

# Comments on CAISO's Analysis of Structural System-Level Competitiveness

May 20, 2019

## Overview

DMM's 2017 annual report included analysis indicating that while the day-ahead market was structurally competitive during most hours in 2017, the day-ahead market was showing some signs of becoming less structurally competitive in a growing number of hours.<sup>1</sup> Based on this analysis and other market trends, DMM recommended that the ISO begin to consider various actions that might be taken to reduce the likelihood of conditions in which system market power may exist and to mitigate the impacts of system market power on market costs and reliability.<sup>2</sup>

To assess the potential for system market power, the CAISO conducted its own analysis of the structural competitiveness of the CAISO market on a system level.<sup>3</sup> The CAISO's analysis utilized the same measure of structural market competitiveness as DMM's annual report – the Residual Supply Index (RSI).<sup>4</sup> However, the CAISO's analysis calculates the RSI using a variety of different methods and data to measure supply and demand that was used in DMM's prior analyses.

The CAISO's report concluded that the CAISO market “was likely structurally uncompetitive in 55 hours in 2018 using the supply and demand assumptions that the CAISO believes most accurately reflect systems conditions,” and explains that “this frequency is significantly less than what DMM analysis identified [325 hours in 2017] primarily due to a different assessment of the appropriate supply and demand inputs.”<sup>5</sup>

After reviewing the CAISO's report, DMM has performed additional analysis using this same framework for assessing structural market competitiveness. DMM agrees that several changes recommended by the ISO's report represent potential improvements and has performed analysis with these changes to supply and demand measurement incorporated in the methodology. However, DMM does not agree with the CAISO's decision to include all virtual supply bids in the analysis as available supply.

After incorporating all but one the changes which DMM views are most reasonable, DMM's analysis indicates that the CAISO was likely structurally uncompetitive in over 300 hours in 2018 (compared to 55 hours in the CAISO's analysis). One additional change that is likely to reduce structurally uncompetitive somewhat will require additional time to incorporate. Analysis by DMM shows that most of the difference in the results of analyses by DMM and CAISO is due to the inclusion of all virtual supply in the CAISO's analysis.

---

<sup>1</sup> *2017 Annual Report*, Department of Market Monitoring, June 2018, p. 153.

<http://www.caiso.com/Documents/2017AnnualReportonMarketIssuesandPerformance.pdf>

<sup>2</sup> *2017 Annual Report*, p. 251.

<sup>3</sup> *Analysis of Structural System-Level Competitiveness in the CAISO Balancing Authority Area*, California ISO, April 29, 2019: <http://www.caiso.com/Documents/SystemMarketPowerAnalysis-May6-2019.pdf>.

<sup>4</sup> The residual supply index which assesses the structural competitiveness of the market based on the ratio of supply from non-pivotal suppliers to demand during each hour. An RSI less than 1 indicates that market is structurally uncompetitive because supply from pivotal suppliers is needed to meet demand.

<sup>5</sup> *Analysis of Structural System-Level Competitiveness in the CAISO Balancing Authority Area*

These comments provide additional discussion and details of this analysis. DMM looks forward to working with the CAISO and stakeholders on further discussion of this issue.

## Methodology

The CAISO's April 2019 report discusses several changes in how supply and demand may be measured when calculating the RSI which DMM believes may represent refinements in the methodology used by DMM in prior annual reports. These include:

- Use of *input bids* for physical generating resources (adjusted for outages and de-rates) instead of post-processed bids used in the final market software optimization (or *output bids*).
- Accounting for losses (typically increasing demand by 2 to 3 percent)
- Including self-scheduled exports as demand (combined with the day-ahead load forecast plus upward ancillary service requirements and transmission losses).

DMM's prior analyses excluded *net buyers* from the pivotal supplier tests, so no changes were made in this aspect of the methodology based on the discussion in the CAISO's report.

DMM prior analyses also excluded wheeling import and export bids and schedules. DMM has reviewed its methodology for identifying wheeling schedules and bids and believes DMM's analysis correctly accounts for these in the calculation.

As noted in the CAISO's report, in performing its analysis "the CAISO determined that accounting for ancillary services bids in excess of energy bids seemed to be another reasonable scenario. To consider because these are available to the day-ahead market to meet ancillary service needs (which are included in the residual supply index total demand)."<sup>6</sup> DMM agrees adding ancillary service bids which do not have a corresponding energy bid may be a further refinement. DMM will work to incorporate these non-overlapping ancillary service bids into the analysis in a way that properly accounts for these bids. This would likely increase the residual supply and reduce the number of hours found to be structurally non-competitive based on the RSI.

With the features described above, the scenario used in DMM's revised analysis is consistent with the demand scenario which the CAISO considers to be the most representative of system level market power conditions except with respect to treatment of virtual bids.

DMM does not agree with the CAISO's decision to include all virtual supply bids in the analysis as available supply. DMM believes this approach significantly overstates the degree to which virtual bidding (for supply and demand) can have the effect of adding competitively priced net supply to the day-ahead market. Additional discussion of the reasons for this are provided later in these comments. However, to highlight the impact of including virtual supply, DMM's analysis included a scenario in which virtual supply is added to the other assumptions used in DMM's analysis.

---

<sup>6</sup> *Analysis of Structural System-Level Competitiveness in the CAISO Balancing Authority Area*, p. 11

## Results

Results of two scenarios examined in DMMs analysis are provided in Table 1. The first scenario (with virtual supply) should be very consistent with the scenario the CAISO believes most accurately reflects systems conditions. The second scenario (without virtual supply) represents what DMM believes is the most appropriate supply and demand inputs. As shown in Table 1, neither of these scenarios include ancillary service bids that do not have energy bids associated with them. As previously noted, additional work is required to properly account for these bids in the analysis.

As shown in Table 1, if virtual supply is included in the analysis, the RSI3 is less than 1 for a total of 45 hours. This is very close to the 55 hours with RSI3 less than 1 in the CAISO’s report. However, when virtual supply is excluded, there are 305 hours with RSI3 less than 1. This is somewhat lower than the 325 hours with RSI3 less than 1 in DMM’s 2017 annual report.

**Table 1. Hours with Residual Supply Index < 1 (2018)**

	With virtual supply	Without virtual supply
<b>Input bids</b>	✓	✓
<b>Transmission losses</b>	✓	✓
<b>Self-scheduled exports</b>	✓	✓
<b>A/S bids without energy bids</b>	No	No
<b>Virtual supply</b>	✓	No
<b>Hours RSI 1 &lt; 1</b>	5	34
<b>Hours RSI 2 &lt; 1</b>	18	100
<b>Hours RSI 3 &lt; 1</b>	45	305

As shown in Table 1, the RSI3 drops below 1 for a total of 260 hours when virtual supply is excluded from the RSI.<sup>7</sup> The amount of virtual supply (and demand) during these 260 hours is summarized below:

- Virtual supply offered in these 260 hours averaged 6,034 MW. This represents the additional supply included in the CAISO’s analysis that was not included in DMM’s approach.
- In about two third of these 260 hours, virtual supply clearing the market exceeded cleared virtual demand, with *net virtual supply* clearing the market averaging 1,001 MW.
- In about one-third of these 260 hours, cleared virtual demand exceeded cleared virtual supply, with *net virtual demand* clearing the market averaging about 659 MW.

Thus, the amount of virtual supply included in the CAISO’s analysis (about 6,000 MW) greatly exceeds the amount of net virtual supply that actually cleared in these hours. In about one-third of these hours, the net effect of virtual bids clearing the market was to actually increase demand, rather than to increase supply.

<sup>7</sup> 305 hours (without virtual supply) – 45 hours (with virtual supply) = 260 hours.

## Discussion

### Virtual bids

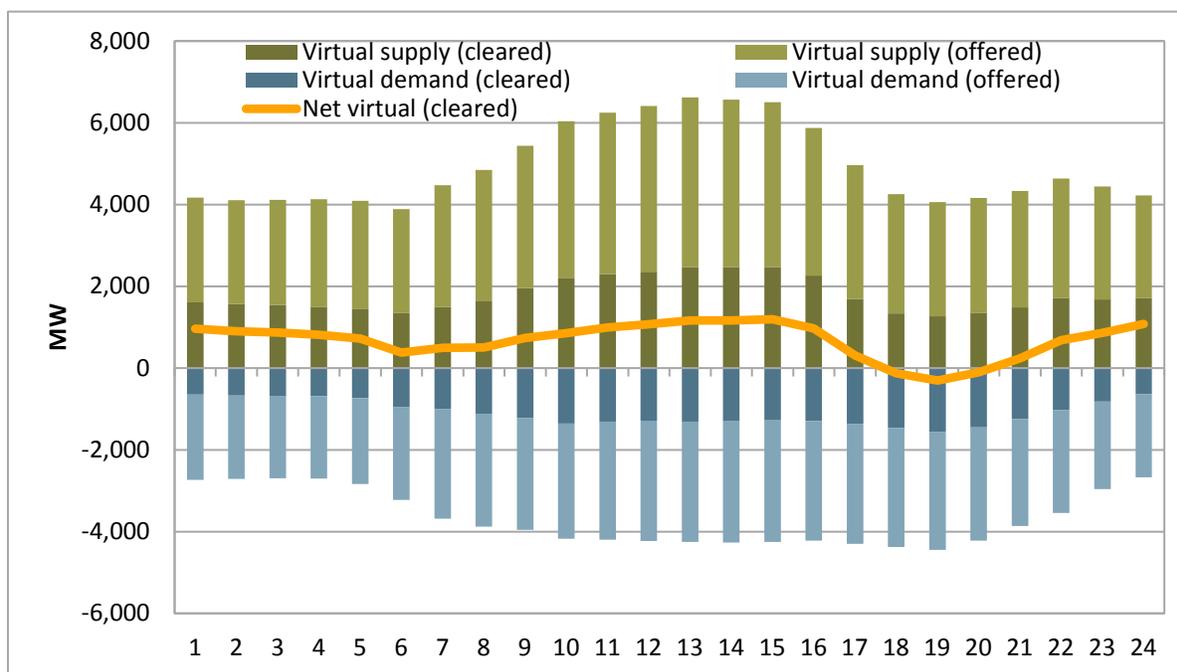
As discussed in DMM’s annual reports, there are two basic types of virtual supply bids.

In 2018, about half of the virtual supply which clears the day-ahead market is designed to profit from differences in congestion between different locations.<sup>8</sup> These virtual supply are paired with virtual demand bids at different location. The combination of these offsetting bids can be profitable if there are differences in congestion in the day-ahead and real-time markets between these two locations. However, these virtual demand and supply bids offset each other in terms of system energy.

Other virtual supply bids are designed to clear only when day-ahead prices reach levels that exceed expected real time prices. There is a large volume of virtual supply bids at prices that are relatively high compared to expected real time prices (and prices that would result under competitive conditions). These bids are only accepted if prices increase significantly above levels that would be expected under prevailing system conditions. These virtual supply bids can help reduce day ahead prices and can limit – but not eliminate - the price impact of market power.

Thus, in practice, a relatively small portion of virtual supply offered in the market is competitively priced, clearing the day-ahead market and not offset by virtual demand bids that also clear the market. This is illustrated in Figure 1, which is from DMM’s 2018 annual report.

**Figure 1. Average net cleared virtual bids in 2018**



<sup>8</sup> 2018 Annual Report on Market Issues and Performance, Department of Market Monitoring, May 2019, p. 134-135. <http://www.caiso.com/Documents/2018AnnualReportonMarketIssuesandPerformance.pdf>

Moreover, even when a significant volume of net virtual supply cleared the day-ahead market in 2018, day-ahead prices remained significantly higher than real time prices. Since virtual bidders profit from these price differences, virtual bidding can help day ahead and real time prices remain closer, but virtual bidding does not eliminate this price difference. Thus, virtual supply can in some cases help to limit the price impact of market power in the day ahead market, but does not keep prices at competitive levels.

For these reasons, DMM believes it is not appropriate to simply include all virtual supply bids as supply when assessing structural market competitiveness with the RSI. If the intent of including virtual bids is to reflect renewable generation that is not scheduled or bid in day-ahead market, but generates in real-time, then it is more appropriate to include the forecasted or actual amount of this generation as supply in the analysis directly.

### **Input bid output bids**

As noted in CAISO's report, in prior analyses DMM has used a set of supply bids that was dependent and constrained based on the day-ahead market optimization. These post-processed bids (or *output bids*) reflect the maximum offer accounting for current-hour conditions including ramp capability and commitment. DMM recognize that this quantity may underestimate the maximum supply available in the day-ahead market optimization and therefore used an input based approach in this additional analysis.

With this input bid approach, it is necessary to correctly limit these input bids to account for de-rates and outages. However, there are a number of other constraints that can impact the availability of offers net of de-rates, even optimized over 24 hours. For instance, minimum off-times or start-up times can make offered capacity unavailable in the day-ahead market. Similarly, a resource may be subject to ramping or commitment conditions relative to the previous day-ahead market solution that can impact the maximum availability of the bid-in capacity, regardless of how the day is optimized over the 24 hours.

It would be very difficult for DMM to fully account for these constraints when determining the amount of input bids that would be actually available in the day-ahead market each hour. Thus, while DMM agrees that the input bids (adjusted to account for de-rates and outages) may provide a better indication of the supply of bids in the day-ahead market, this approach may somewhat overestimate the actually supply available in the day ahead market optimization.

### **Ancillary service bids that do not overlap with energy bids**

DMM agrees that the subset of ancillary service offers that do not overlap with energy offers in the day-ahead market should be included as the RSI calculation accounts for upward ancillary service requirements in the demand-side. DMM reviewed non-overlapping ancillary service offers using post-processed bids. During the 500 hours with the lowest RSI<sub>3</sub>, there were roughly 200 to 800 MW of this capacity. The bulk of the non-overlapping ancillary service awards were from net buyers or smaller net sellers, and therefore its inclusion tends to increase the RSI calculation.

## **Changes in resource supply and other future trends**

In the June 2018 meeting of the Market Surveillance Committee, DMM presented RSI results from 2017.<sup>9</sup> This analysis (included as Figure 1 in the CAISO's report) also included a sensitivity with the significant change in control of resources that occurred in June 2018 applied to results for 2017. These results showed if 2017 results were modified to changes in control of resources taking effect in 2018, the number of hours with an RSI less than one increased from 325 to about 500 hours.

The CAISO's report and presentation indicate that based on this sensitivity analysis DMM "projected" that the day-ahead market would be structurally uncompetitive for about 500 hours in 2018. DMM clarifies that this type of sensitivity analysis does not represent a forecast or projection. The purpose of this analysis was to highlight the degree to which trends in changes in ownership can impact market competitiveness. Any projection of future structural market competitiveness would need to take a variety of other factors into account (loads, resource additions/retirements, hydro conditions). In addition, such analysis should be viewed as analysis of the range of different scenarios, rather than as a forecast of system conditions.

---

<sup>9</sup> Market Surveillance Committee - System Market Power, June 7, 2018, slide 10, 11:  
[http://www.caiso.com/Documents/Presentation-SystemMarketPower-June7\\_2018.pdf](http://www.caiso.com/Documents/Presentation-SystemMarketPower-June7_2018.pdf).