Enhancing the flexible ramping product to better address net load uncertainty

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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.

![Graph showing load adjustments and net load over the hours of the day from July to September 2019. The graph includes lines for hour-ahead load adjustment, 15-minute market load adjustment, 5-minute market load adjustment, and net load. The x-axis represents the hour of the day, while the y-axis represents the load adjustment in MW. The graph shows peaks in load adjustment around the middle of the day and a general decrease towards the evening.](image)
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**.
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 97.5\textsuperscript{th} 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.

![Graph showing net load forecast and uncertainty bands.](image-url)
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 in the net load forecast made at 13:45 for 16:15 assumes forecast for 16:00 is accurate.
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.

- “15-minute” uncertainty that RT FRP schedules for at 13:45
- Actual net load realization
- Net load forecast at 13:45
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:

• DMM quarterly and annual reports

• DMM comments on 2020 market design initiatives
  – http://www.caiso.com/Pages/documentsbygroup.aspx?GroupID=E0E702C8-DC83-4625-98E2-36230535B44A

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