Flexible ramping product requirements and load forecast discussion

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Market Surveillance Committee Meeting
General Session
June 7, 2018

Outline

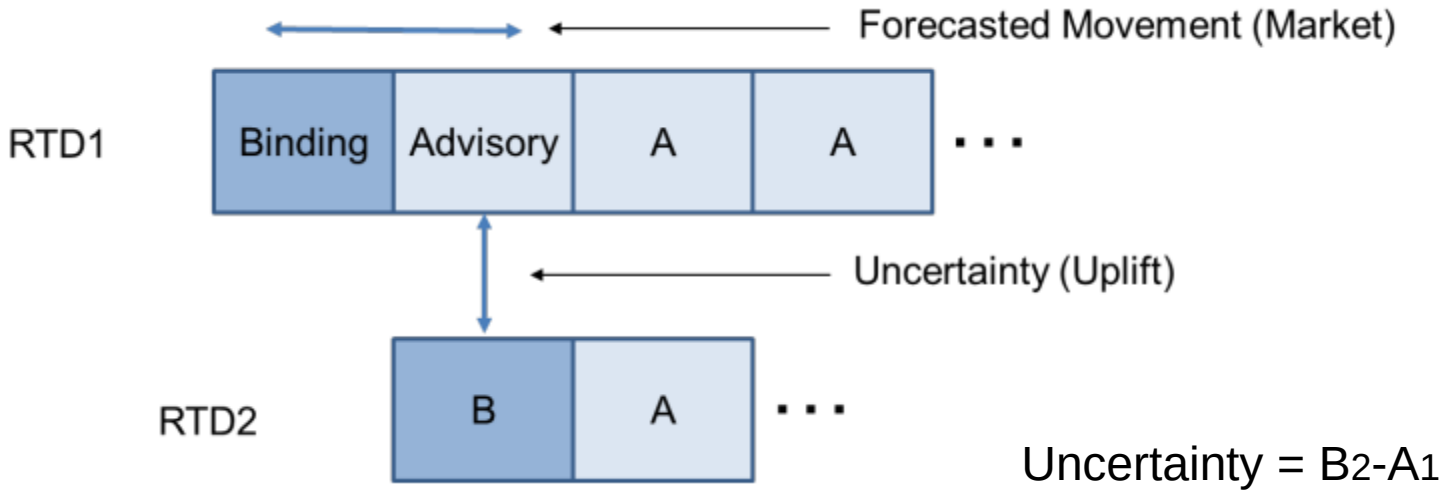
- Flexible Ramp Product Update
- Renewable Forecast: Persistence Market Model Background and Performance
- Market Forecast vs. Raw ALFS Forecast

FLEXIBLE RAMP PRODUCT UPDATE

Summary of Recent Updates for the Flexible Ramping Requirement

- Item 1:
  - Uncertainty Requirement Calculation
  - Summary of Change:
    - Prior to 2/21/2018 the BARR tool was calculating the uncertainty using B2-A2 instead of B2-A1.
  - Presented at February 20, 2018 MPPF
    - http://www.caiso.com/Documents/AgendaandPresentation-MarketPerfomanceandPlanningForum-Feb202018.pdf
  - Fix Deployed 2/20/2018 for operating date 2/21/2018

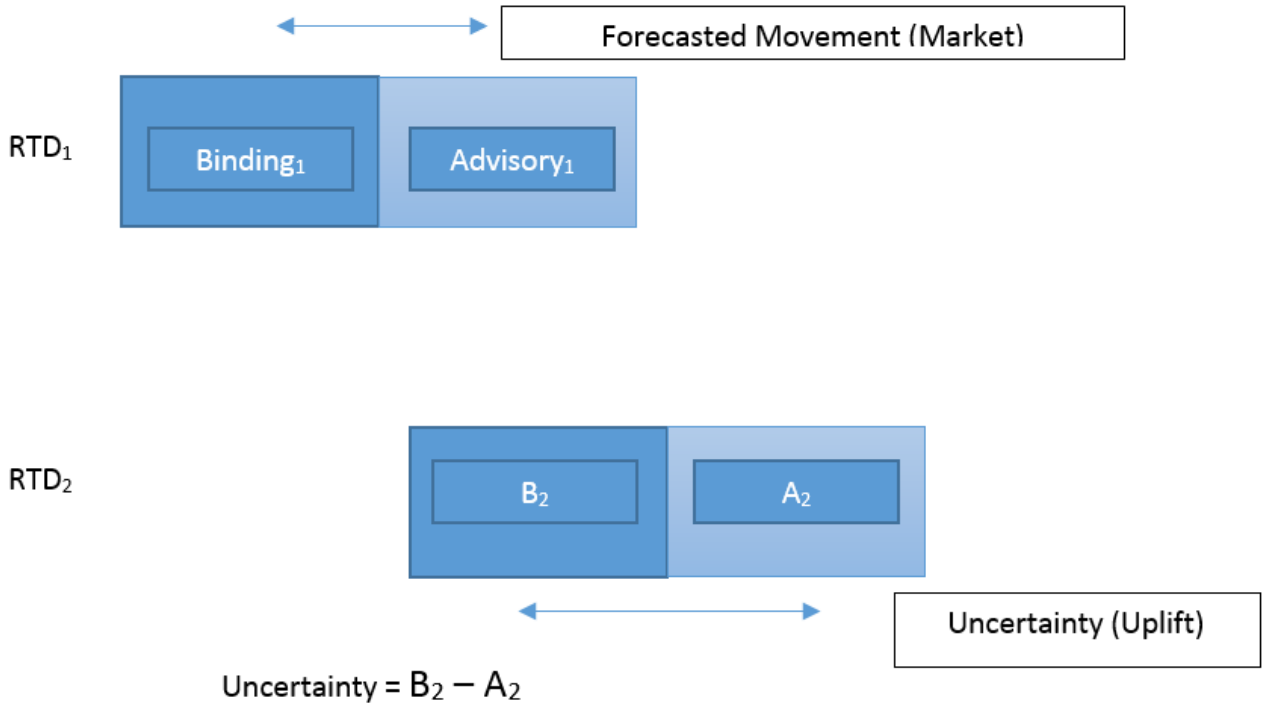
Expected Flexible Ramping Uncertainty Requirement Five Minute Real-Time Dispatch (RTD) Calculation



Uncertainty = B_2-A_1

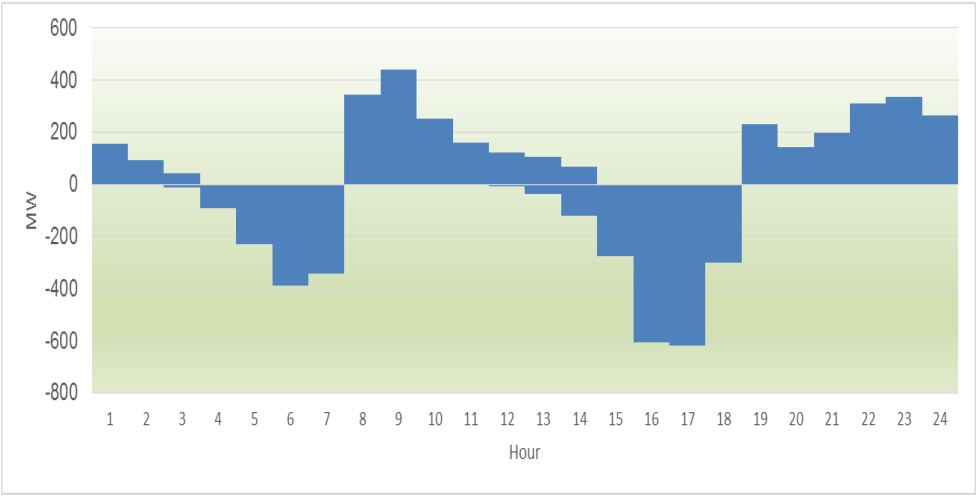
RTD Net Load Forecast Error is difference between the binding interval net load forecast and the prior market run first advisory net load forecast

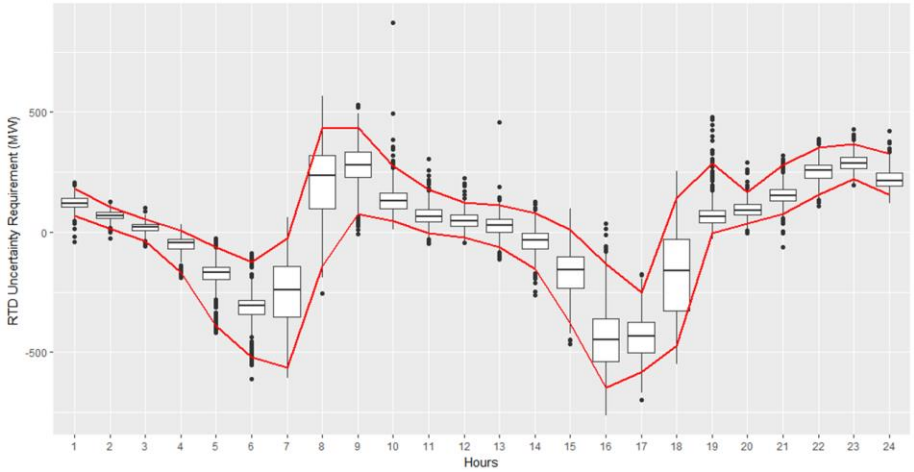
Prior to Fix: Flexible Ramping Uncertainty Requirement
Five Minute Real-Time Dispatch (RTD) Calculation



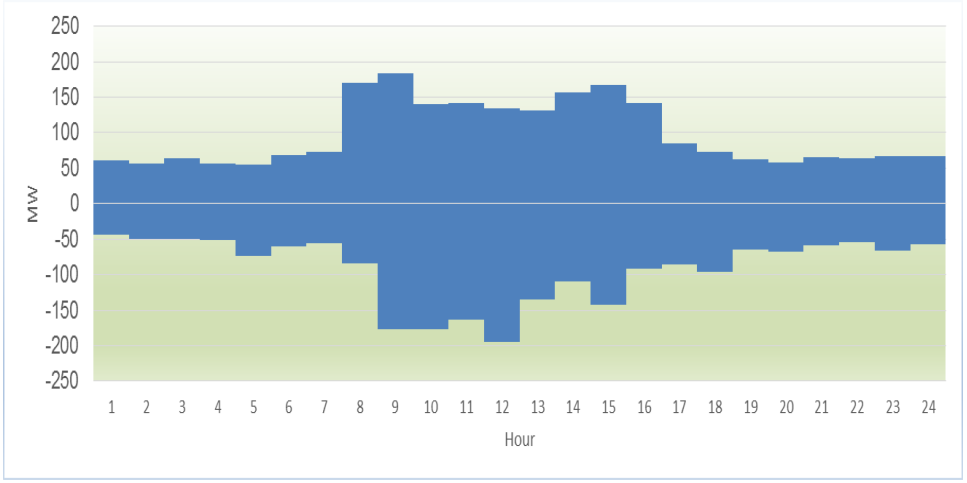
RTD Net Load Forecast Error is difference between the binding interval net load forecast and the second run first advisory net load forecast

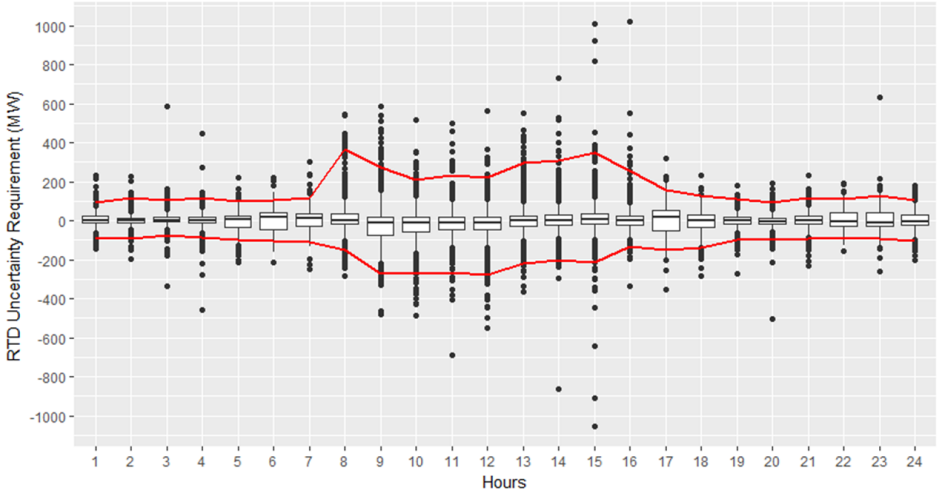
RTD Prior to Fix: Average Flexible Ramp Product Cleared Awards for EIM_Area – January 23, 2018





RTD After Fix: Expected Average Flexible Ramp Product Cleared Awards for EIM_Area – January 23, 2018





Summary of Recent Updates for the Flexible Ramping Requirement Continued

- Item 2:
  - Renewable Resources Time Interval
  - Summary of Change:
    - Prior to 3/23/2018 the BARR tool was using starting interval instead of ending interval in the calculation.
  - Fix Deployed 3/22/2018 for operating date 3/23/2018

Summary of Recent Updates for the Flexible Ramping Requirement Continued

- Item 3:
  - Treatment of RTPD time frames in the uncertainty calculation (averaging vs. no averaging)
  - Summary of Change:
    - BARR was previously using one interval within the RTPD time frame instead of performing an average of the 3-5 minute intervals for the renewable resources inputs into the net load calculation. Following the change the 3-5 minute intervals were averaged for the renewable resources.
  - Fix Deployed 3/30/2018 for operating date 3/31/2018

Summary of Recent Updates for the Flexible Ramping Requirement Continued

- Item 4: FRP Requirement Threshold Documentation
  - PRRs Created for Business Practice Manual Changes:
    - Energy Imbalance Market
      - Resource Sufficiency Evaluation
        - » Section 11.3.2
    - Market Operations
      - Flexible Ramping Product
        - » Section 7.1.3

You can follow these BPM changes at the following links:
https://bpmcm.caiso.com/Pages/default.aspx
https://bpmcm.caiso.com/Pages/ViewPRR.aspx?PRRID=1051&IsDlg=0

PRR 1051 – Flexible ramping clarification

- **Reason for revision**
  - This is to clarify the flexible ramping requirements for the new EIM entities joining the Energy Imbalance Market.
- **Language Proposed**
  - *CAISO shall set the histogram values described in Section 7.1.3 of the Market BPM to ensure the flexible ramp requirements stay within a reasonable level for a transitional period following implementation. This histogram value will be used until the ISO is able to collect sufficient production-quality data to accurately calculate the flexible requirements based on the historical information gathered from Production. These initial thresholds may be adjusted according to each balancing authority area's conditions including factors and data observed during market simulation and parallel operations. These thresholds will allow the Flexible Ramping Requirements to stay within a reasonable band during the transitional period until an accurate histogram can be calculated from Production data for the balancing authority area.*
- **Initial comments**
  - No comments submitted
- **Initial comment period expired**
  - April 18, 2018
- **Next step**
  - Post ISO recommendation

PRR 1053 – Flexible ramping clarification

- **Reason for revision**
  - This revision is to further clarify the flexible ramping product requirement thresholds.
- **Language Proposed**

"The ISO shall use a rolling 40 day average, with a separate histogram for weekends and holidays, to evaluate the historical advisory RTUC imbalance energy requirement error pattern for each RTUC hour. The ISO will also evaluate if hours with similar ramping patterns could be combined to increase the sample size used in the historical analysis. The ISO expects that the estimate of uncertainty will improve over time. Therefore, the actual method of calculating the demand curve will be included in the business practice manual versus including these details in the tariff.

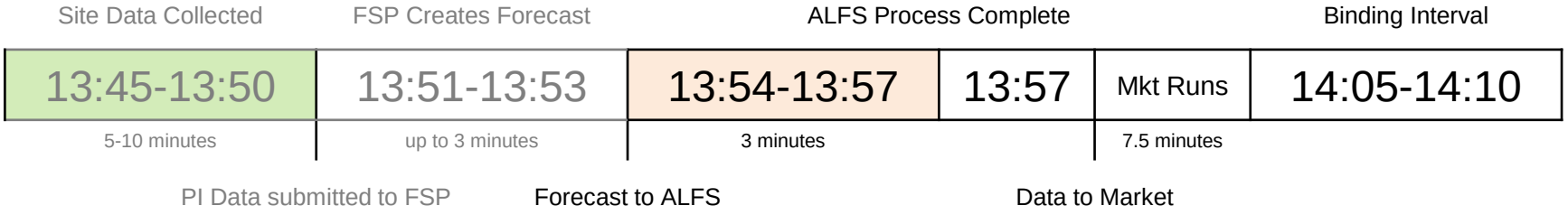
Additionally, because the requirements are based on historical information, the requirements determined through this process may be representative of future forecast uncertainty and may at times also produce extreme outlier values. To ensure the CAISO does not set extreme requirements, the CAISO enforces thresholds that are determined based on the 98% percentile of the historical uncertainty calculations. The CAISO will evaluate these thresholds every quarter, or as needed with changing weather conditions. To the extent permissible, the CAISO will provide EIM entities a week's notice prior to making any changes to the thresholds."

- **Initial comments**
  - No comments submitted
- **Initial comment period expired**
  - May 15, 2018
- **Next step**
  - Post ISO recommendation

RENEWABLE PERSISTENCE MARKET METHODOLOGY UPDATE

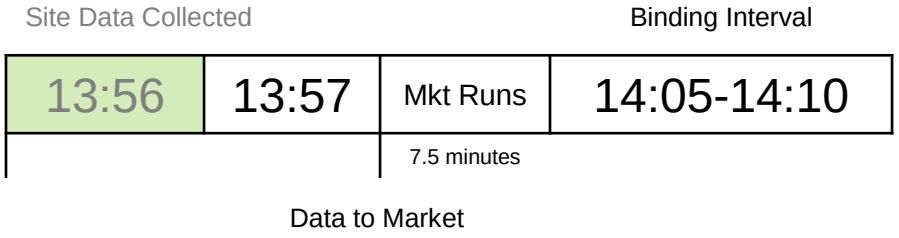
Why Is the Persistence Method needed?

Current:



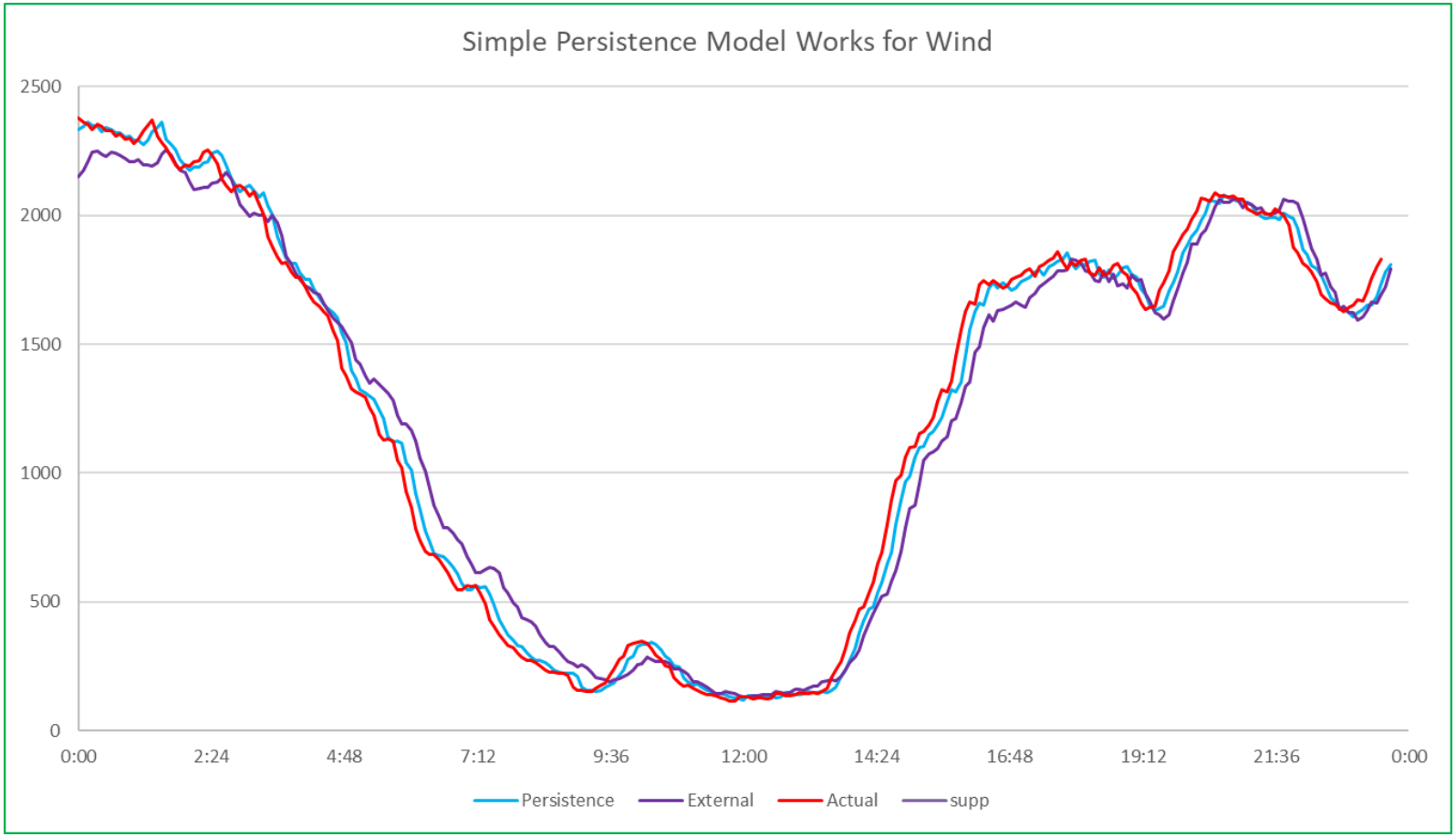
Persistence Method:

- More recent telemetry is used in forecast
- 6+ minutes are eliminated from lag

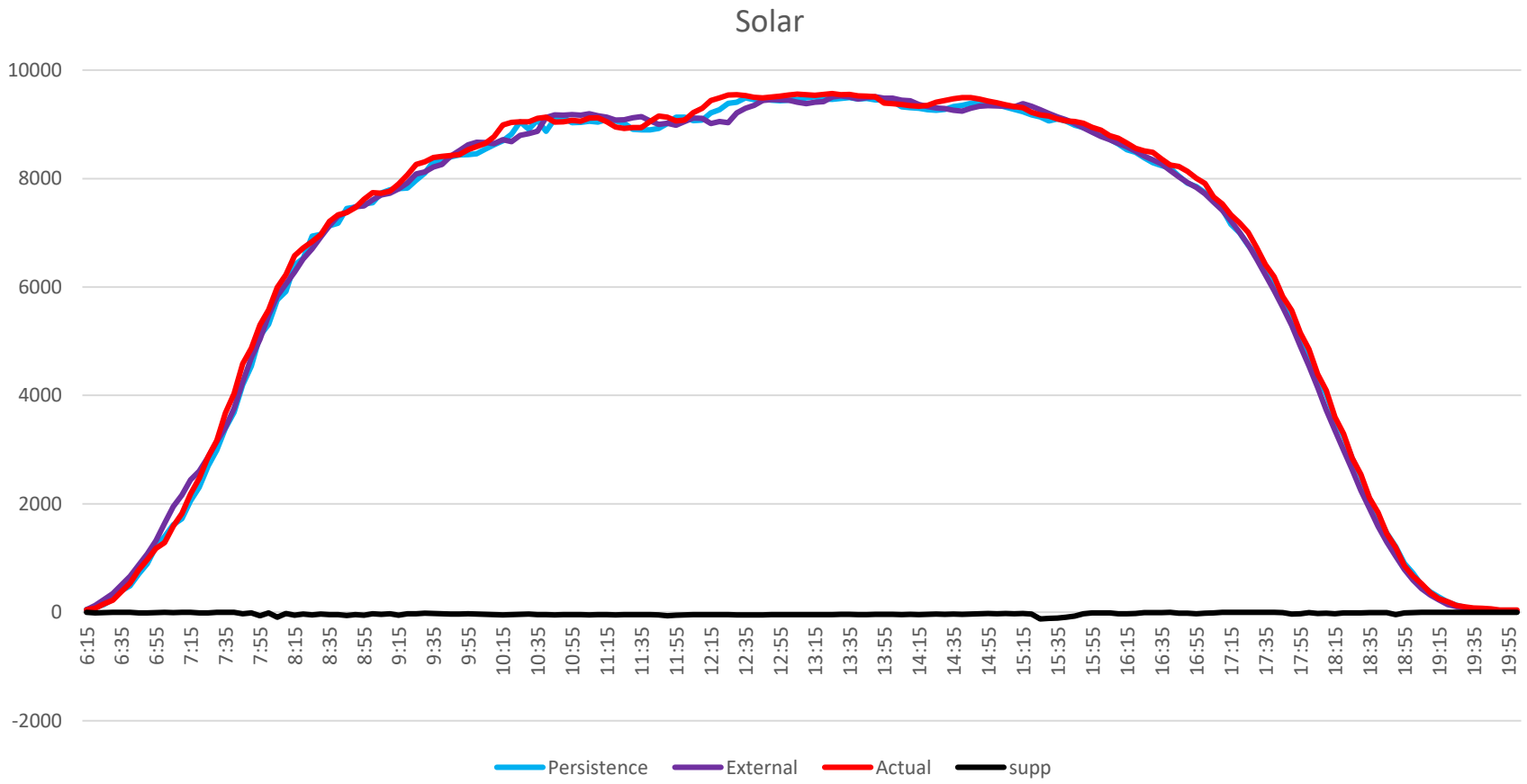


Forecast calculated in market, eliminating ALFS & processing time needed outside of CAISO

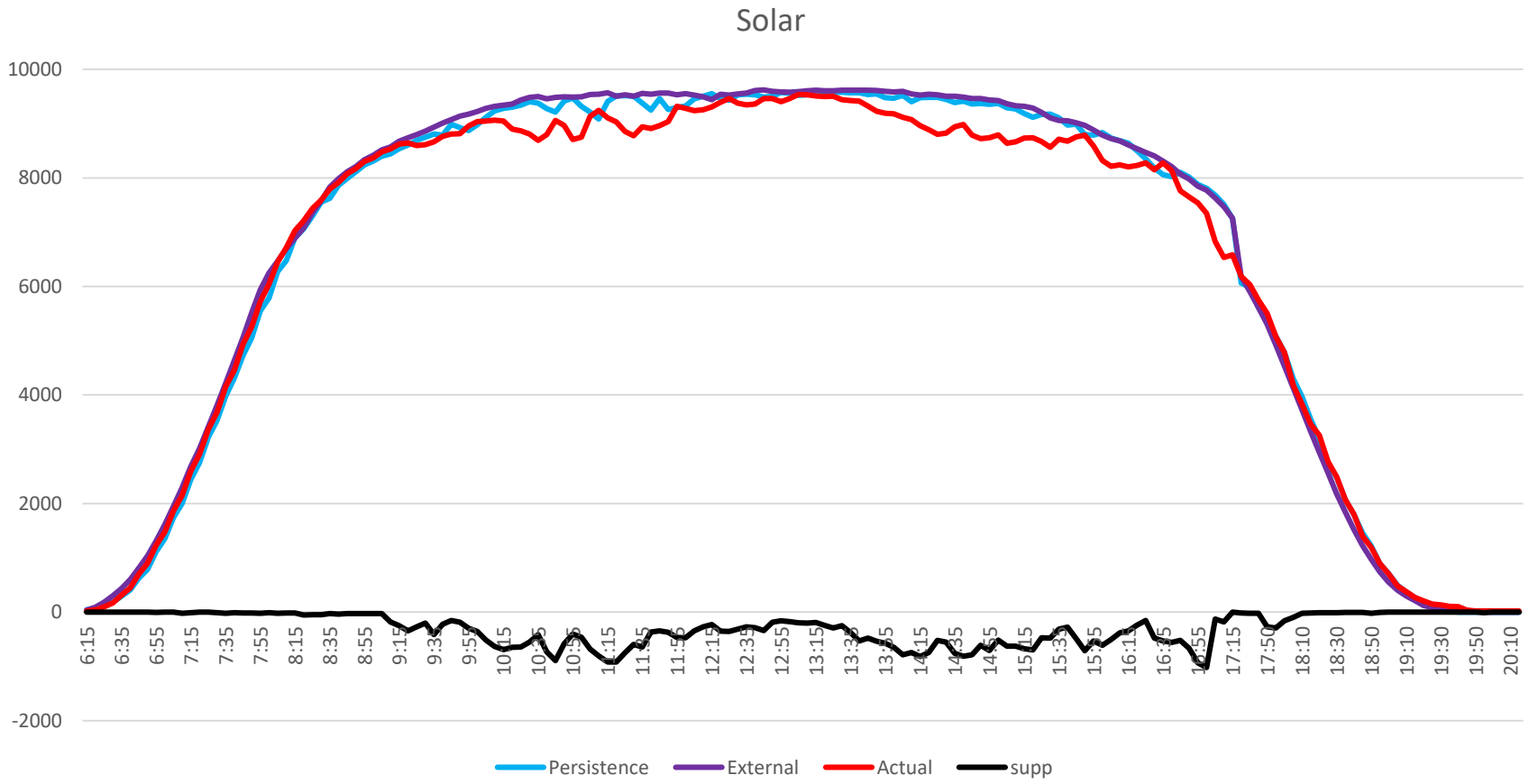
Impact of Shortened Processing Time for Wind



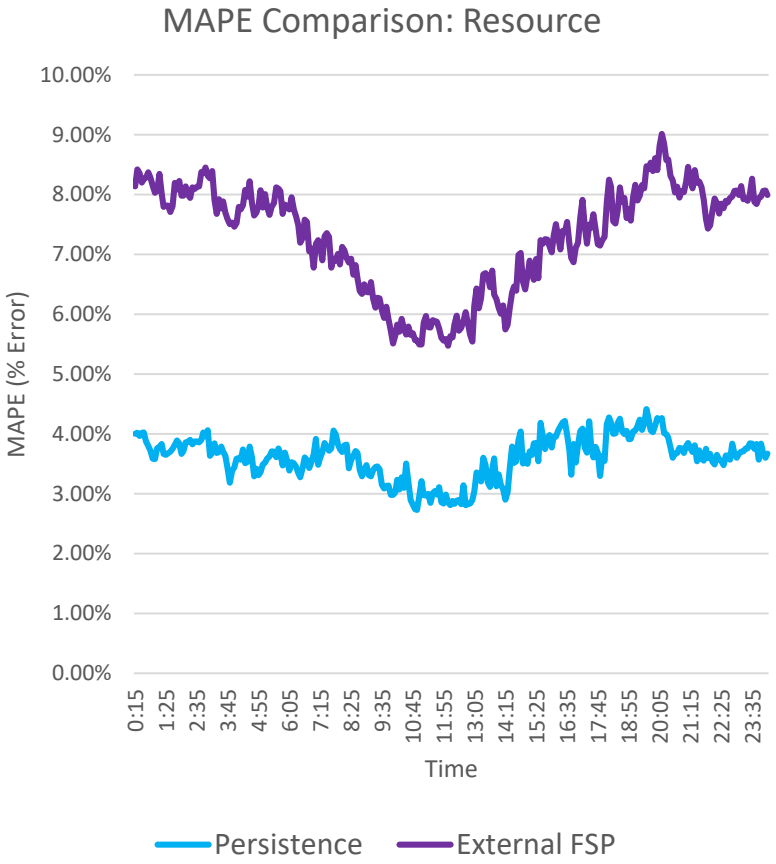
Results: Contour Persistence Works for Solar

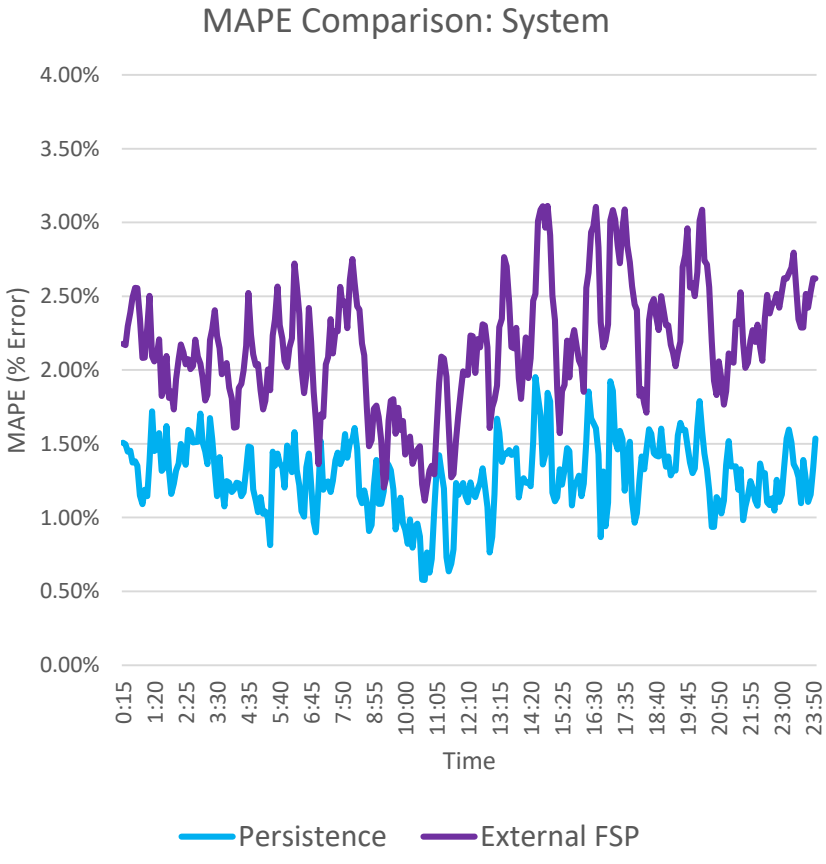


Results: Contour Persistence Method when Heavy Supplemental Dispatches are Present



Results: RTD Wind Mean Absolute Percent Error (MAPE)





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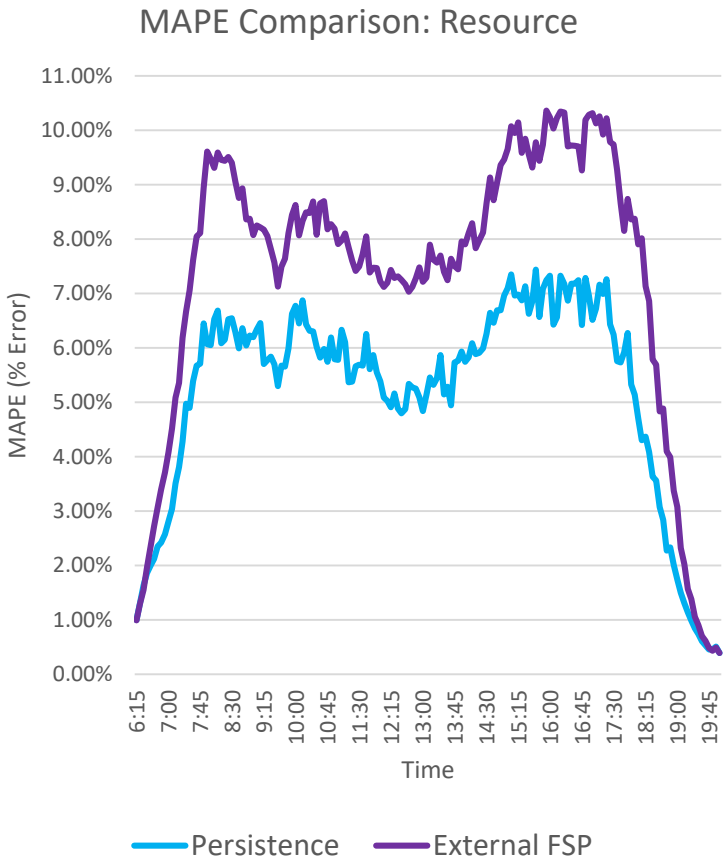
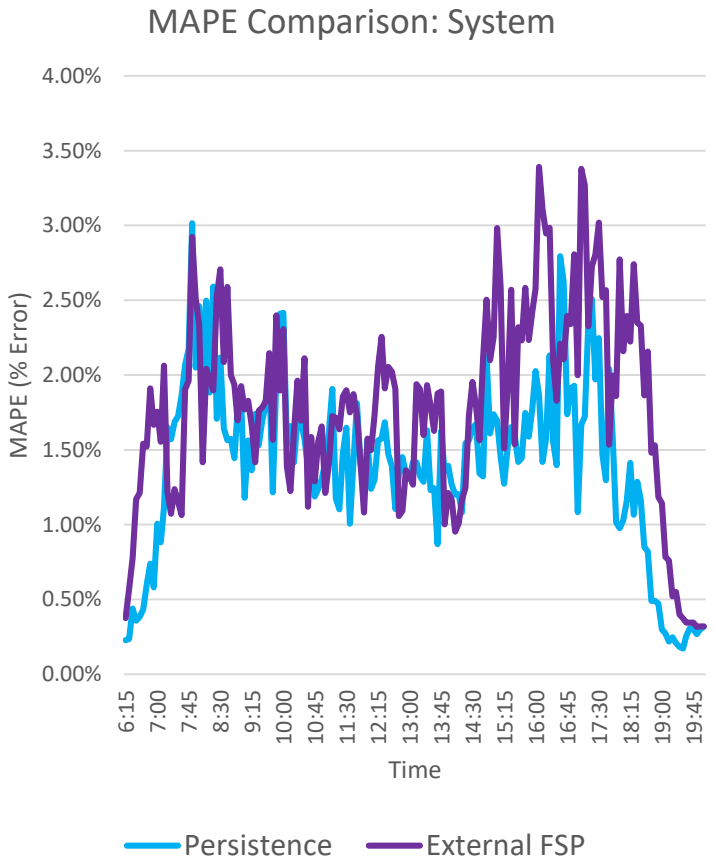




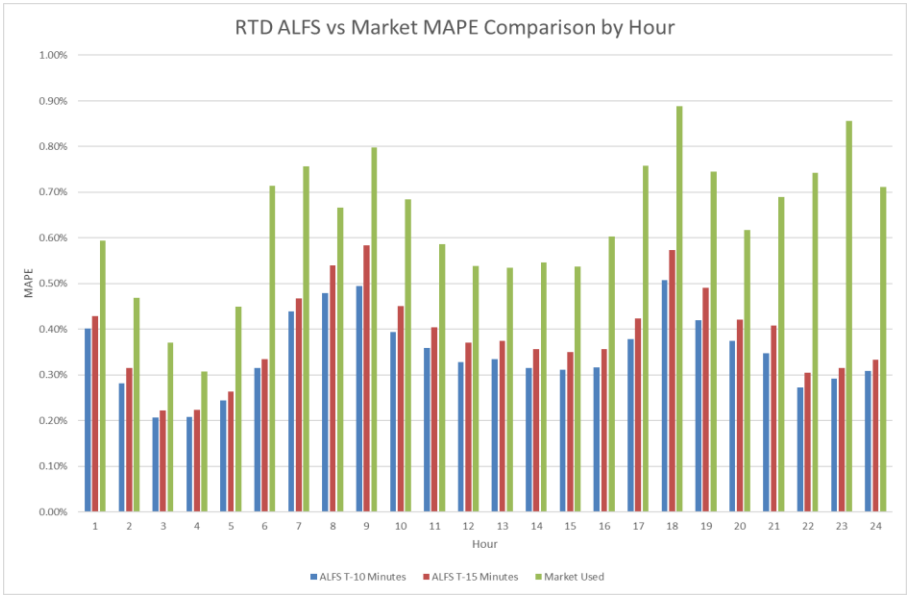
MARKET FORECAST VS ALFS FORECAST

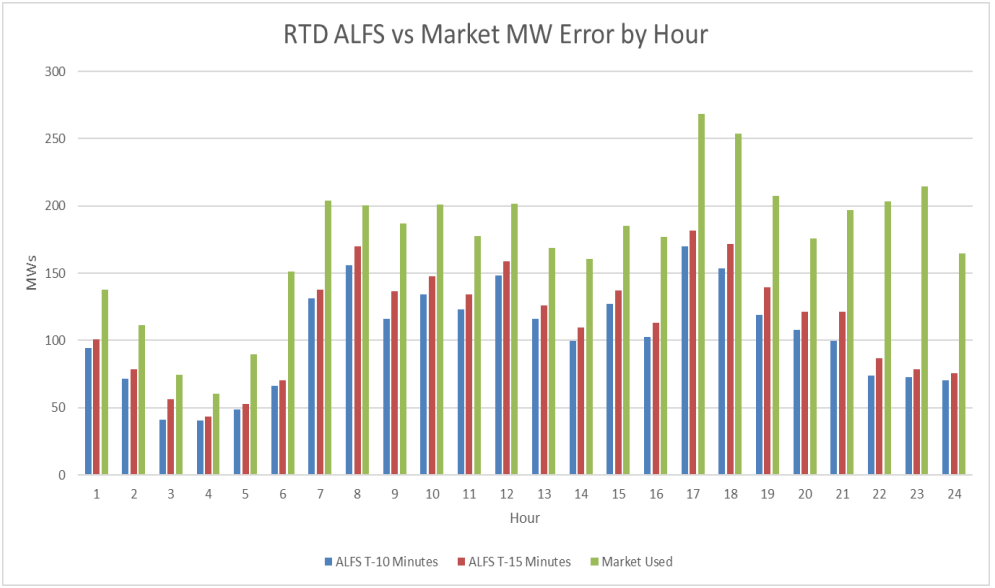
Background Information

- What is the current role that exists within the CAISO Operations Functions for updating the load forecast within the Market Optimization?
- Why did this functionality originally get developed?
- In this presentation we will look at the differences of the pure raw ALFS Load Forecast vs the Market Optimization

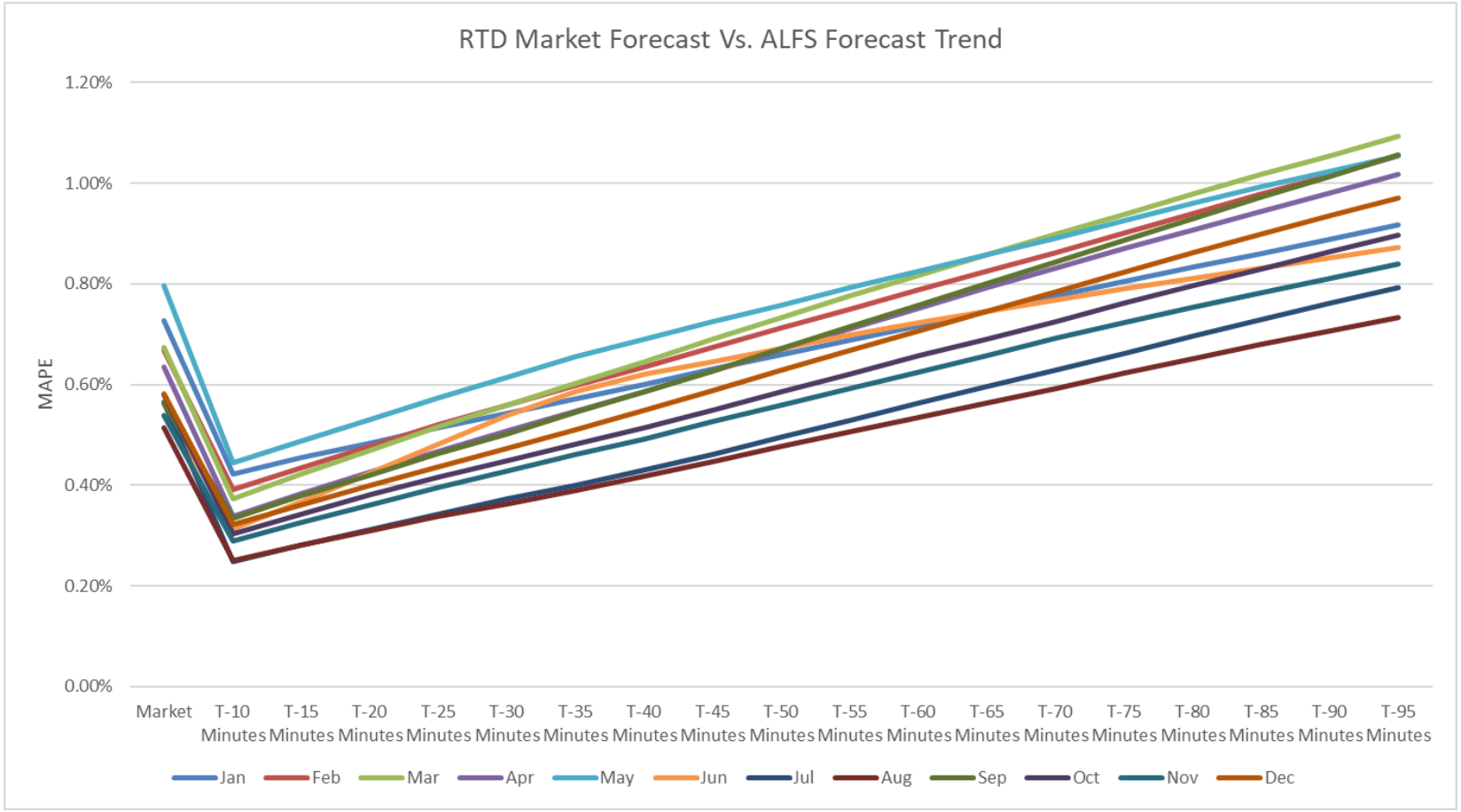
Note: analysis was done with data from 1/1/2017 through 4/30/2018

RTD Forecast Accuracy Trends

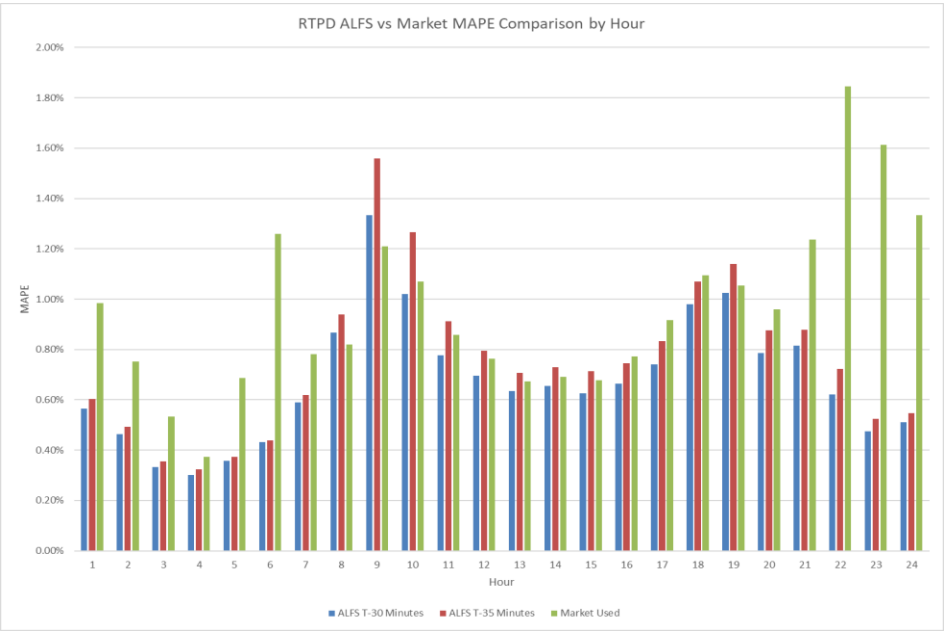


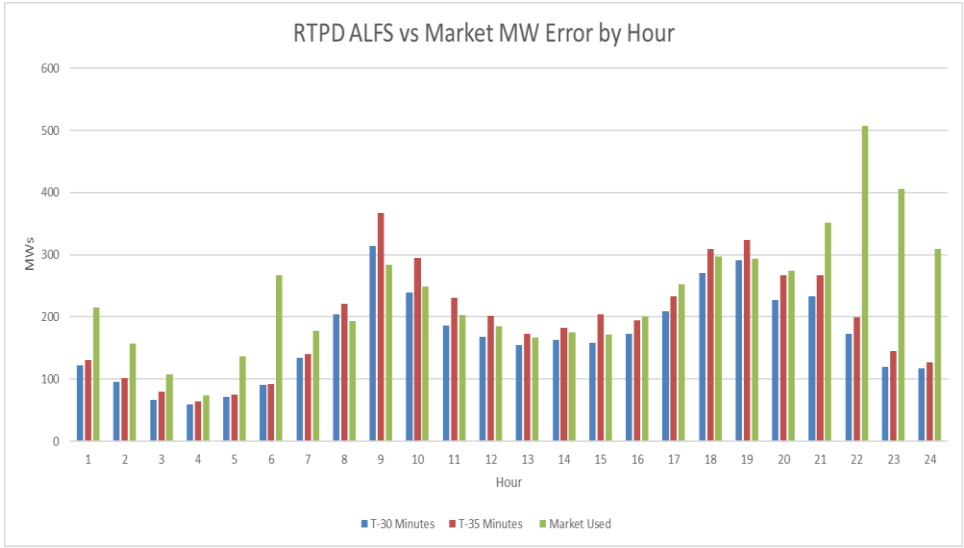


RTD Time Evolution of Accuracy Trends



RTPD Forecast Accuracy Trends





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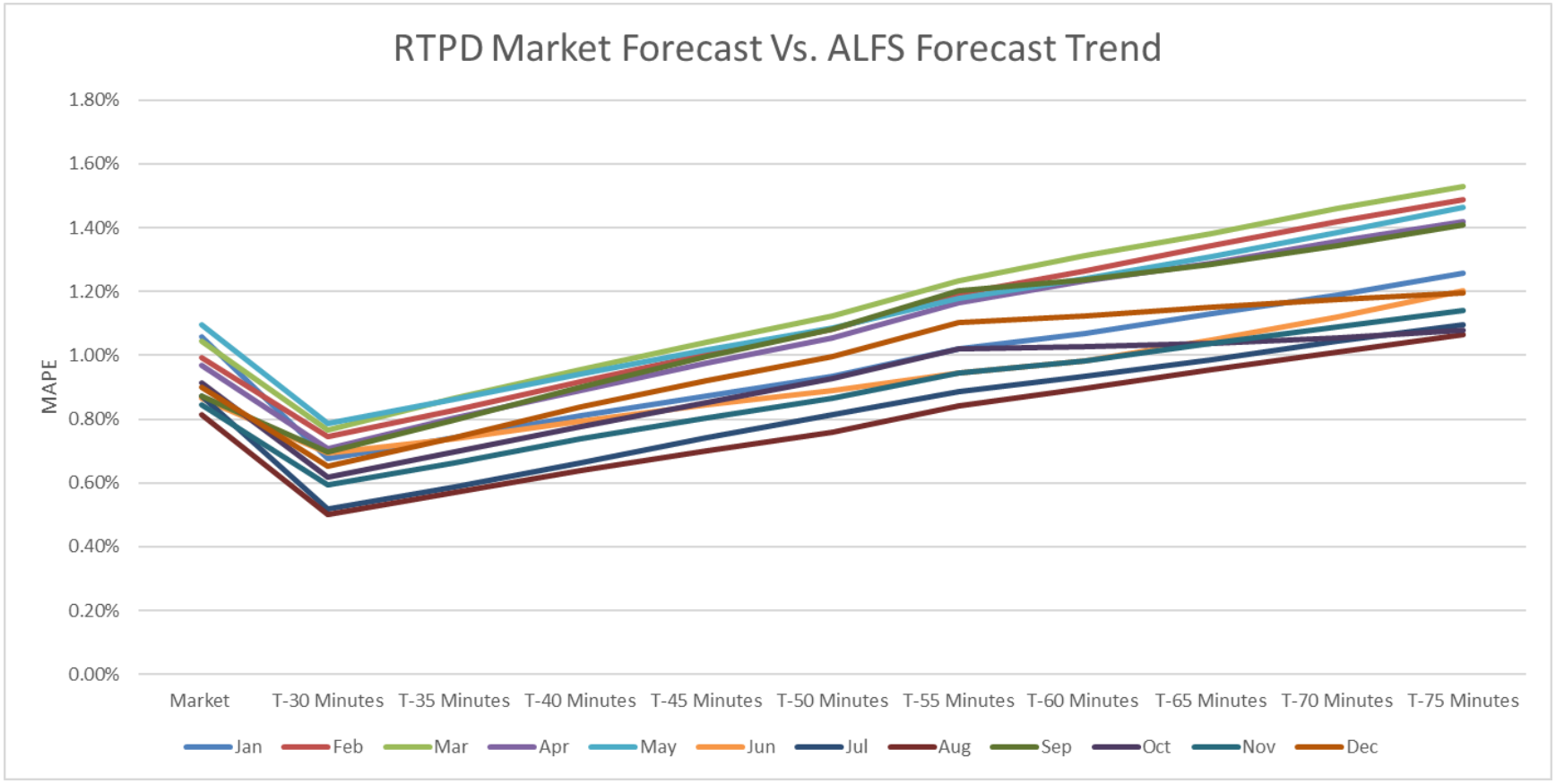
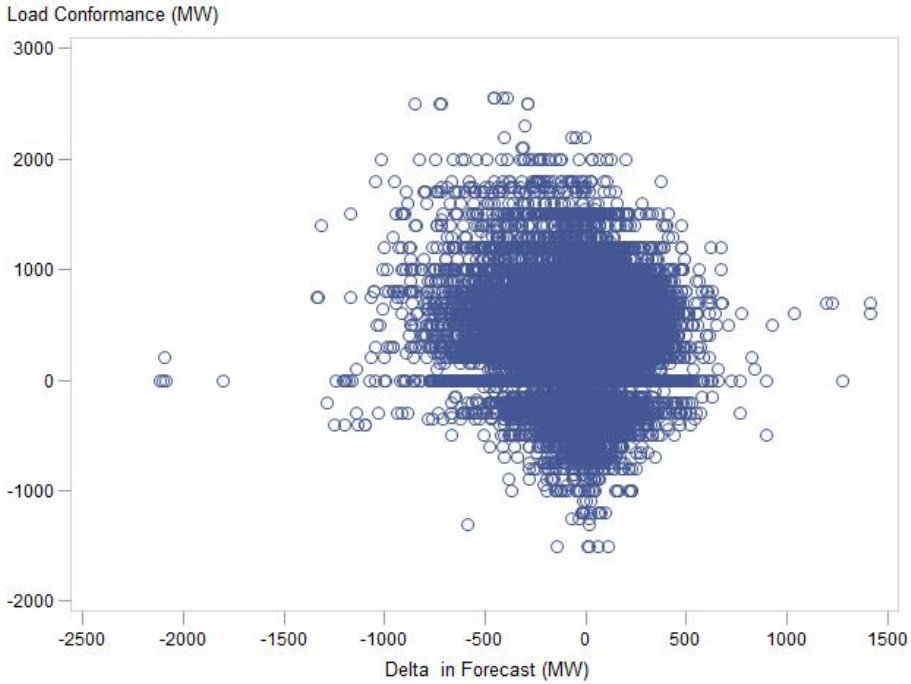


Load Conformance patterns do not show yet a meaningful difference with the changes introduced

A large set of load conformance instances do not offset the effect of the manual forecast updates

15-minute market



5-minute market

Summary of Findings

- ALFS Forecast performs better than Market Submitted on Average.
- Market Submitted forecast is performing better in some intervals; such as during the morning turn of the load, and at times during the evening peak.
- Market Submitted forecast has less movement between RTD and RTPD.

Next Steps

- Continue to work with Operations to automatically push the ALFS load forecast updates during periods of obvious better performance and limited system reliability impact.
- Continue to work to improve the ALFS load forecast in all intervals including key real time intervals as well as improving the model accuracy for the morning turn.

APPENDIX

How the VER Persistence Market Method Works

- Simple Persistence:

$$F(t) = A(t\text{-}lag)$$

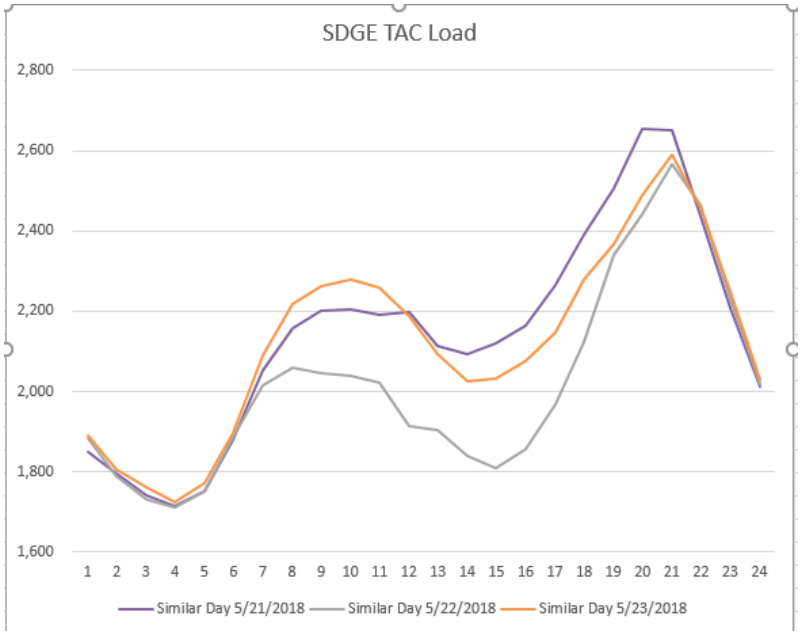
- Contour Persistence Model:

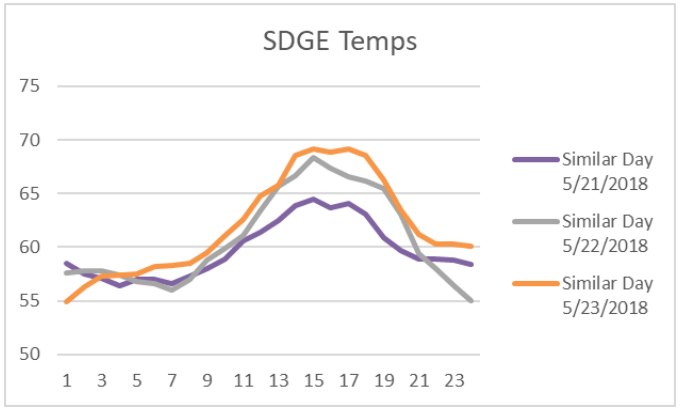
$$F(t) = A(t\text{-}lag)*R(t)/R(t\text{-}lag)$$

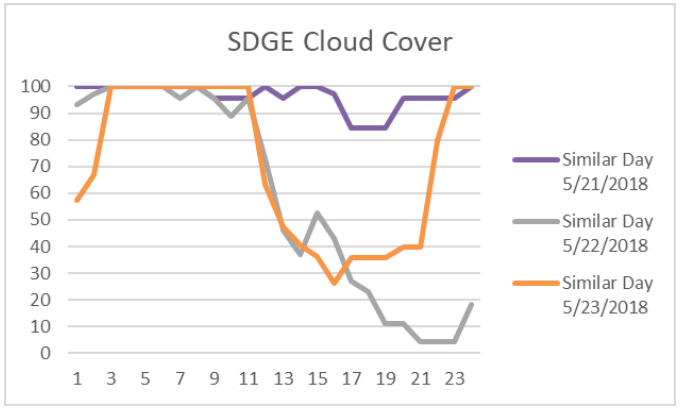
R(t) is expected full fuel (full sun) reference curve

Complexities of Load Forecasting

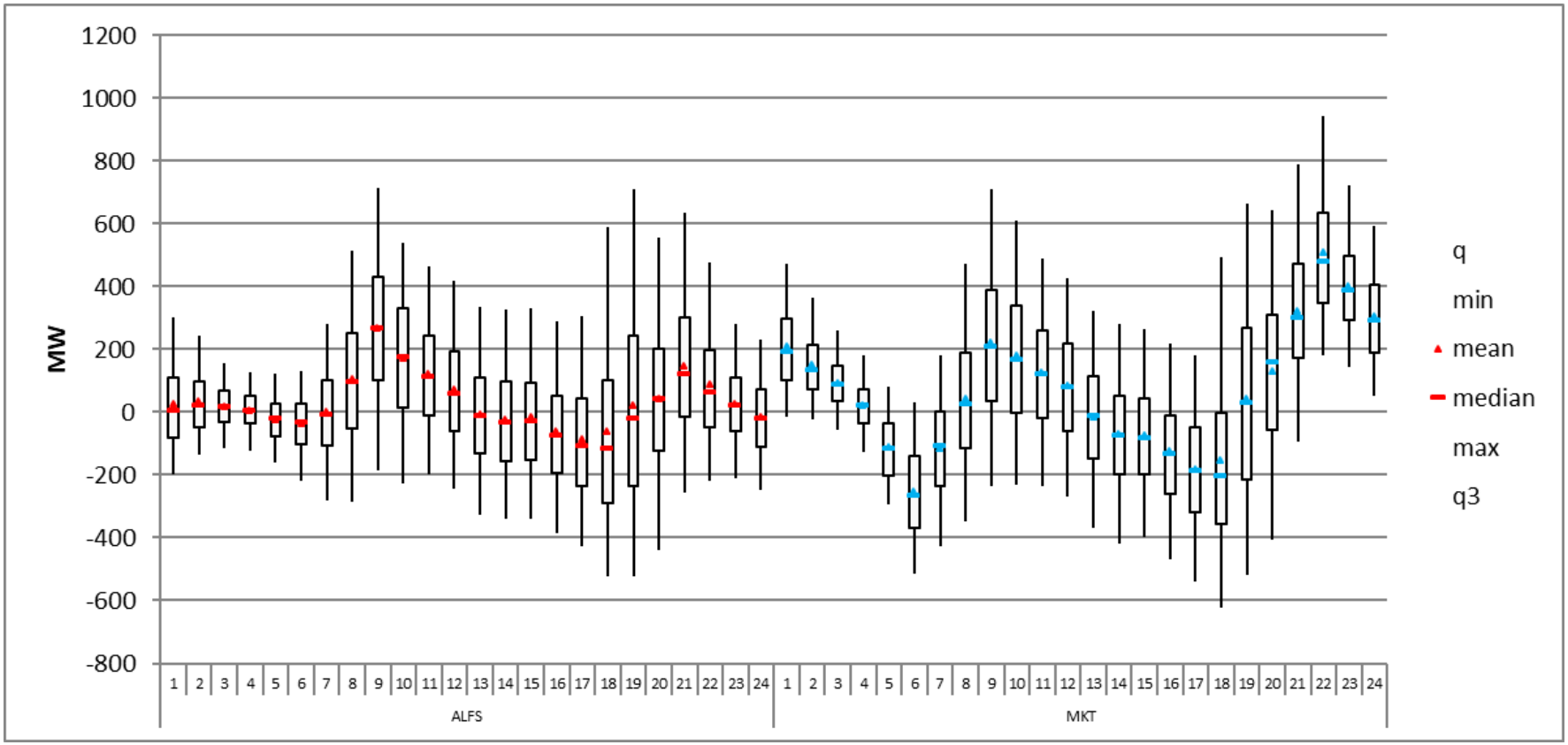
- "May Gray" Marine Layer Example







RTPD Distribution of MW Trends



RTD Distribution of MW Trends