Resource Sufficiency Evaluation

Bid Range Capacity Test

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Agenda

- Resource sufficiency evaluation for CAISO
  - Bid Range Capacity Test Overview
- Answer open questions regarding CAISO capacity test

1. Did CAISO test include EIM transfers that allowed it to pass the Test?

   No, transfers were (and are) not included in the test for CAISO or EIM areas

2. Did CAISO verify that EIM transfers were correctly calculated in the capacity Test?

   Yes, EIM transfers have not been included. They are not included in the test for EIM entities either.

3. How did CAISO pass the capacity test during intervals under EE2 or EE3?

   Due to i) two errors in the calculations previously reported, ii) the current scope of the test used for all areas, and iii) bid range being indeed available at the time of performing the test

Resource sufficiency evaluation for CAISO

Tests applicable to ISO

- Bid Range Capacity Test
- Flexible Ramp Sufficiency Tests

Tests not applicable to ISO

- Balancing Test
- Feasibility Test

CAISO does not have a balancing test but CAISO's RUC process in the day-ahead market acts as a balancing process towards the real-time market.

Rules for Bid Range Capacity Tests

- Three tests are performed: (T-75, T-55 and T-40)
- Tests are performed for both Under and Over direction for each 15-minute interval
- The first two tests (T-75 and T-55) are advisory and enable a BAA to adjust their schedules in order to make necessary adjustments to pass the test (T-40)
- For CAISO, there is no action between T-75/T-55 and T-40 to cure any failures
- A BAA fails the bid-range capacity test if they fail the test at (T-40)
- If a BAA fails the bid-range capacity Under test, it automatically fails the flexible ramp sufficiency up test.
- If a BAA fails the bid-range capacity Over test, it automatically fails the flexible ramp sufficiency down test.

Inputs to the Bid Range Capacity Test

- Fifteen-Minute Demand Forecast
  - FMM CAISO's forecast
- Imports and Exports
  - For CAISO's test at T-40, only Fifteen-minute Imports and Exports bids are considered.
  - Hourly net schedule interchange schedules
  - EIM transfers are not included
- Resource Bids
  - Bids for all internal supply resources
  - FMM schedules for upward Ancillary Services
- Resources' derates and rerates
- EIM transfers -either Imports or Exports- are **NOT** an input to the Bid Range Test for either CAISO or EIM area calculation
- Historical Intertie deviation

  Histogram data given in percentiles

The objective of the Bid Range Capacity Test is simply assess whether there is sufficient Bid-Range Capacity in the BAA to meet its capacity requirements

If

Bid range capacity>Capacity requirement

Then

BAA passes the test

Bid range is the summation of the bid range of all resources

Requirements for Bid Range Capacity Test includes an incremental requirement to account for historical intertie deviations

There can be more than one way to numerically calculate the capacity test but at the end it is about what bid range is available to meet the capacity requirements

- Gross-based calculation

Total bid range> Total requirement

$$G^{max} > LF - NSI$$

- Incremental-based calculation

Inc bid range> Imbalance requirement

$$\Delta G > \Delta(LF - NSI)$$

$$(G^{max} - G^{*}) > (LF - NSI) \text{-} (LF^{*} - NSI^{*})$$

$$(G^{max} - G^{*}) > (LF - NSI) - G^{*}$$

$$G^{max} > LF - NSI$$

G^{max}	Upper capacity limit
LF	Load Forecast
NSI	Net Schedule (Import-Export)
G^{*}	Generation schedule

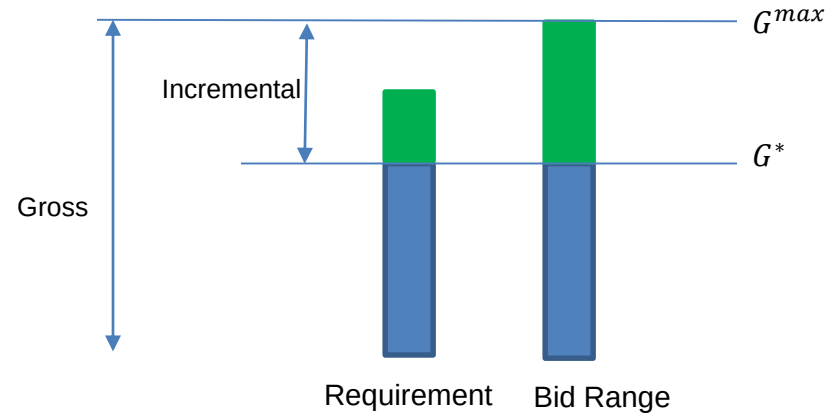
Illustration of gross calculation versus incremental

G^{max}=100

G^{*}=95

NSI=50

$LF = 147$



- Gross assessment

$G^{max} > LF - NSI$

100 >147-50

100>97

Total Bid range>Total Requirement
The test is passed

- Incremental assessment

$(G^{max} - G^{*}) > LF - NSI - G^{*}$

(100-95)>147- 50-95

5>2

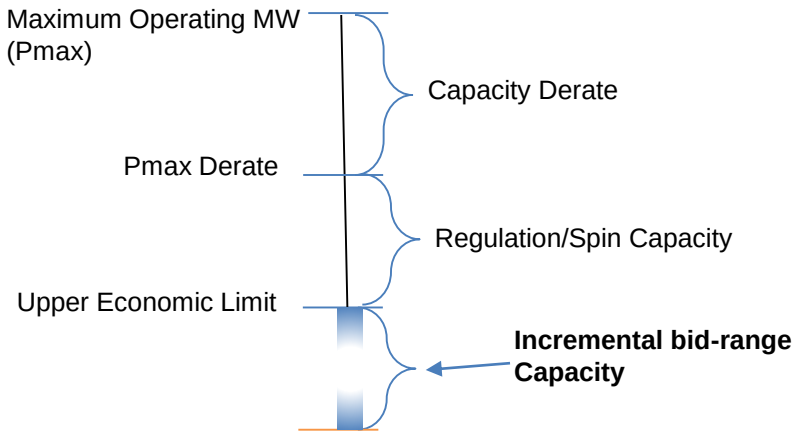
Inc Bid range> imbalance requirement
The test is passed

Why is it important to highlight the relative calculation between gross and incremental?

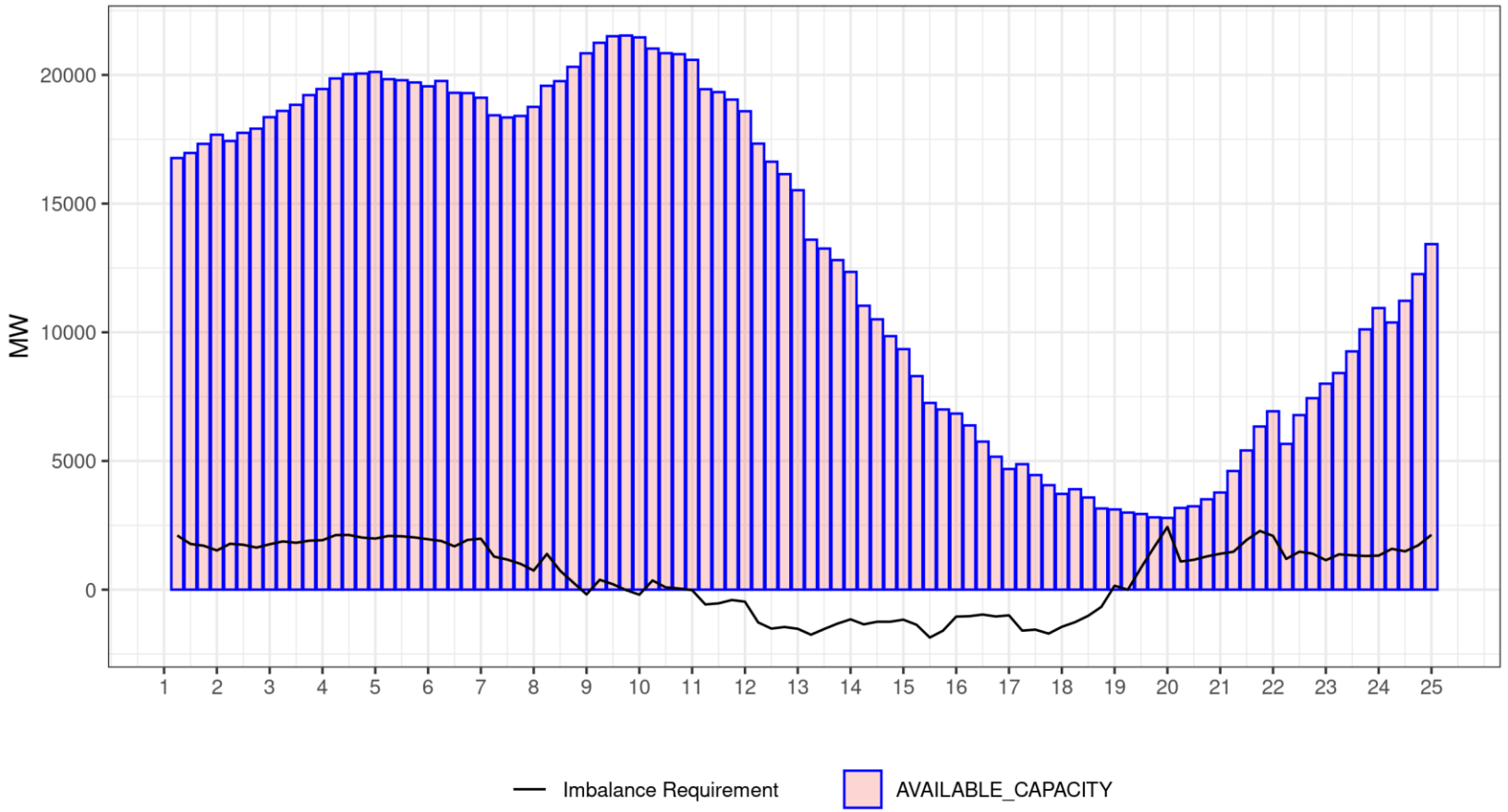
- In previous discussions CAISO has explained the capacity test using the formulas of incremental calculation
- EIM areas test can be intuitively explained in incremental terms since Base Schedules serve as natural reference
- CAISO follows the same calculation in the test but has no base schedules so FMM schedules are used instead as a relative reference only
- The use of FMM schedules under the construct of incremental terms may create the wrong perception that CAISO test is depending on accounting for EIM transfers
- EIM transfers are not considered in the CAISO or EIM entities tests

Calculation of the resource –gross or incremental- bid range capacity does not account for temporal constraints, it's all about bid range

- Incremental bid-range Capacity
  - Upward AS is discounted
  - For offline resources incremental capacity is minimum of (Pmax derate, Maximum operating MW, Bid-in Economic Maximum)
  - Derates are factored in
  - Capacity on Intertie transactions only considered for FMM interties



Based on original solution, CAISO passed all hours of the bid range test since bid range capacity was greater than Imbalance requirement for August 14, 2020



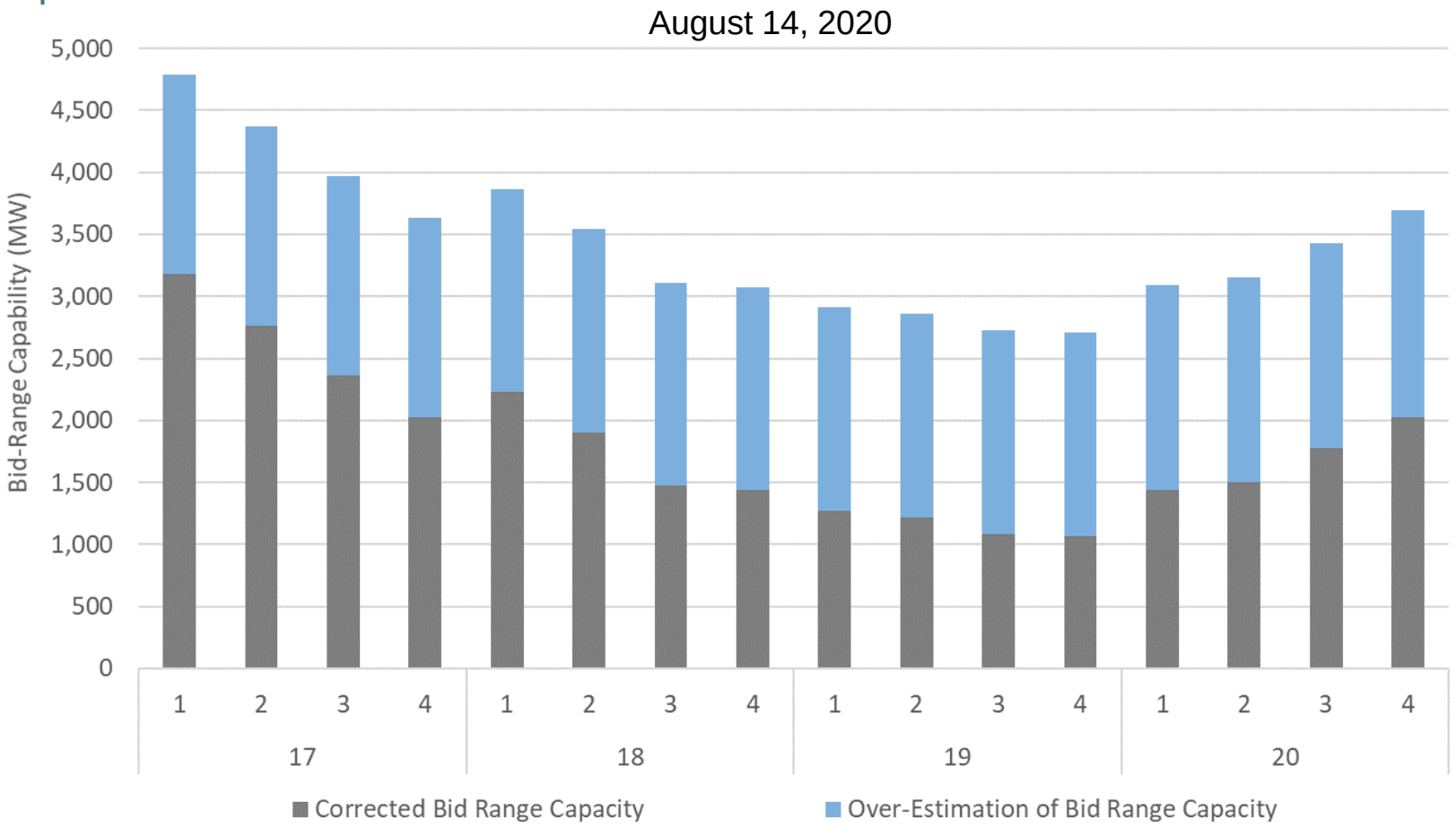
How could CAISO pass the bid range capacity test even during hours of EE2 and EE3?

There are two basic major areas that led to this outcome

1. The Bid range capacity test had two miscalculations
   - Inaccurate Net Schedule Interchange values used for CISO BAA due to inclusion of the mirror resources. This underestimated the bid range requirements
   - Resource Derates and Rerates were not included in the capacity calculations. This overestimated the resource bid range capacity.
   - These issues resulted in a less restrictive test, passing more intervals than it should be

2. The current construct of the bid-range test, which is equally applied to both CAISO and EIM areas

The miscalculation in the Bid Range Capacity test overestimated the resource capacity range, making it easier to pass the test*



* The two issues leading to the incorrect calculation were fixed on February 4, 2021

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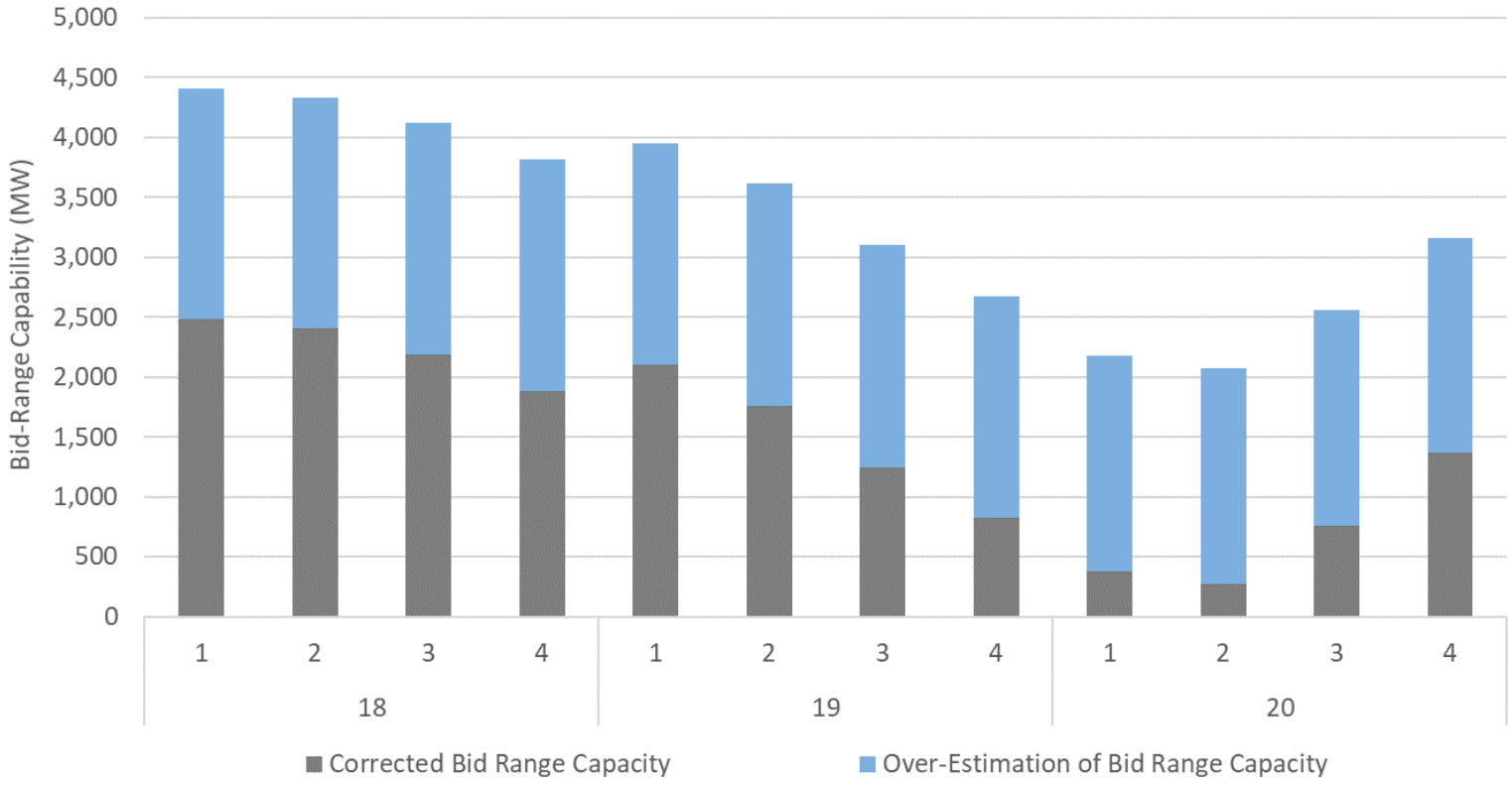
August 15, 2020



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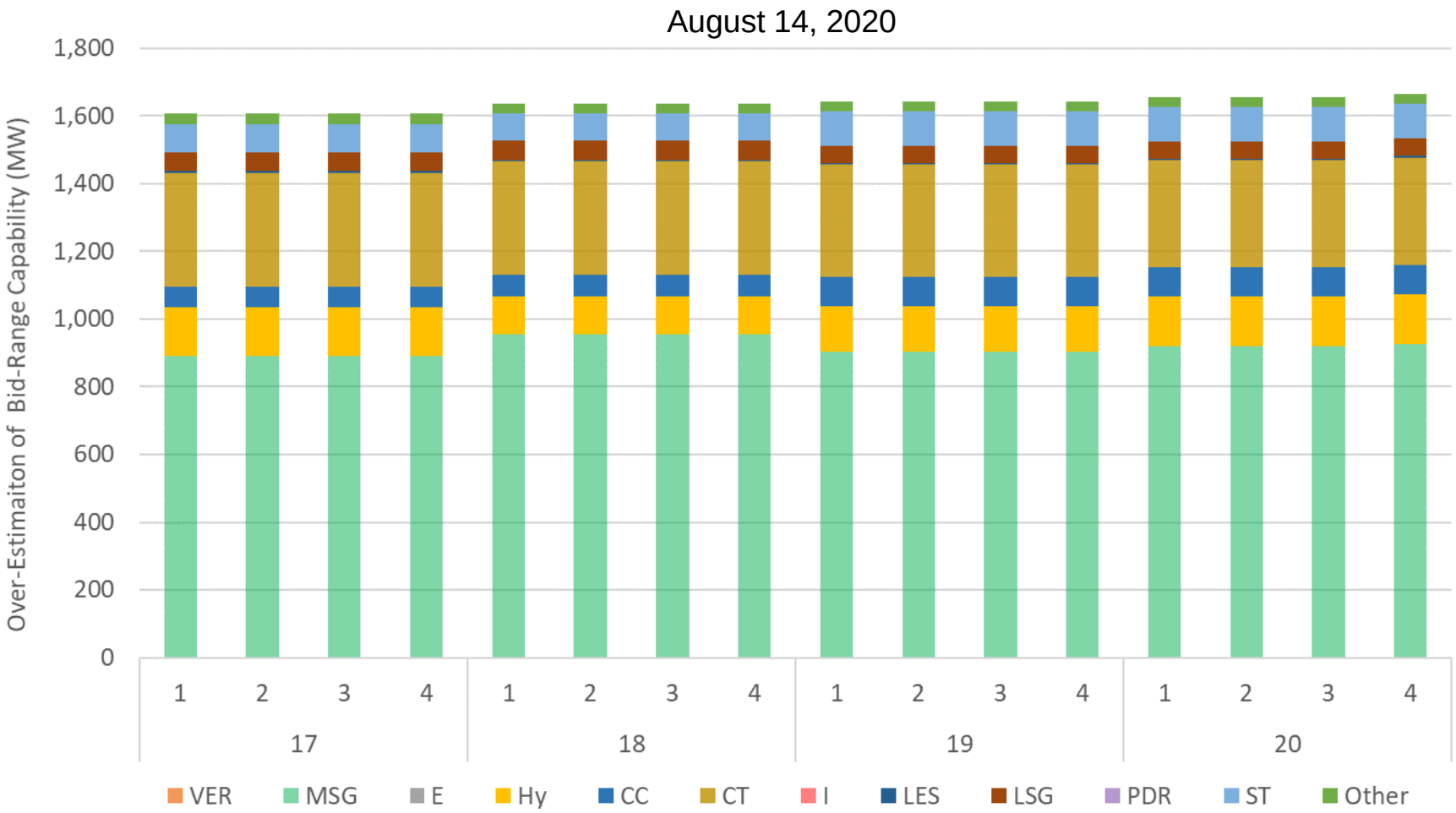
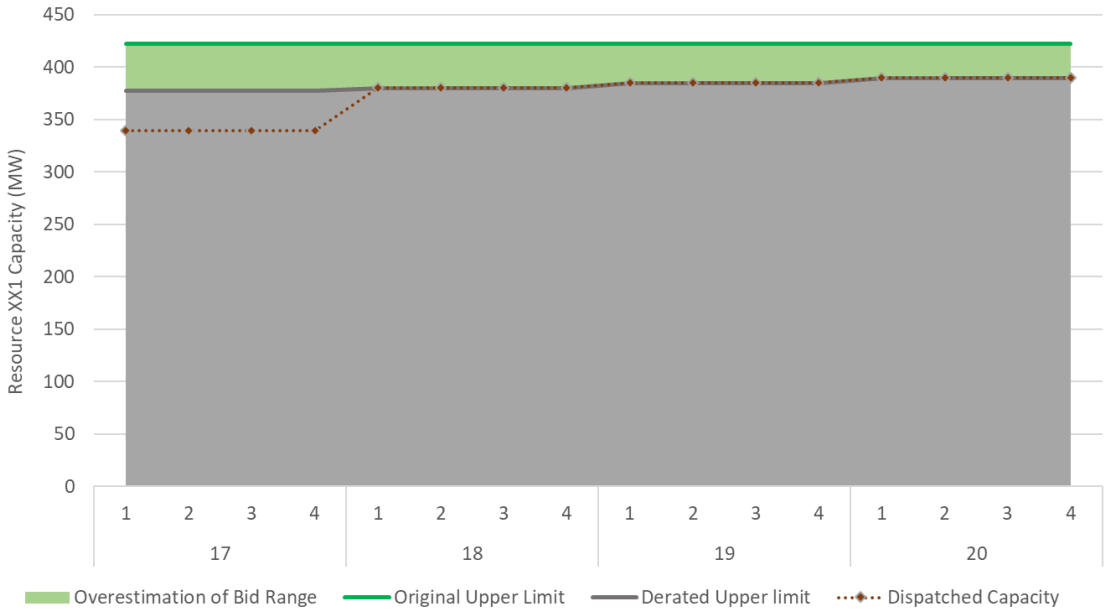
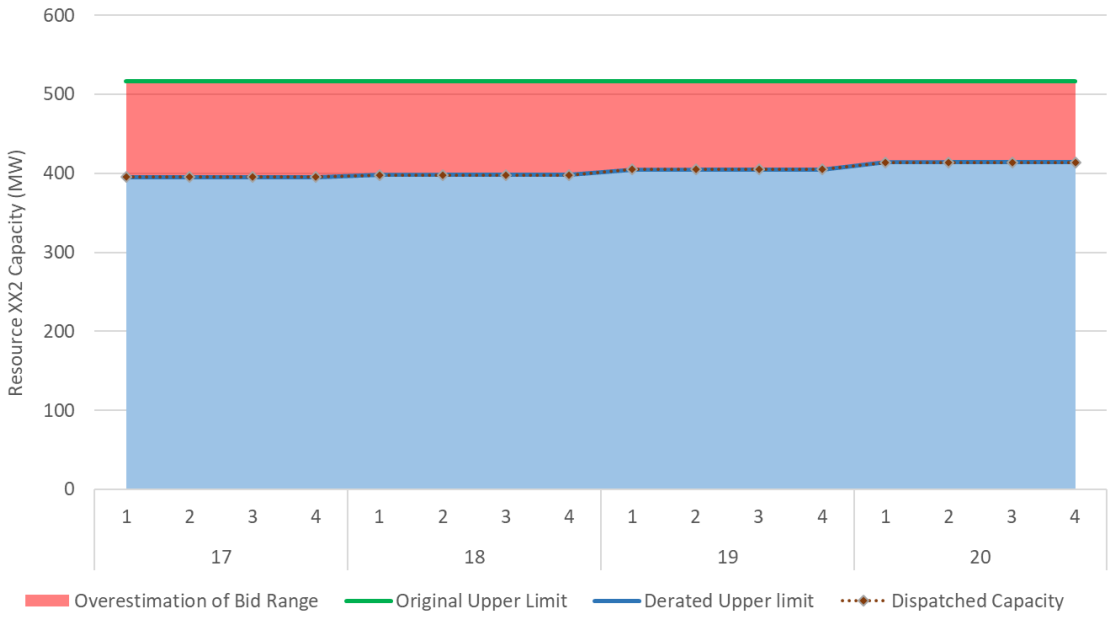
The over-estimation of the resource bid range was largely attributed to not accounting for resource derates

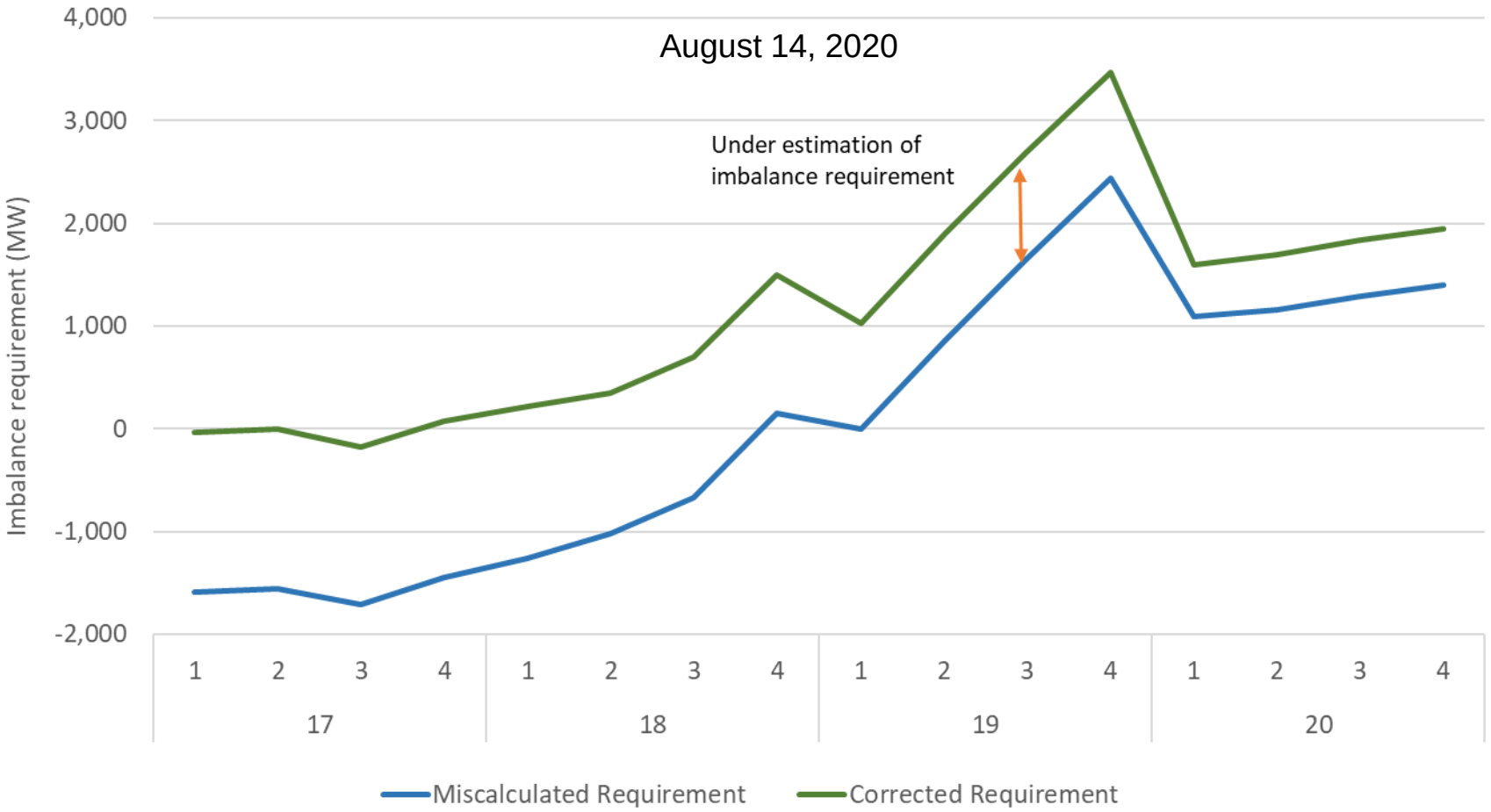


Two actual resource calculation can illustrate the overestimation of the resource bid range capacity on August 14

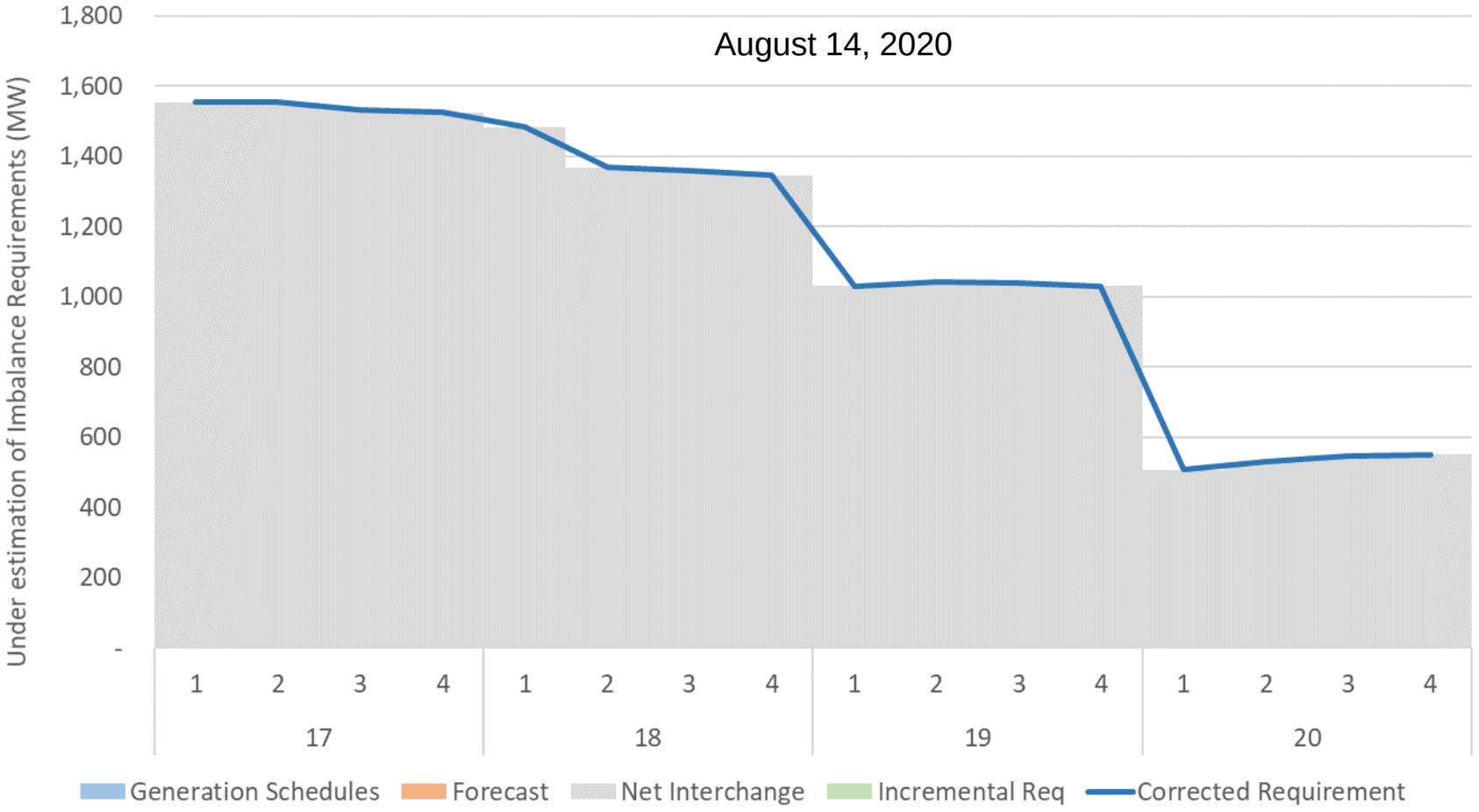




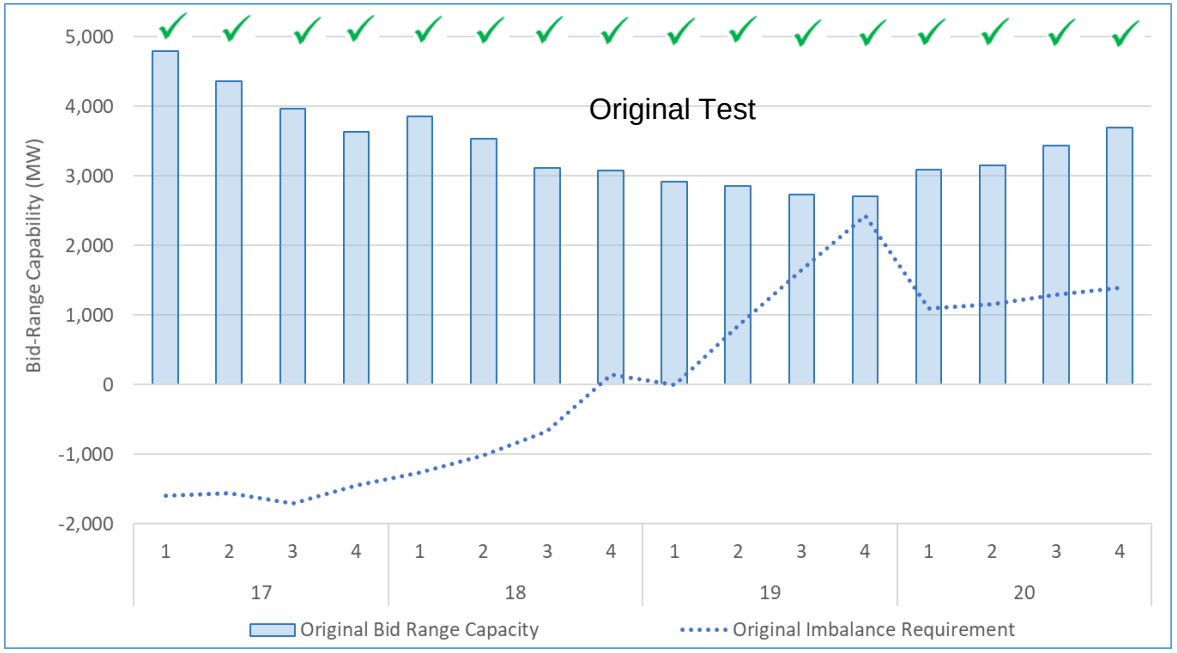
The miscalculation in the bid range test resulted also in under-estimating the imbalance requirement, making it easier to pass the bid range test

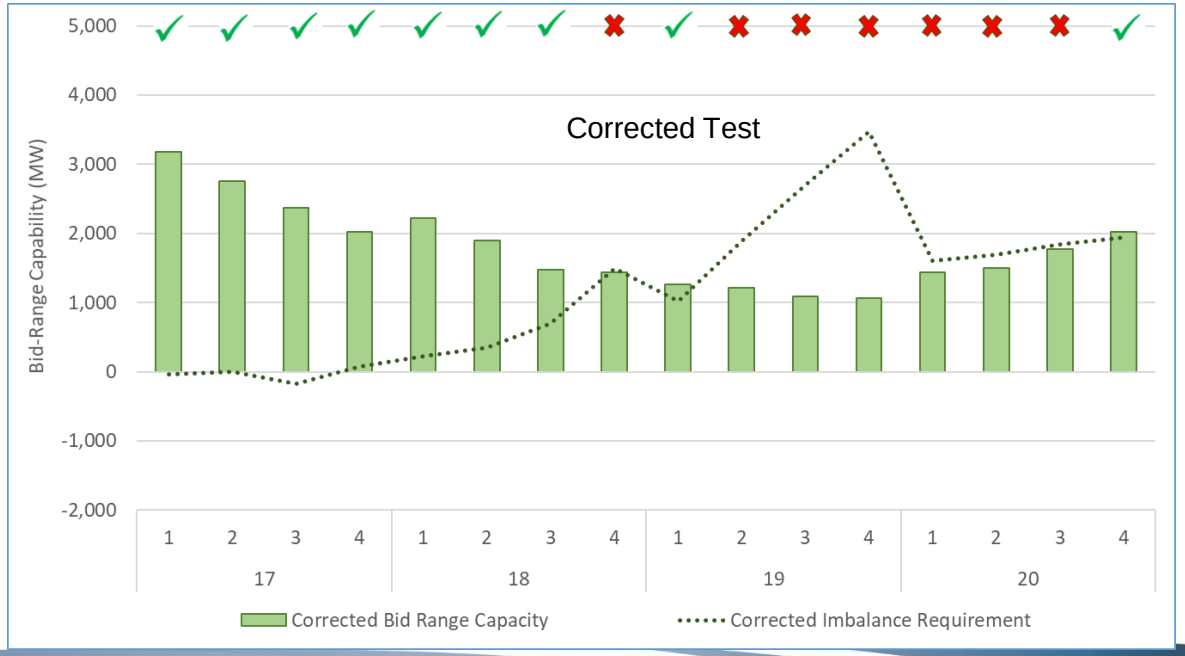


The second issue of not accounting properly for Mirror resources was the main contributor to the under estimation of the Imbalance Requirements



Once the calculation of both the bid range requirements and resource bid range capacity are corrected, CAISO area fails in multiple intervals during the EE2 and EE3 time periods on August 14





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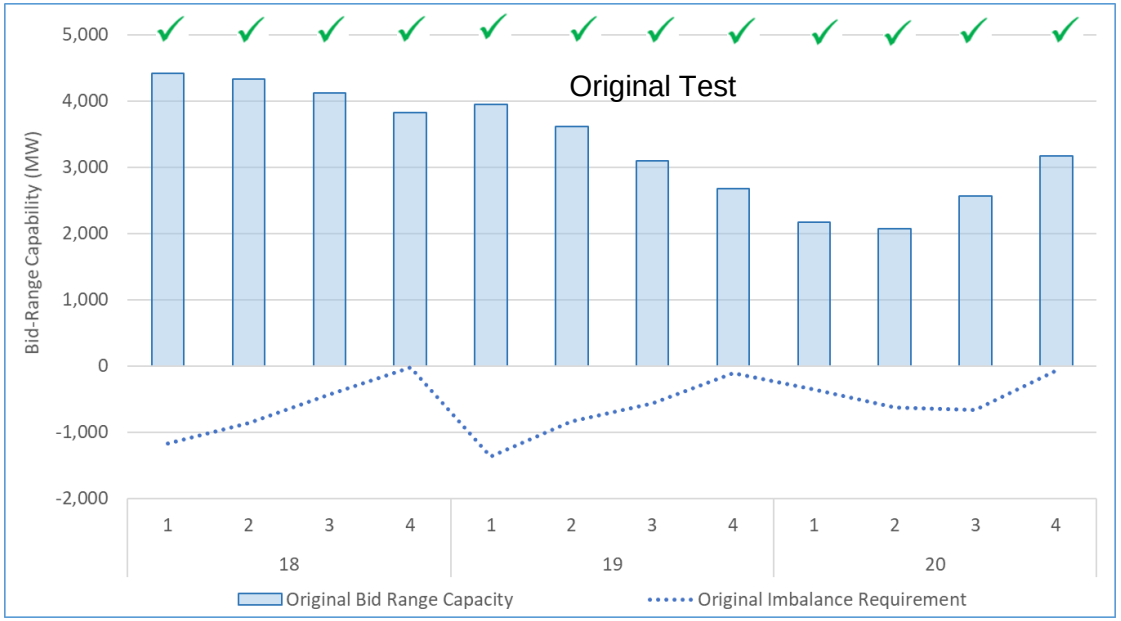
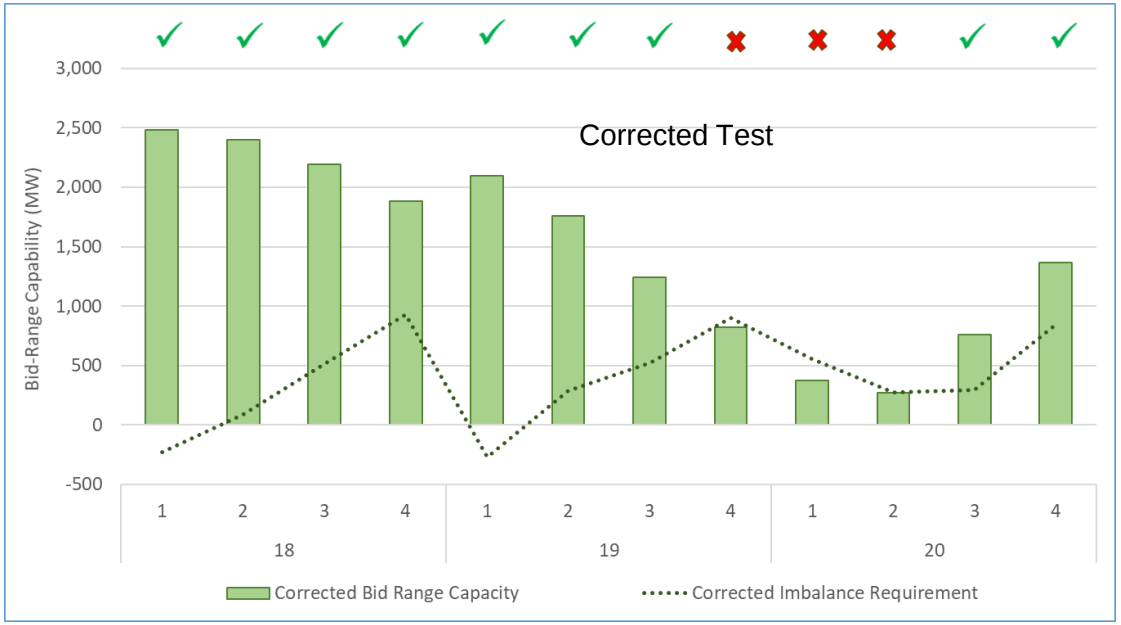
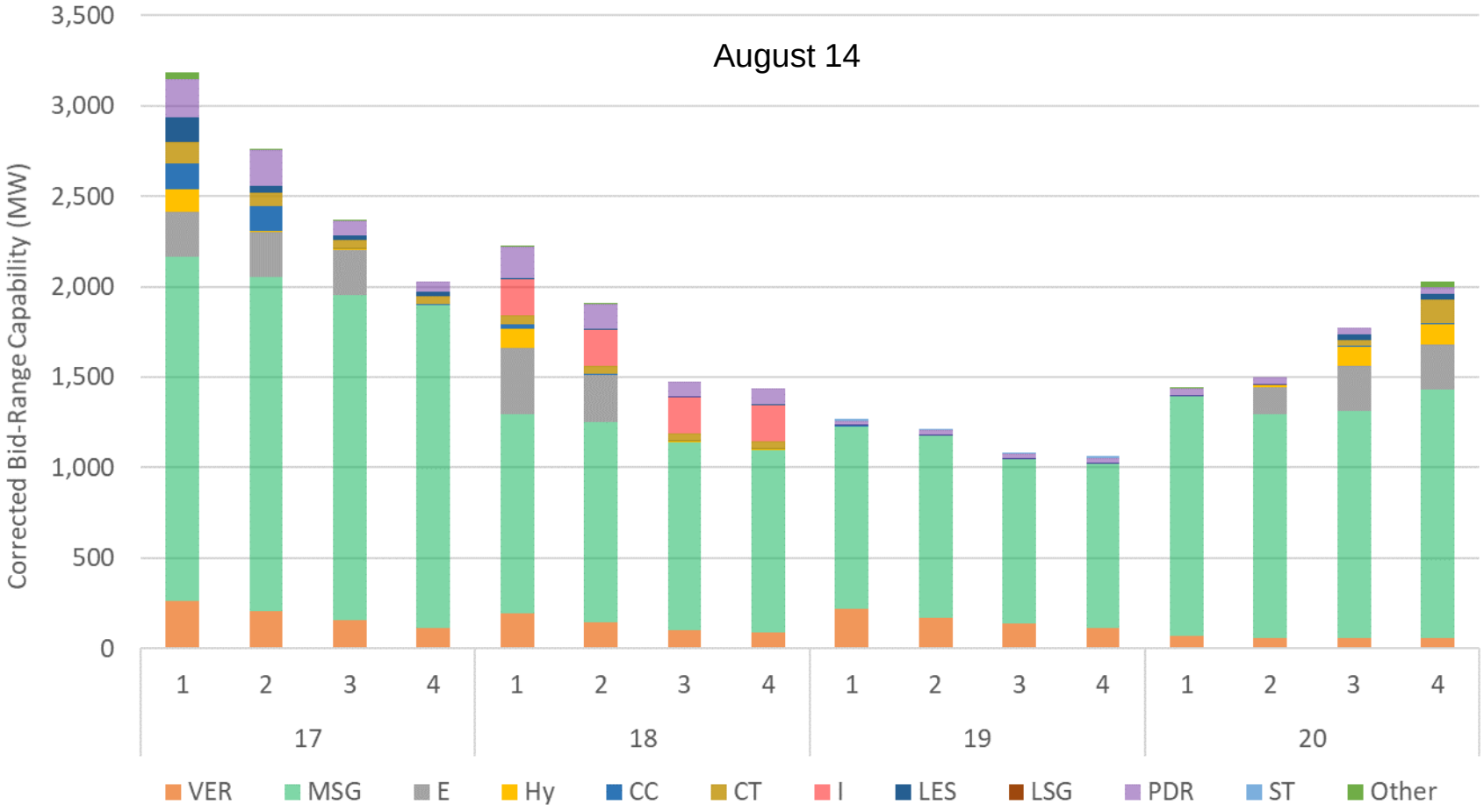




With correct calculation, the bid range test shows CAISO's area still has some bid range capacity available largely from MSG and VER resources



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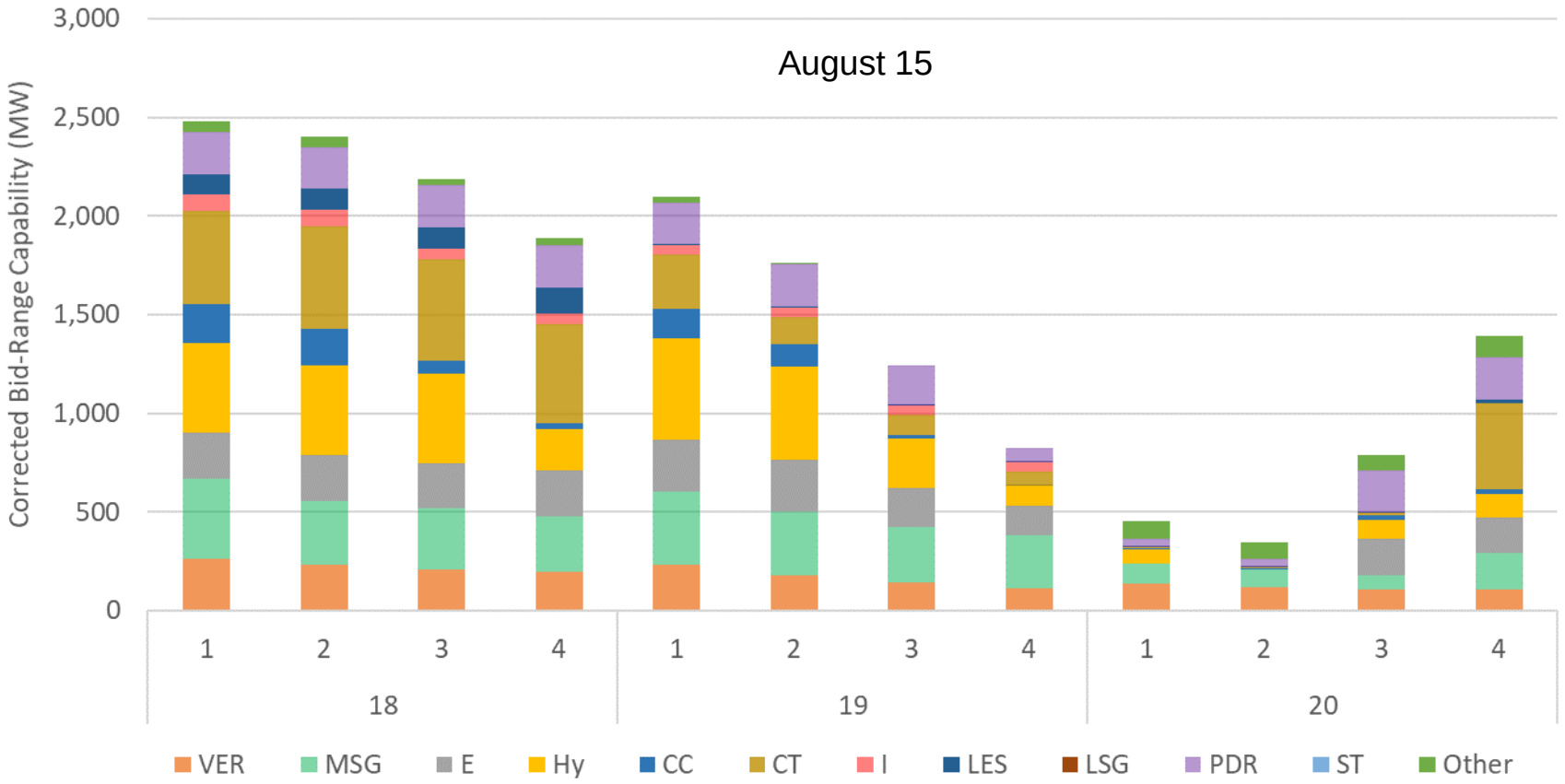
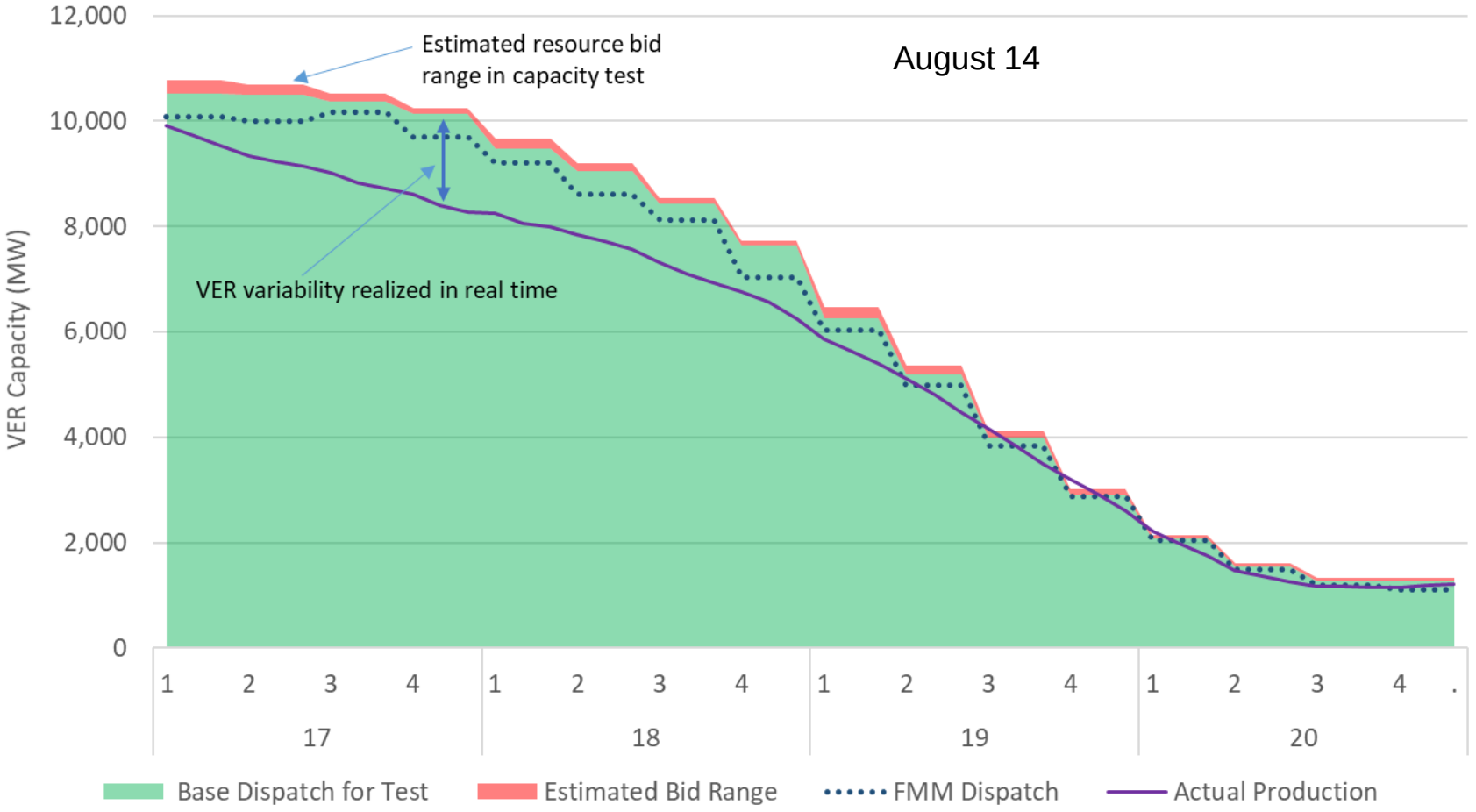
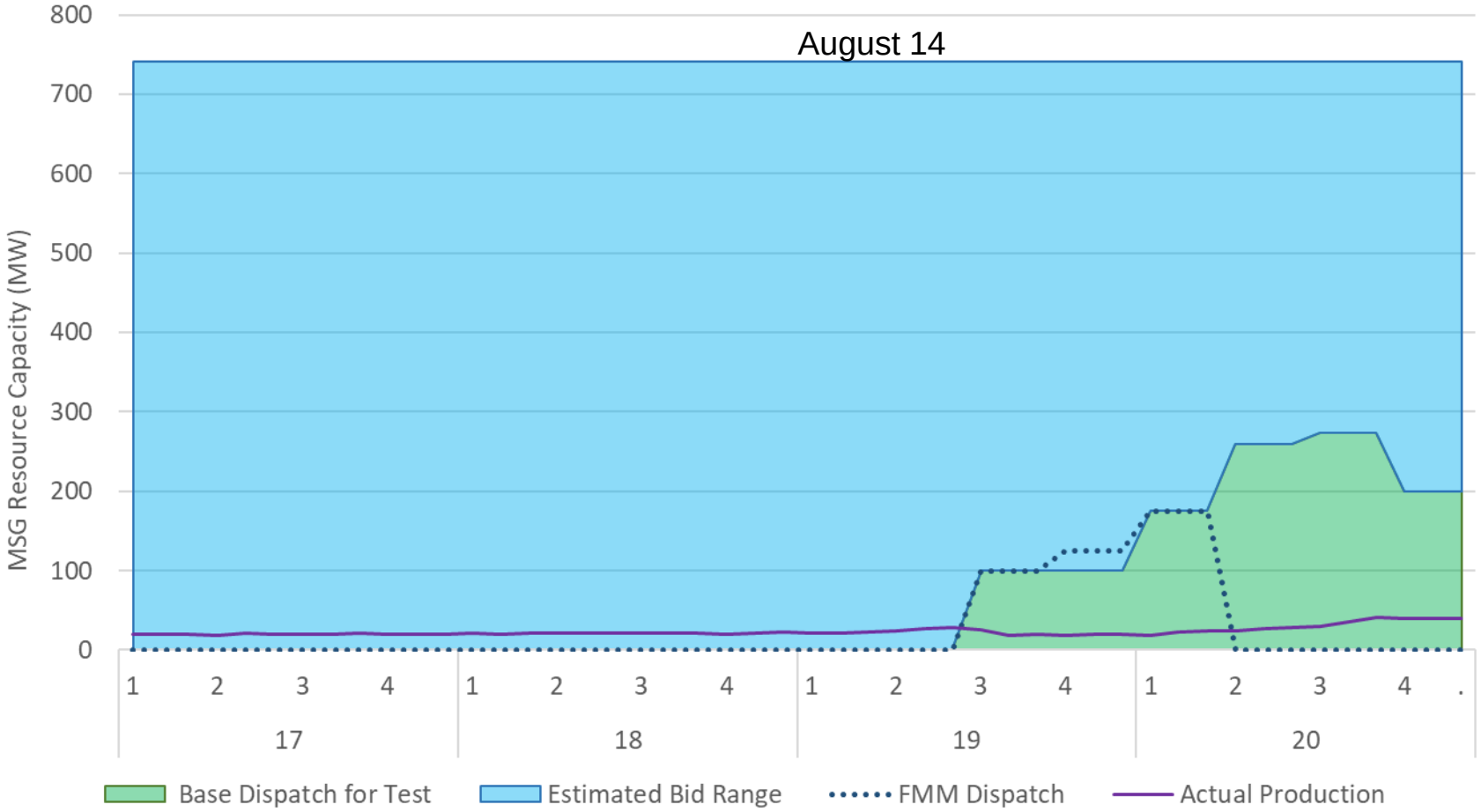


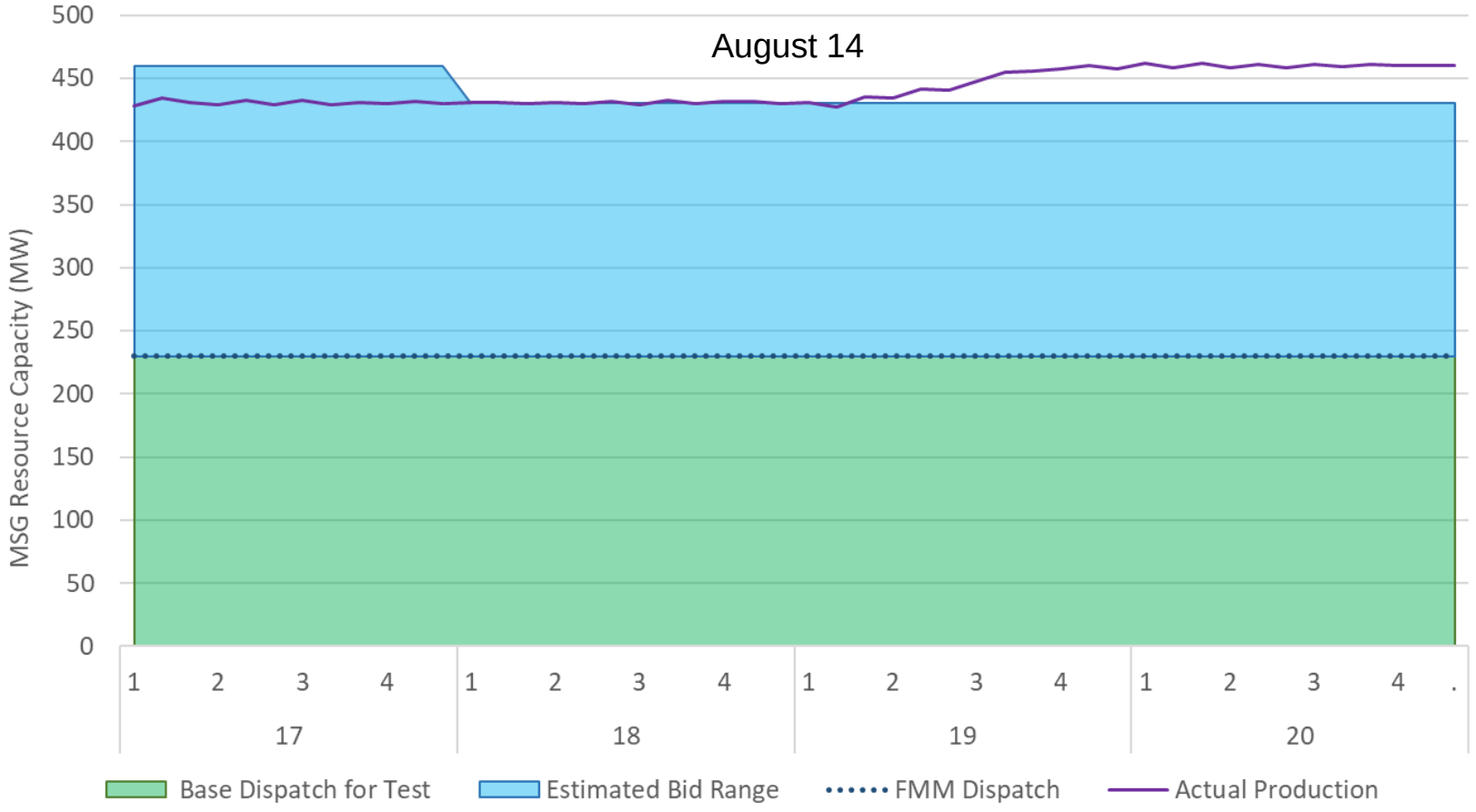
VER provided between 265 and 55MW of bid range capacity, but its variability resulted in an under production of up to 1,800MW



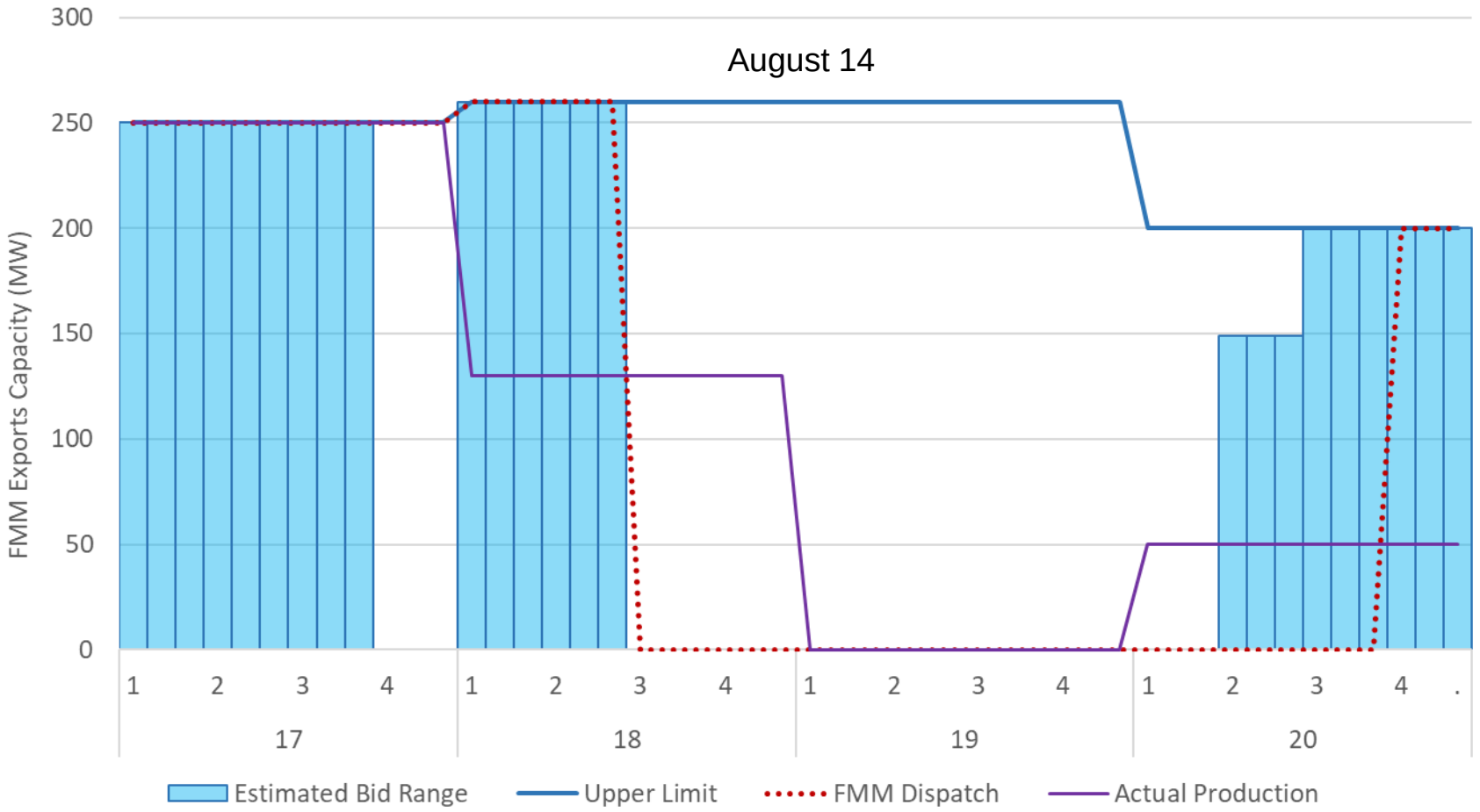
A large MSG had bids for the capacity test timeframe and was trying to come online; this, together with no consideration of temporal constraints, resulted in estimating up to 700MW of bid range for this unit alone



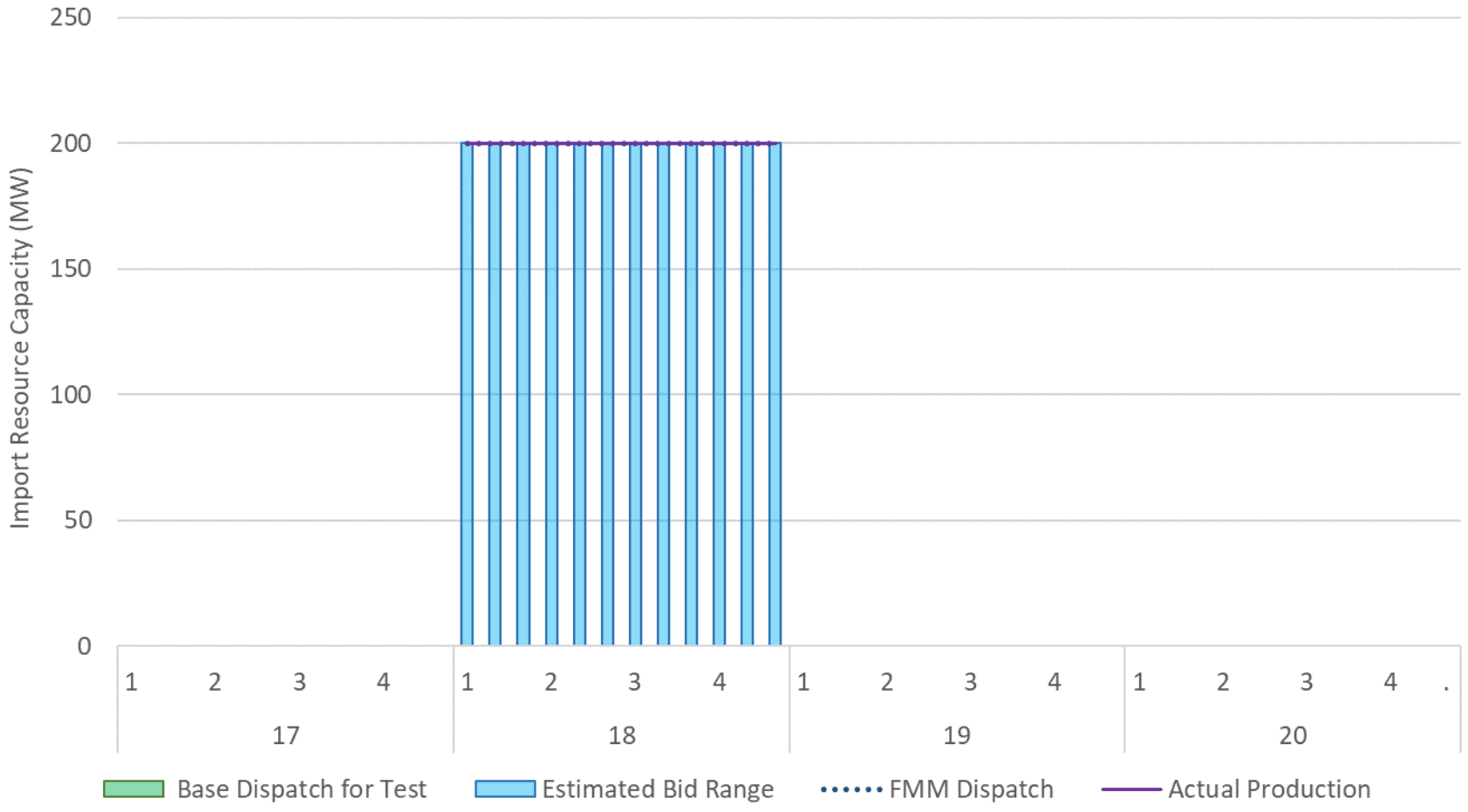
Another MSG had bid range capacity when FMM schedules were in a lower configuration and there were bids for higher configurations.



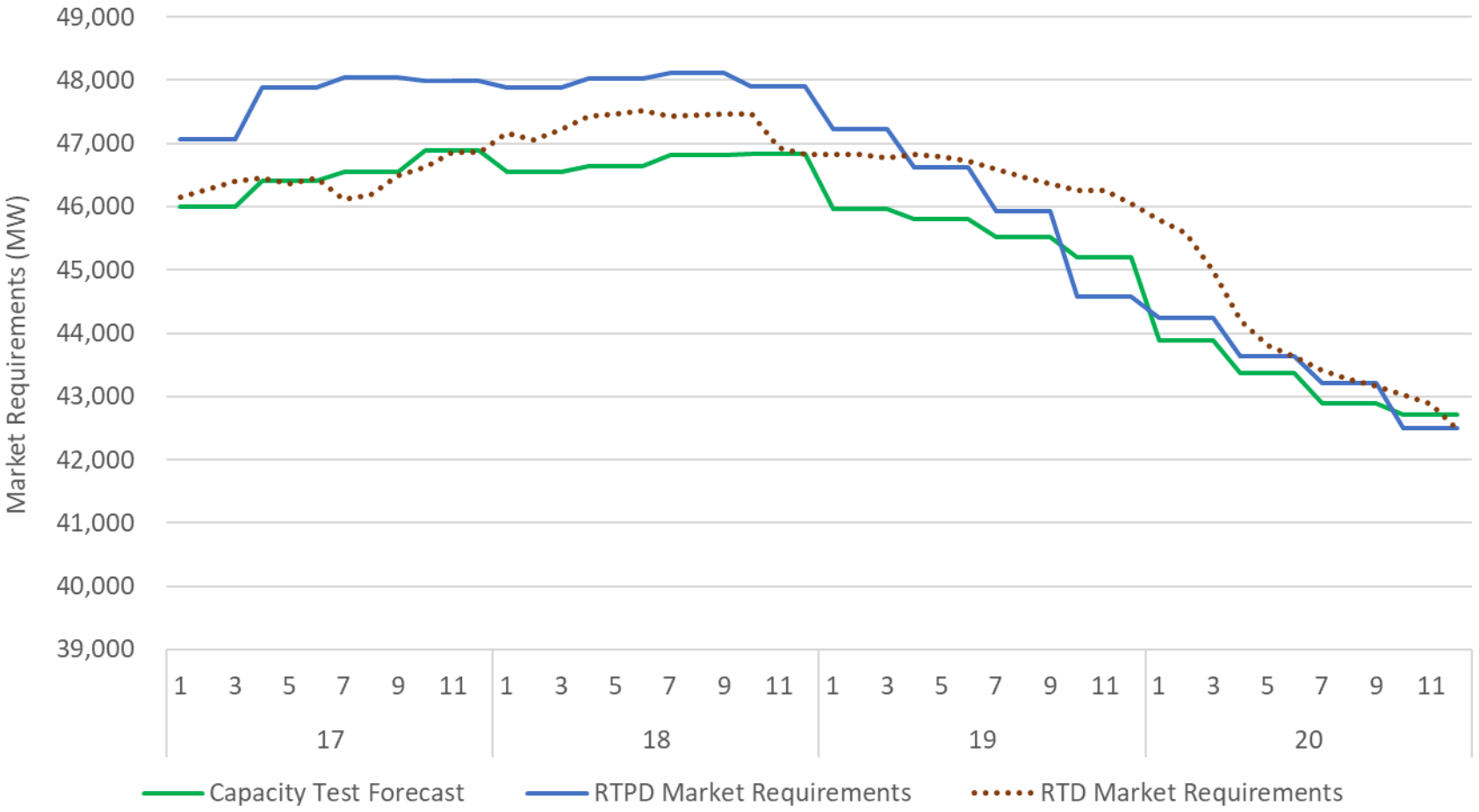
The bid range test accounted for bid capacity only for FMM-type Exports.



The capacity test estimated bid capacity for FMM-type Imports only for hour ending 18, August 14

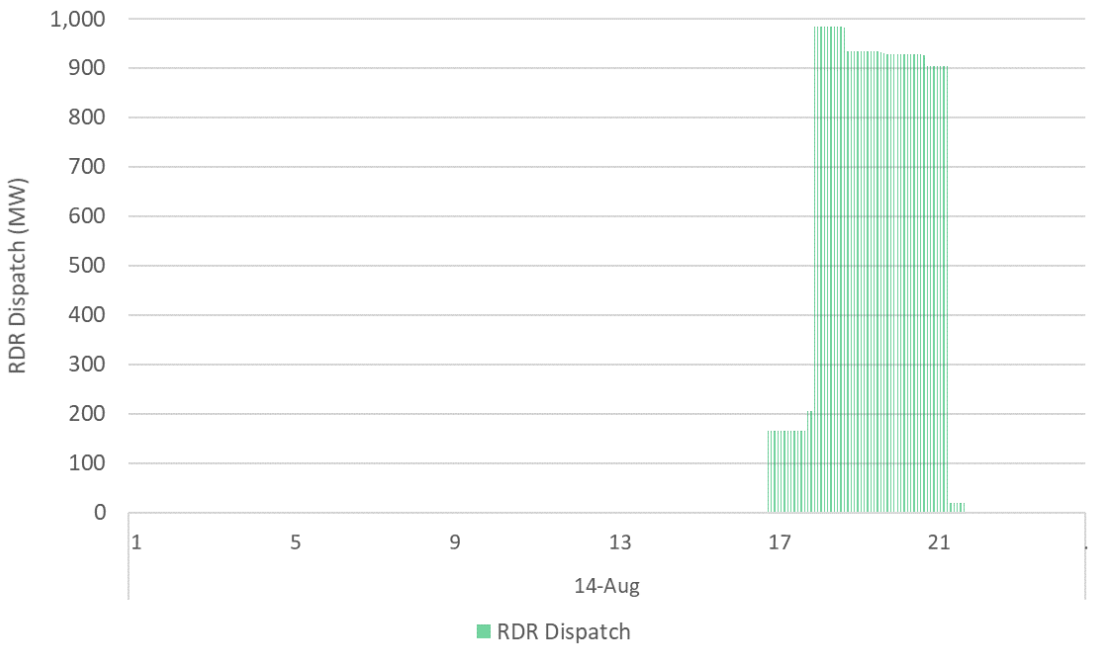


Load Forecast used in the Capacity Test was below the market requirements used in the real-time market in several intervals of the peak hour on August 14

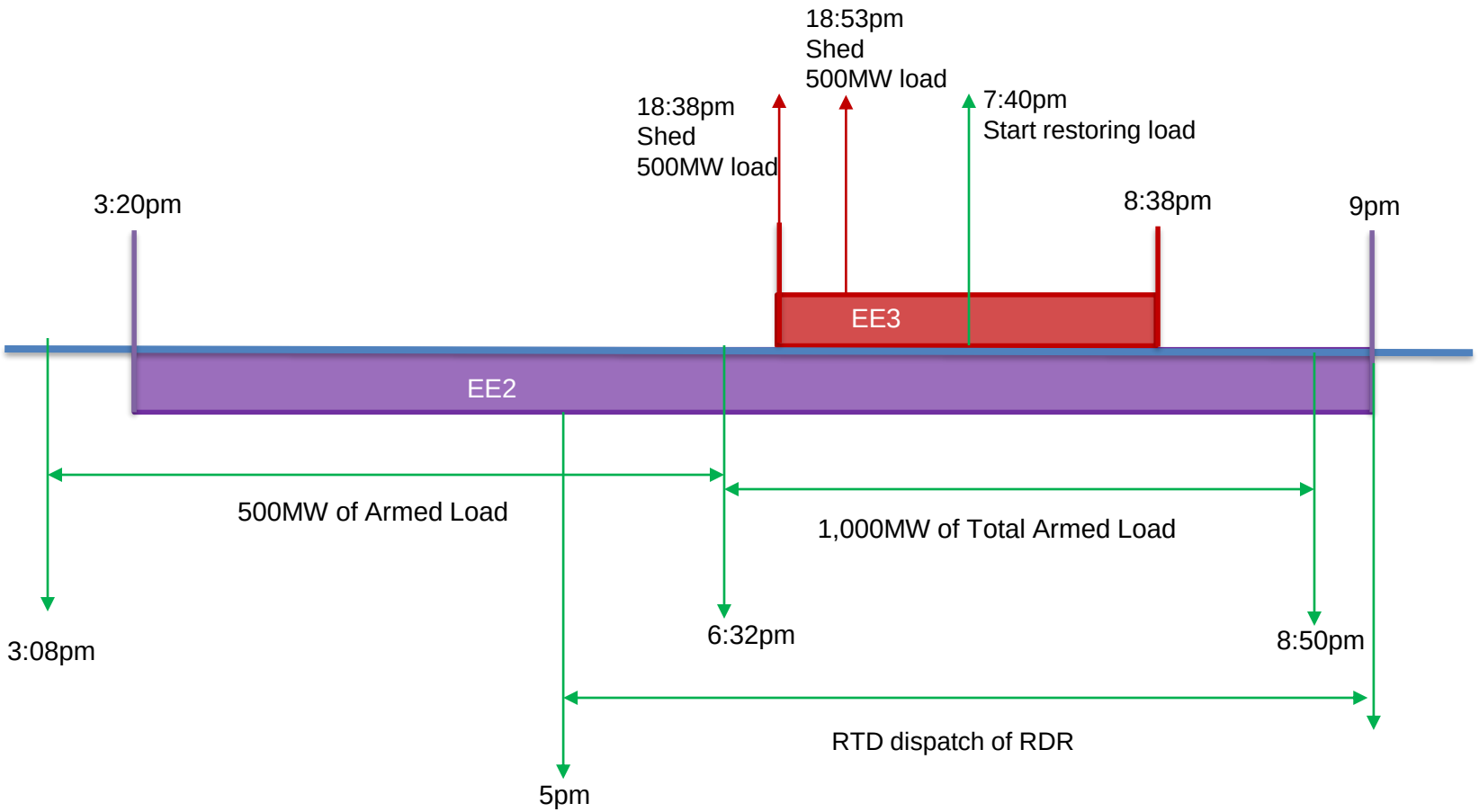


Taking August 14 as a reference, CAISO took actions to deal with the tight supply, which resulted in additional capacity that was not accounted for in the bid range capacity test

- RDRD were manually dispatched close to 1,000MW
- Load was armed to be able to deploy non spinning reserve into energy for a total of up to 1,000MW
- Additional interties were brought through manual dispatches



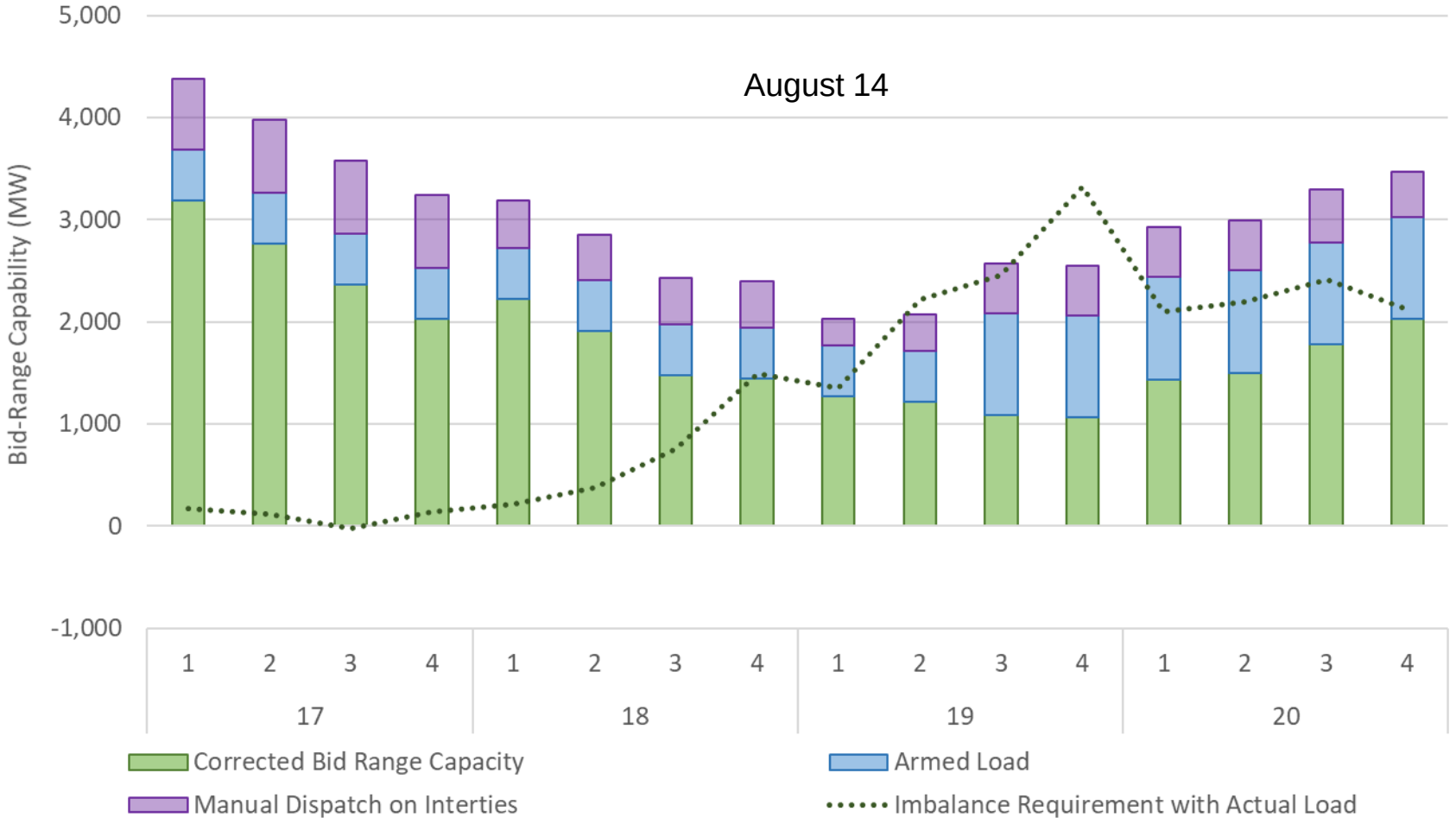
Understanding the timing of CAISO's actions on August 14



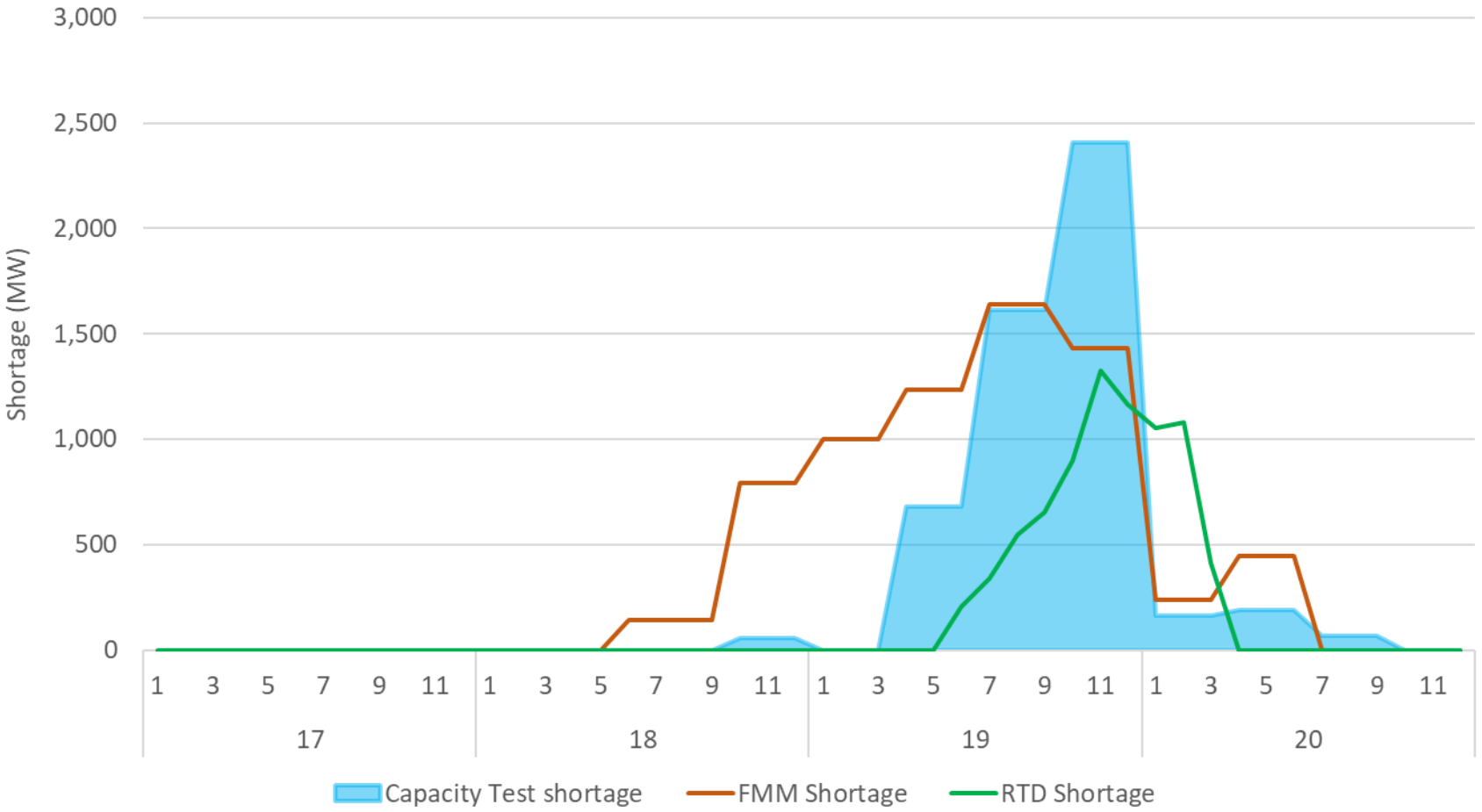
A counterfactual analysis of bid range based on what actually happened in real-time may not be that straight

- CAISO actions brought in capacity that was not foreseen in the capacity test
- Actual load was different than the one used in the test, so do VER production
- PDRD/RDR dispatched in the market may have under performance in actual system; thus, actuals were lower
- Arming load is a just-in-time action so it needs to be considered in relation to the capacity test timeframe
- Shed load may have reduced the actual requirements

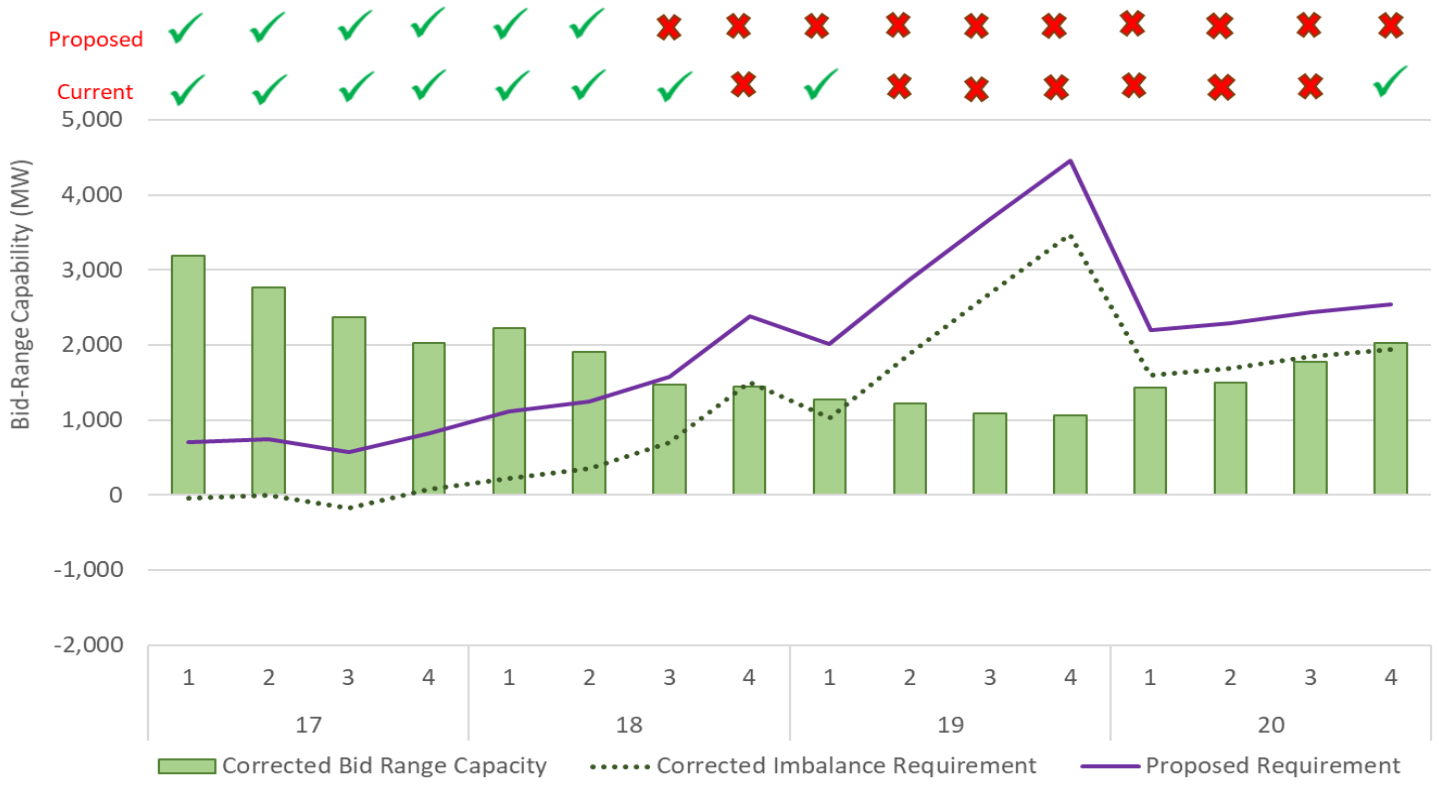
Using actual load for the capacity requirements already reflects RDR dispatches and shed load. This together with arming load and manual dispatches still results in CAISO failing the test



Corrected Bid Range Capacity test failures coincide with projected real-time infeasibilities on August 14



Adding raw ~~Proposed enhancement to add the~~ FRP uncertainty to the capacity requirement as an approximation of the proposed enhancement would have resulted in three additional interval failures on August 14



* Plot revised on April 8 to correct for a typo showing HE18, interval 3 as an interval with Fail instead of Pass status

Using the FRP uncertainty requirement estimated from the flexible ramp test (to assess the summer enhancement impact) would have resulted in two more intervals failing the capacity test