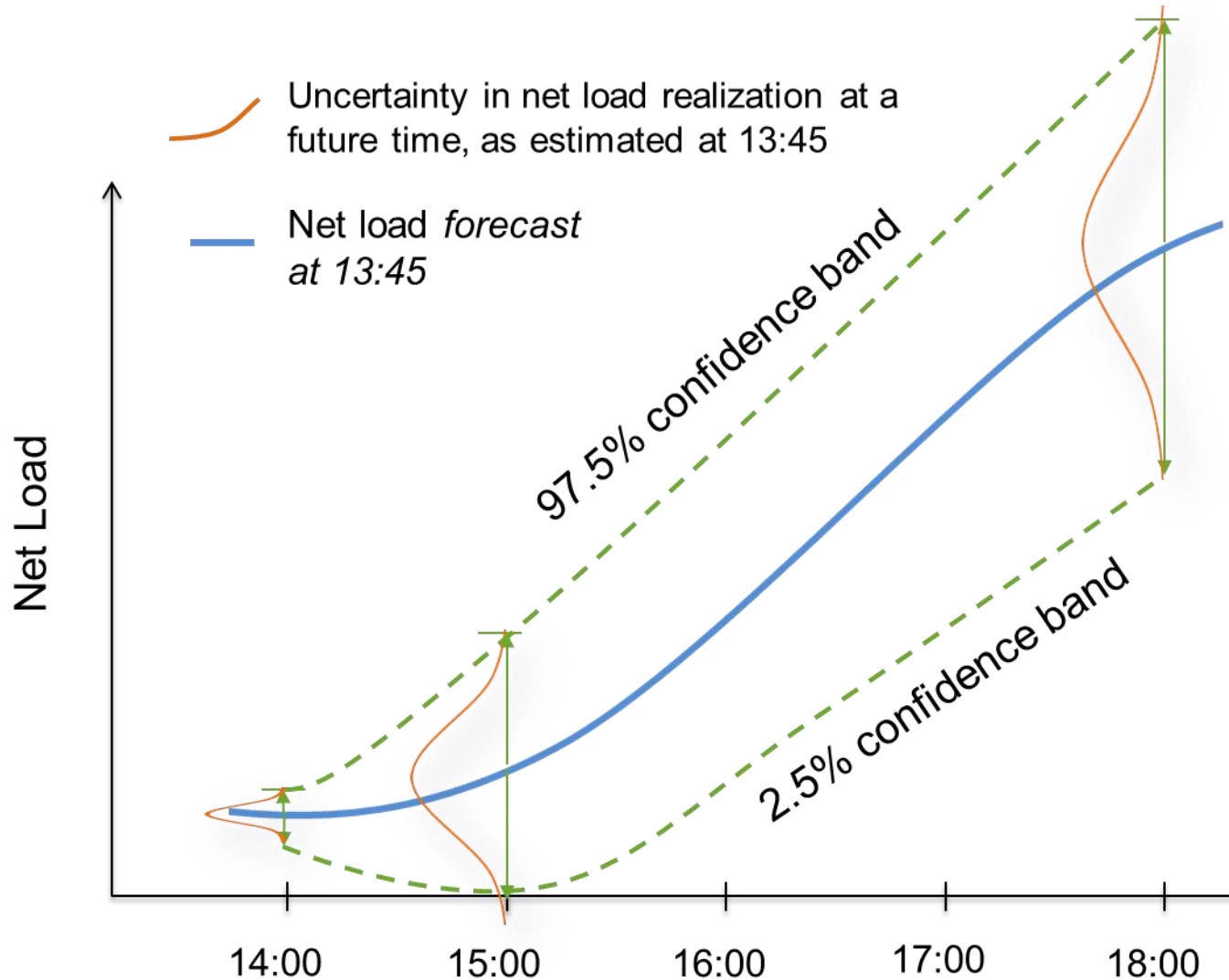
# Overview of issue

Short horizon for considering uncertainty

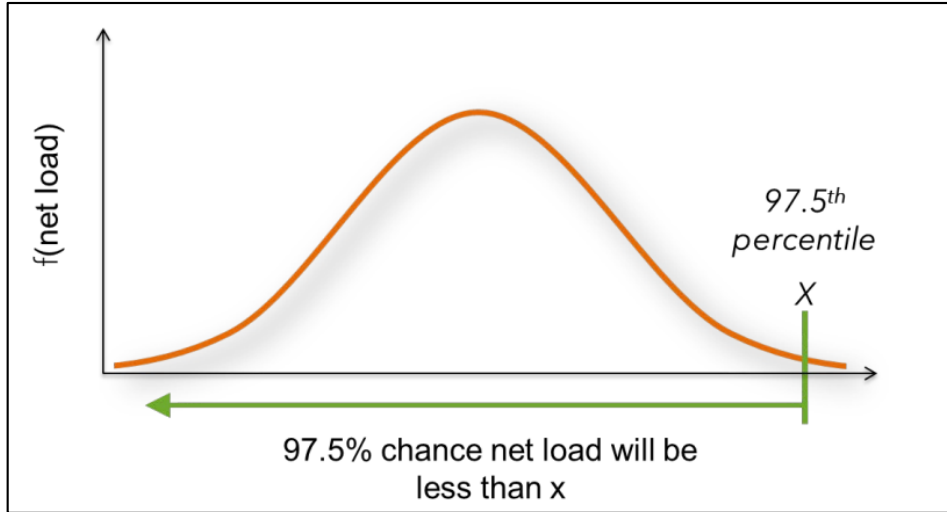
In real-time, the market software uses net load forecast for every interval up to 4.5 hours in future to determine optimal schedules at the current interval (e.g. 13:45 in this example).



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.

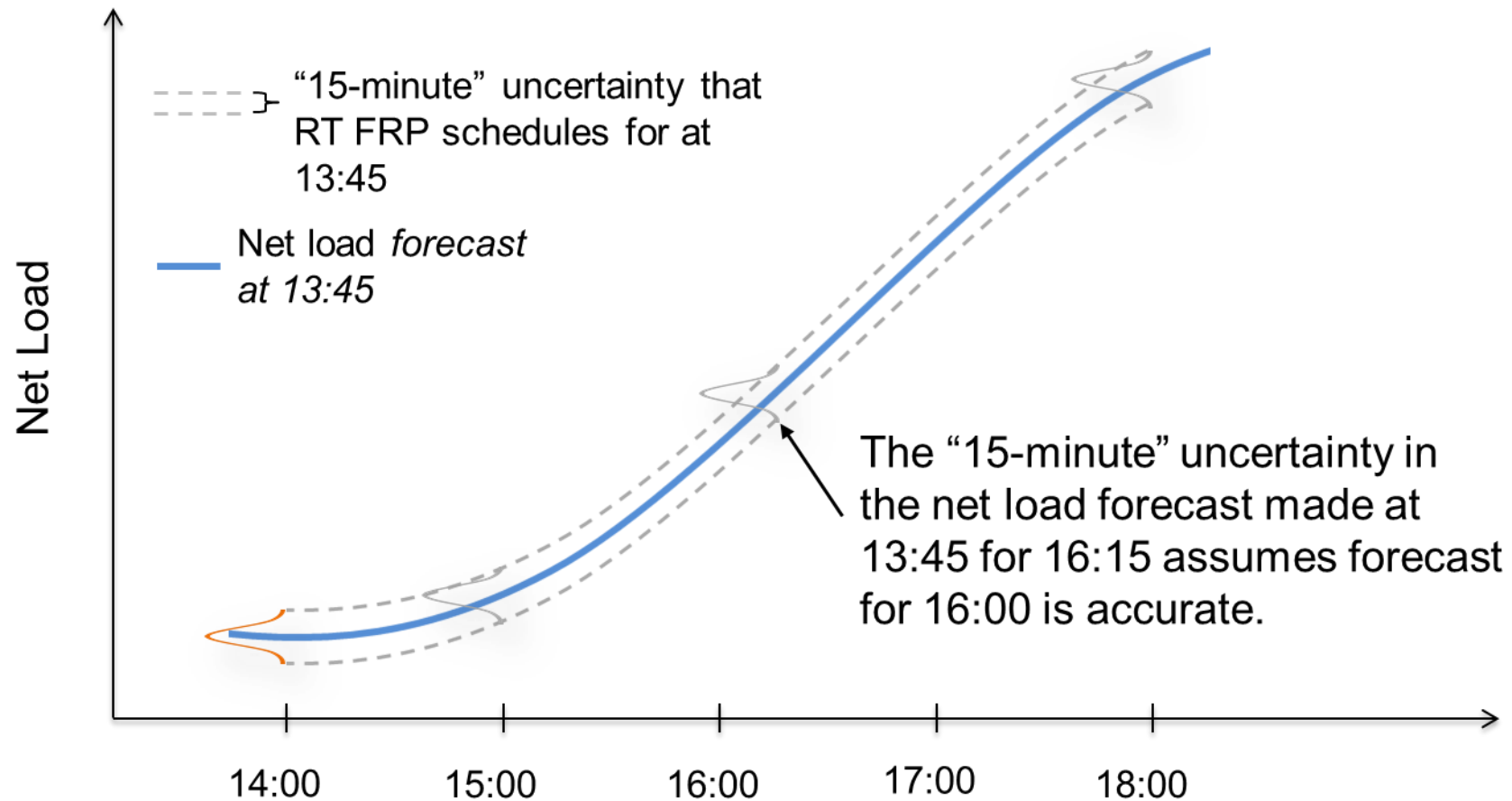


Probability density function of net load uncertainty around a forecast

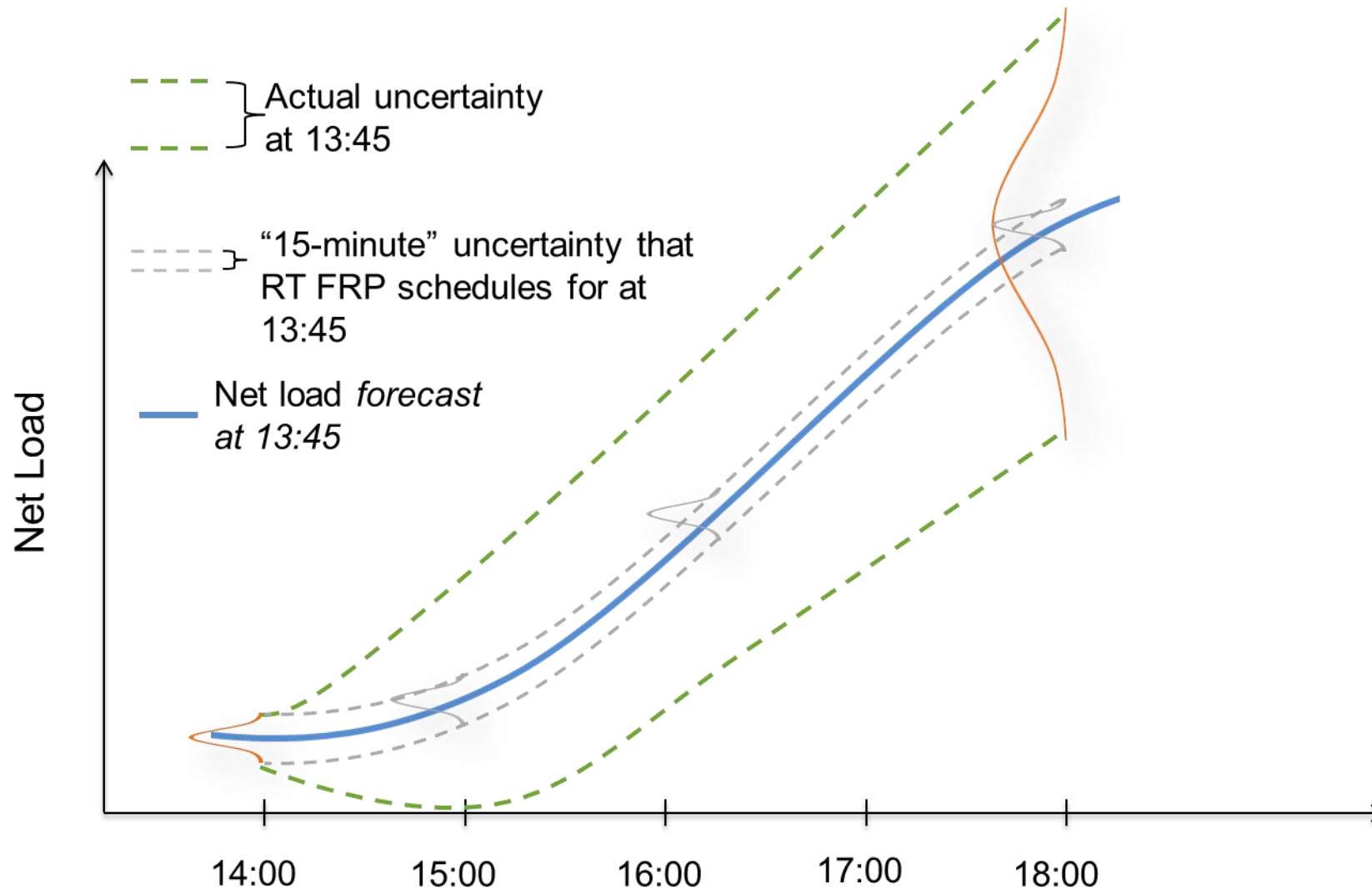


- Net load at a time in the future with a range of uncertainty can be characterized by a *probability density function*.
- A wider probability density function indicates a wider range of uncertainty.

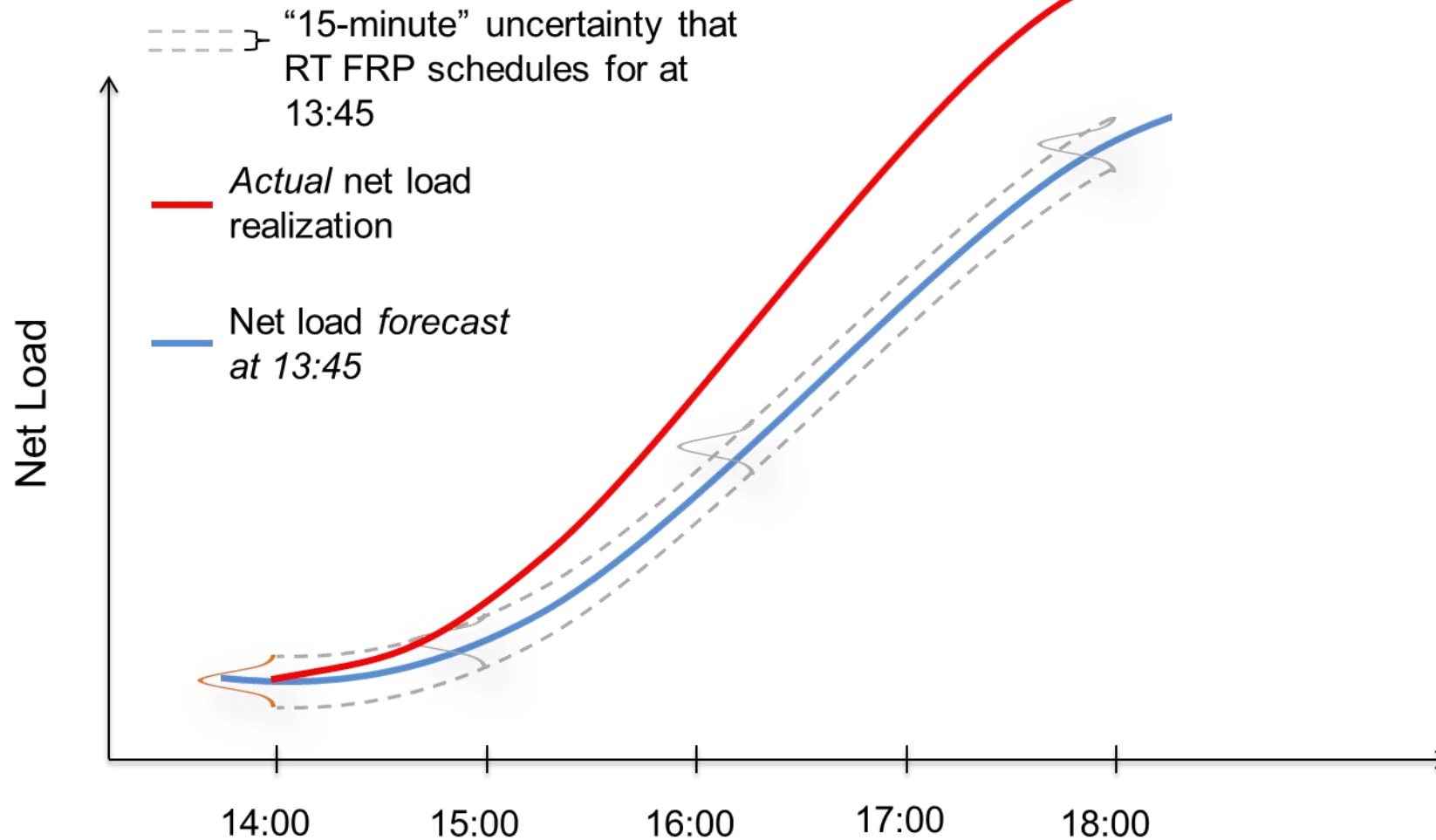
Flexible ramping product has improved real-time software by considering some uncertainty around the net load forecast for every interval 4.5 hours in future used to determine optimal schedules at the current interval.



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.



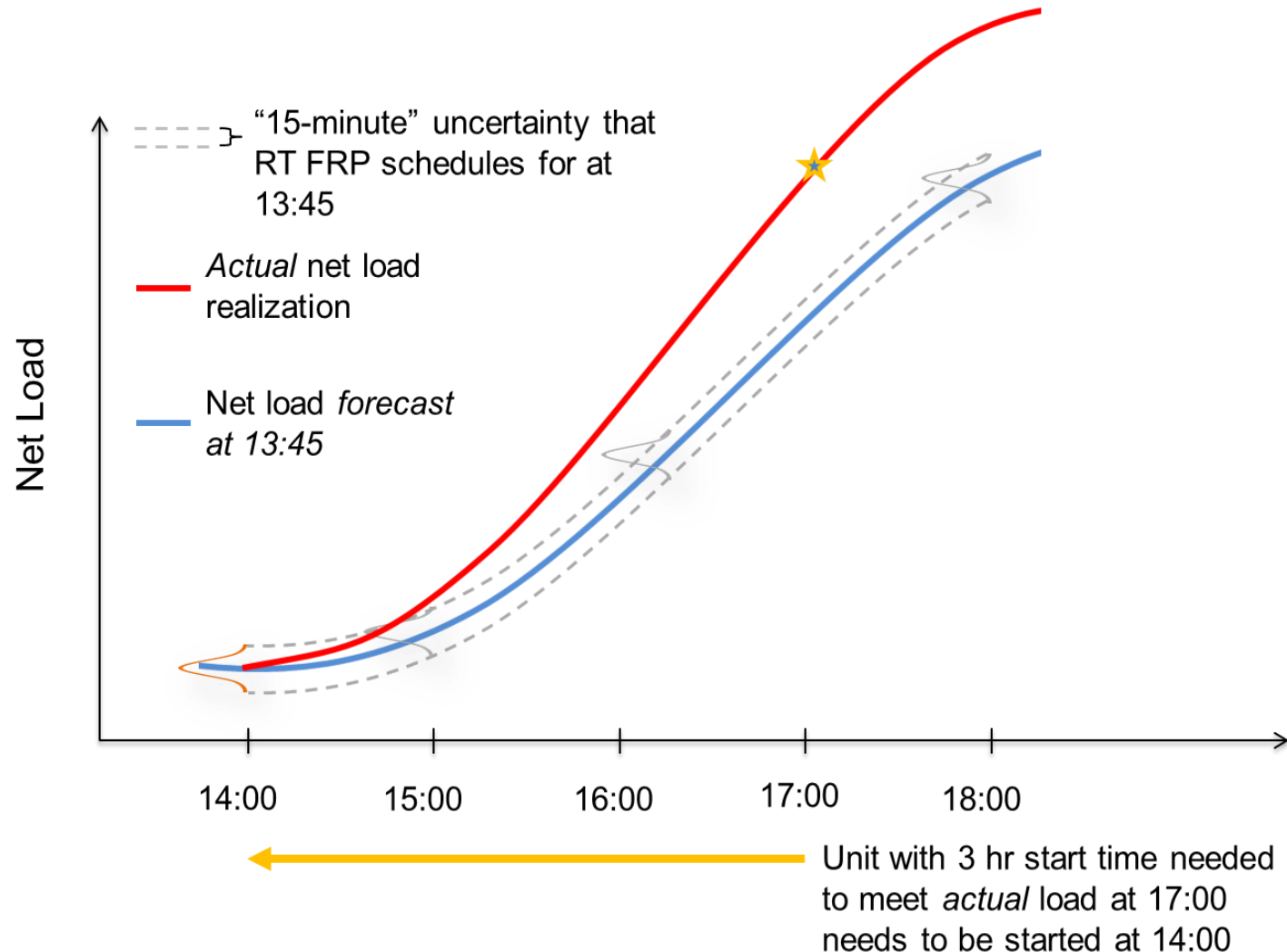


# Benefits of longer uncertainty horizon

## Benefits of extending FRP uncertainty time horizon

1. Allow the optimization to better position resources to consider upcoming scarcity in further out market intervals.
2. Improve flexible capacity and energy prices ahead of a scarcity by considering longer time horizon for uncertainty.
3. Procuring capacity to meet net load uncertainty over longer time horizons in the market, rather than through operator interventions.

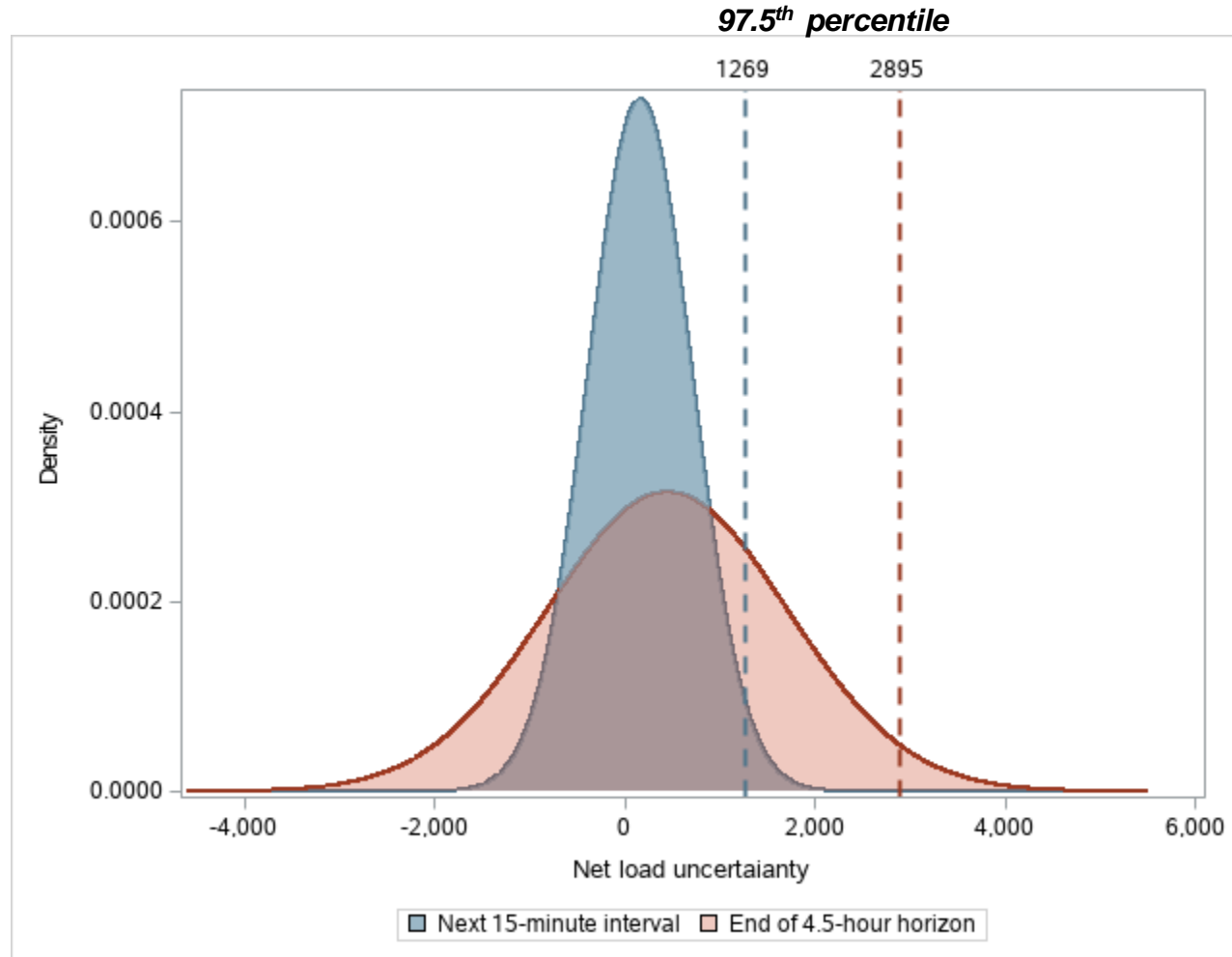
## Improved ability for software to meet higher potential net load outcomes



*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 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*

# Sample of observed net load uncertainty over different time horizons



Distribution of WEIM system net load uncertainty — next 15-minute interval versus end of 4.5 hour horizon (Historical 180-day sample from hour-ending 20 ahead of August 1, 2024)

## Improve flexible capacity and energy prices ahead of a scarcity by considering longer time horizon for uncertainty

- By considering uncertainty that can materialize over a longer time horizon, both flexible capacity and energy prices should increase.
- However, because FRP currently only considers uncertainty in the upcoming interval, the flexible capacity and energy prices don't reflect the potential upcoming scarcity in the more-distant horizon.

## Summary

Extending the flexible ramping product time-horizon would:

- Better position resources to meet higher potential net load outcomes.
- Improve flexible capacity and energy prices ahead of a scarcity by allowing the market optimization to consider a longer time-horizon for uncertainty.
- Potentially lower the need for manual load adjustments

Therefore, DMM continues to recommend that the CAISO extend the flexible ramping product time-horizon or create products or constraints to serve the same purpose as extending the horizon.