Analysis of Structural System-Level Competitiveness in the CAISO BAA

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Background

- In June 2018 the Department of Market Monitoring recommended that the ISO consider actions to be taken to reduce the conditions in which market power may exist

- Currently the Residual Supply Index (RSI) is used to identify hours in which system market power may exist

- DMM reports track RSI metrics for the top pivotal suppliers

Current RSI calculation

- RSI metrics employed by DMM is not a counter-factual metric but an after-the-fact metric developed using market data from the day-ahead market solution

- While the RSI metric is well established, its components can take different values depending on the data considerations and assumptions made

- RSI metrics calculated as recent as 2017 Study Year are based on hour-by-hour calculations and showed hours with RSI below the competitive threshold (1pu)

RSI calculation

- A group of *n* participants will be considered jointly pivotal if

$$\sum_{i=1}^{n} P_i > P_S - P_D$$

where

P_i: supply *under* control of participant *i (i-th Pivotal supplier)*

P_S*:* total system supply

P_D*:* system demand

- Rearranging the above equation, the Residual Supply Index (RSI) is

$$RSI_n = \frac{P_S - \sum_{i=1}^{n} P_i}{P_D}$$

if RSI_n*<1,* the *n-th* pivotal test fails

Basis used in DMM's current RSI calculation

- P_D: *system demand*

  Day-ahead load forecast +

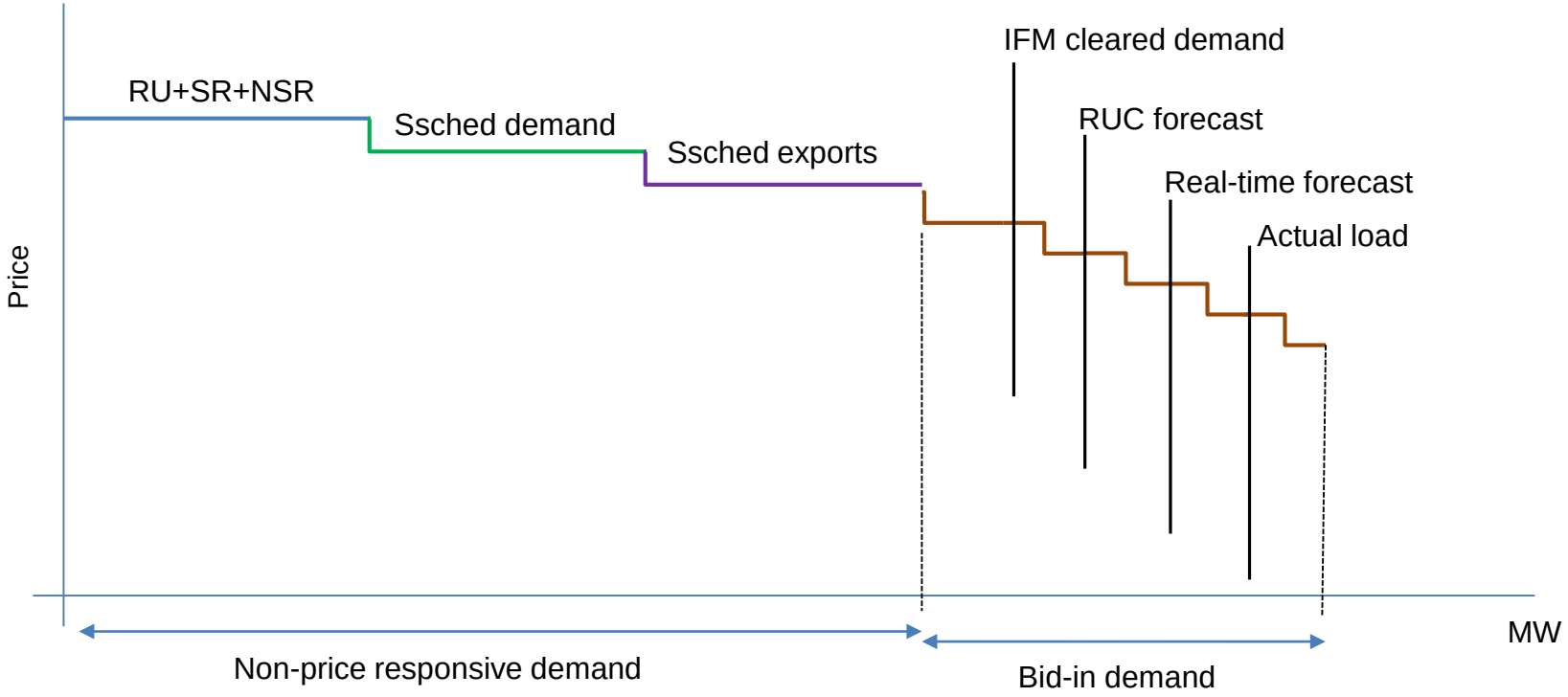
  Regulation up requirements +

  Operating Reserves requirements

- P_S: *total system supply*
  - ✓ *Energy bids only*
  - ✓ *All types of internal generation (physical only)*
  - ✓ *Interties (including Import wheels)*

- P_i: *Pivotal supplier*
  - ✓ *Considers all affiliates*
  - ✓ *Excludes Net buyers from the test*

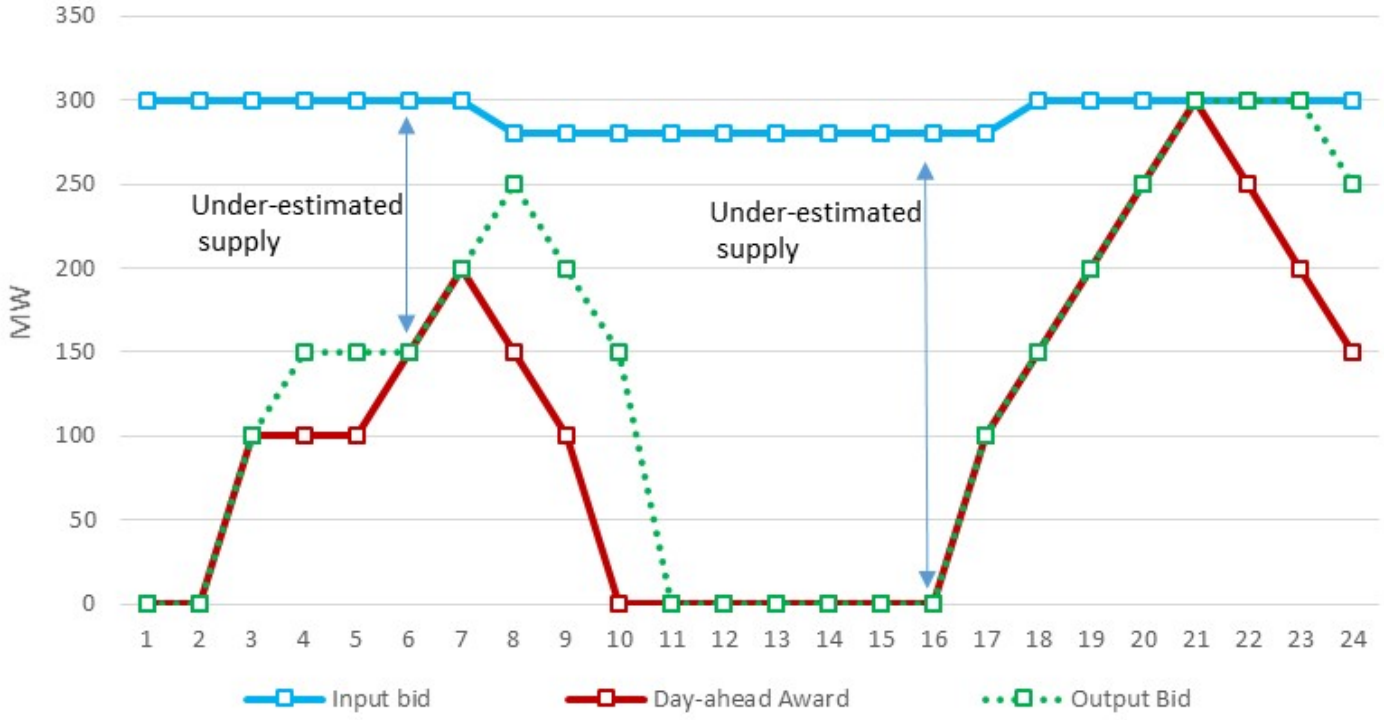
What should the system demand P_D be?



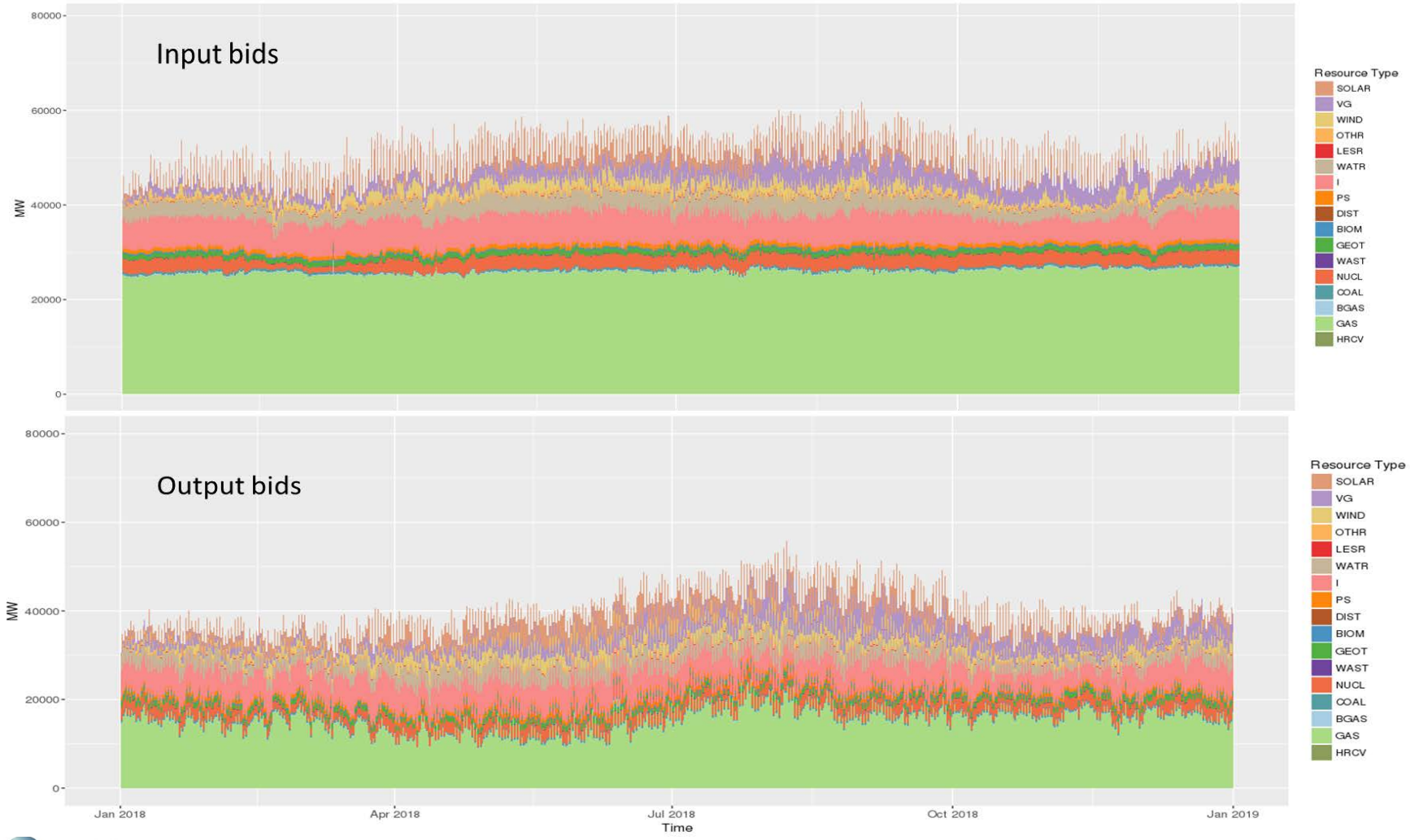
- Price responsive demand can curb market power in day-ahead

What should the supply (P_S, P_i) be?

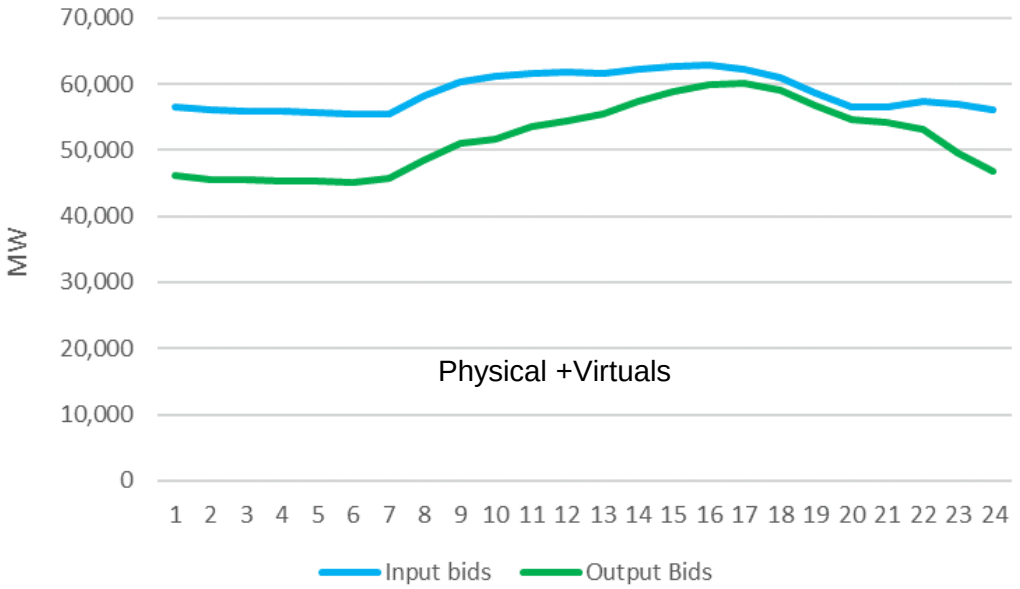
- Current RSI calculations rely on bid data pre-processed within the market calculation; these are referred as *Output bids*
- Range of *Output Bids is based* on the already optimized DAM solution
- This data is not reliable as it does not necessarily reflect the available supply to the market.

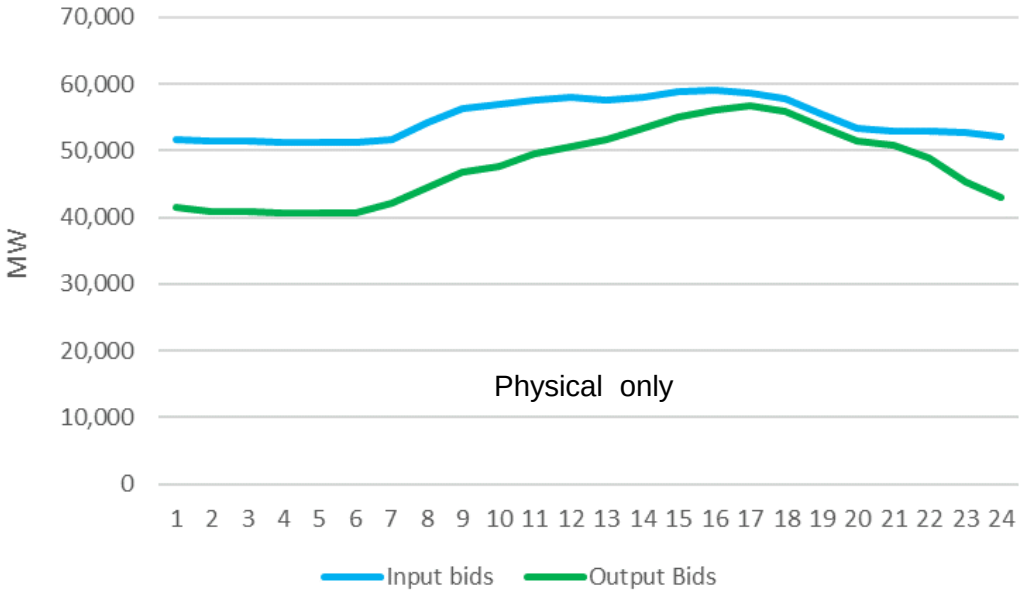


Supply considered using input bids will be greater than supply considered with pre-processed bids

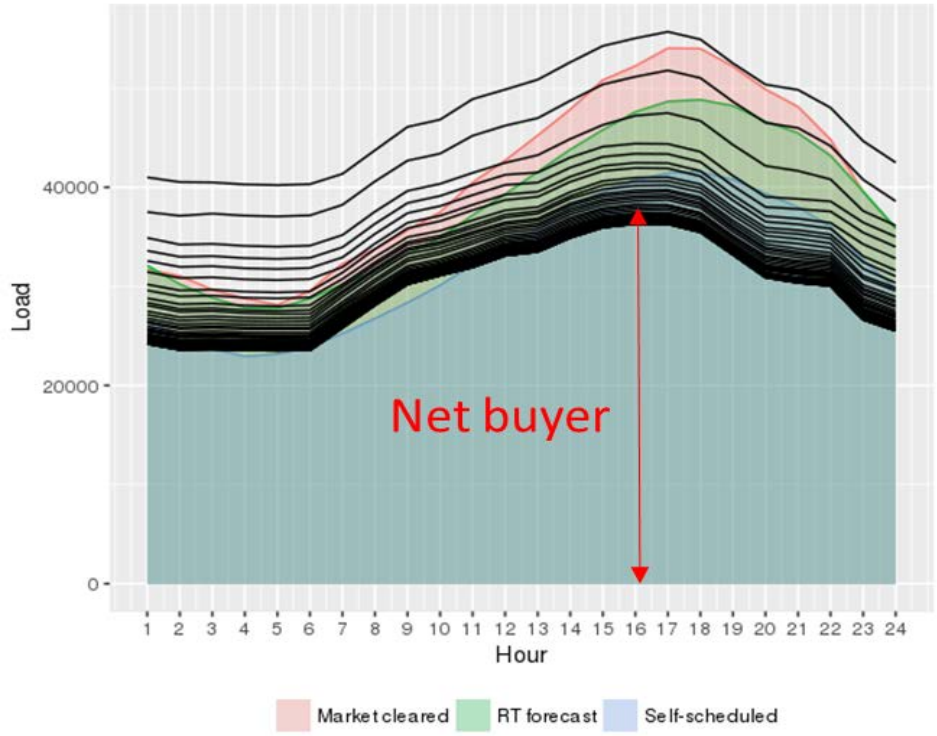


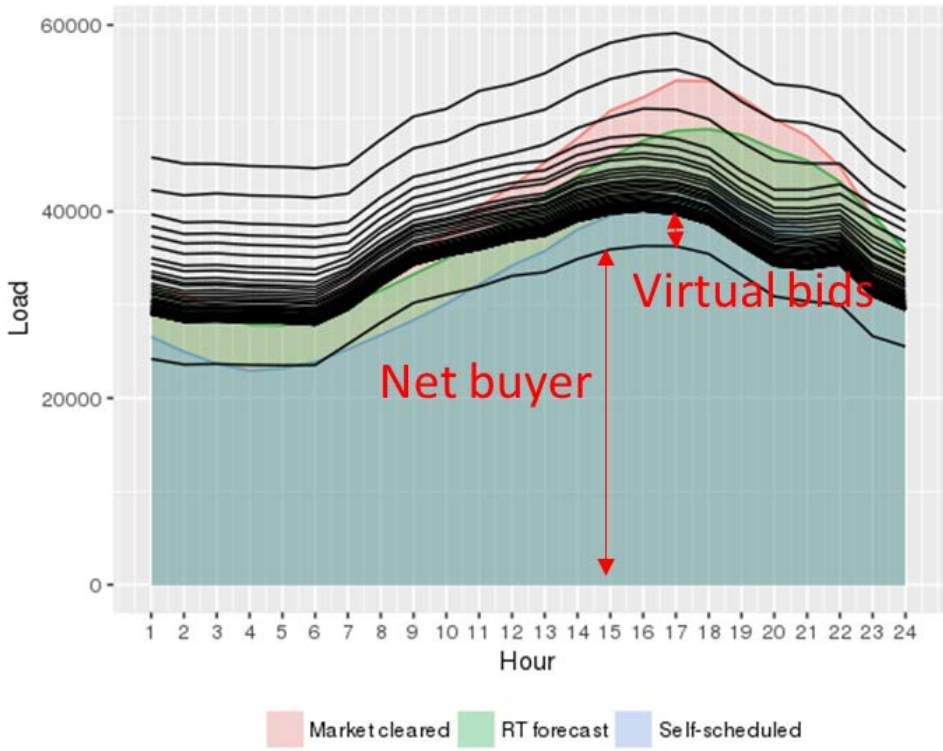
Using inputs versus solution-based available capacity will yield different outcomes





Input bids against different assumptions of demand lead to different outcomes of RSI

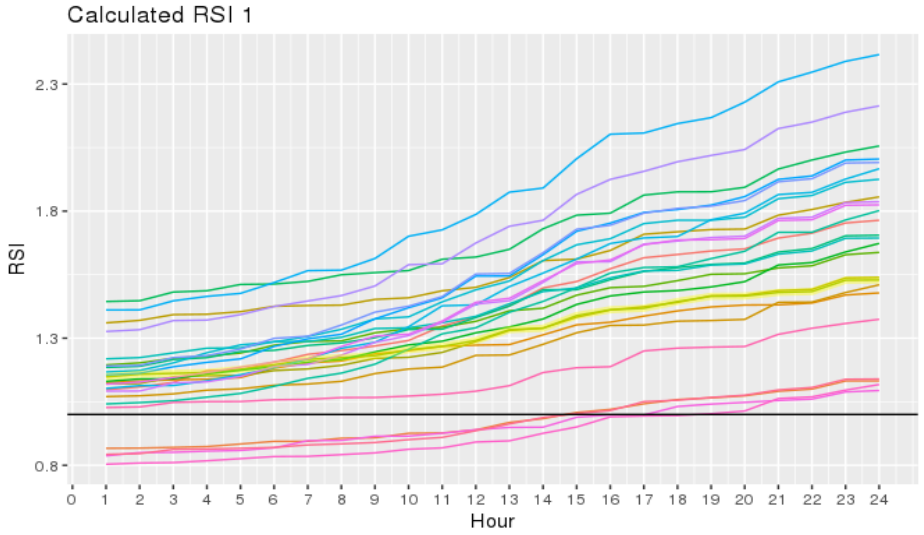


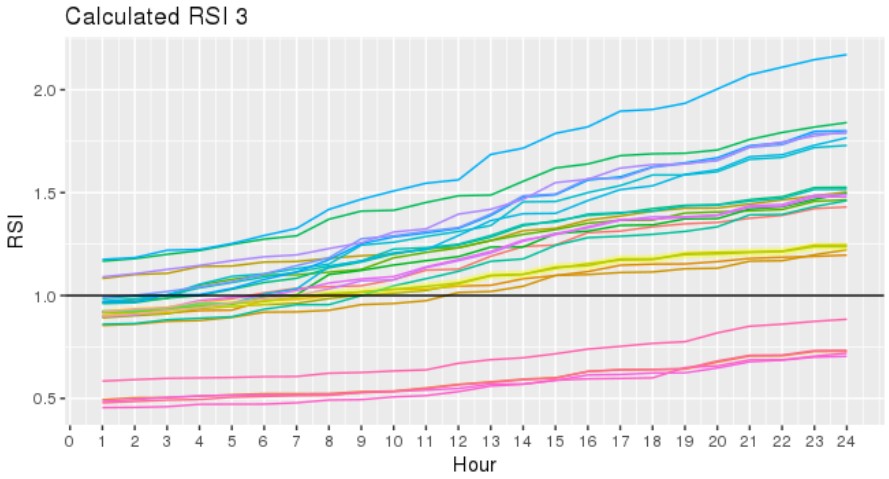


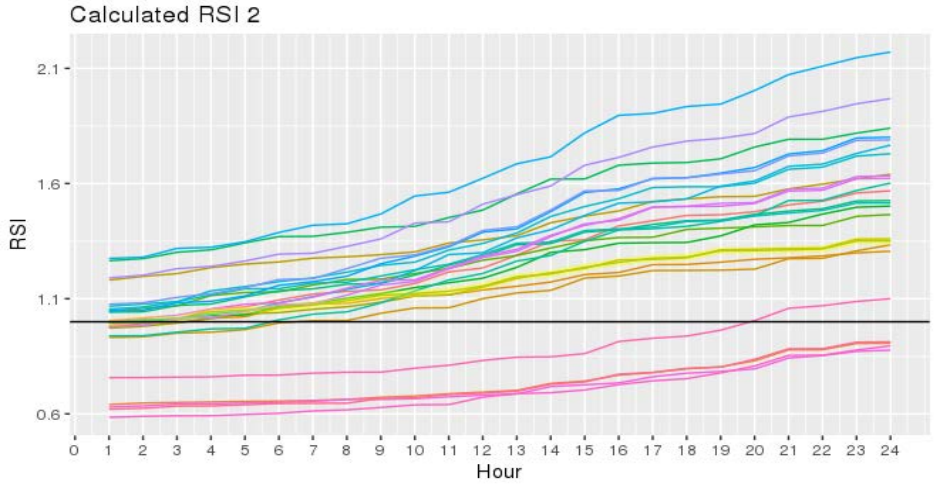
Assumptions for the Supply and Demand components of RSI calculation for sensitivity analysis

Supply	Demand
1. **Input physical - net buyer**	1. Measurement
2. **Output physical**	2. Cleared demand
3. **Output physical - net buyer**	3. Self-schedule
4. **Output physical + virtual - net buyer**	4. DA forecast
5. **Input physical+ virtual - net buyer**	5. RT forecast

Sample peak day of RSI metrics using 25 cases for sensitivity analysis shows a large spectrum of outcomes







Sensitivity analysis for 45 different scenarios shows a wide range of potential outcomes

Hours when RSI fails with 1 pivotal supplier (RSI1)

Demand	Input Physical - Net Buyers	Output Physical	Output Physical - Net Buyers	Output Physical + Virtuals - Net Buyers	Input Physical + Virtuals - Net Buyers
RT Forecast	0	1247	3	0	0
DA Forecast	6	1234	9	0	0
Self-Schedule	0	38	0	0	0
Market Cleared	37	2490	106	8	5
Measurement	3	1682	16	0	0

Supply

Demand	Input Physical - Net Buyers	Output Physical	Output Physical - Net Buyers	Output Physical + Virtuals - Net Buyers	Input Physical + Virtuals - Net Buyers
RT Forecast + Self-Scheduled Exports	16	1941	37	2	0
DA Forecast + Self-Scheduled Exports	25	1987	46	5	5
Self-Schedule + Self-Scheduled Exports	0	135	0	0	0
Measurement + Self-Scheduled Exports	8	2573	34	0	0

Supply

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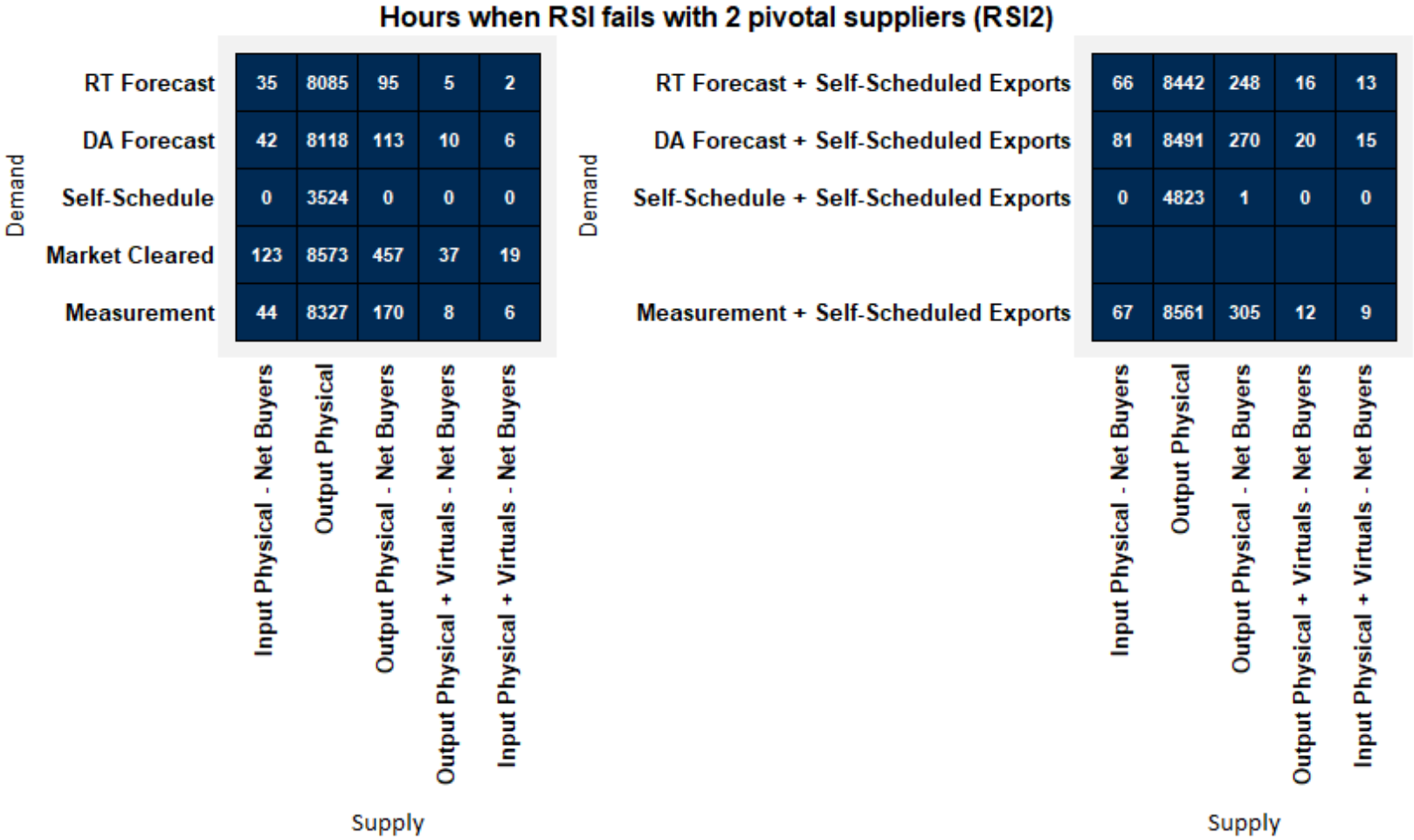

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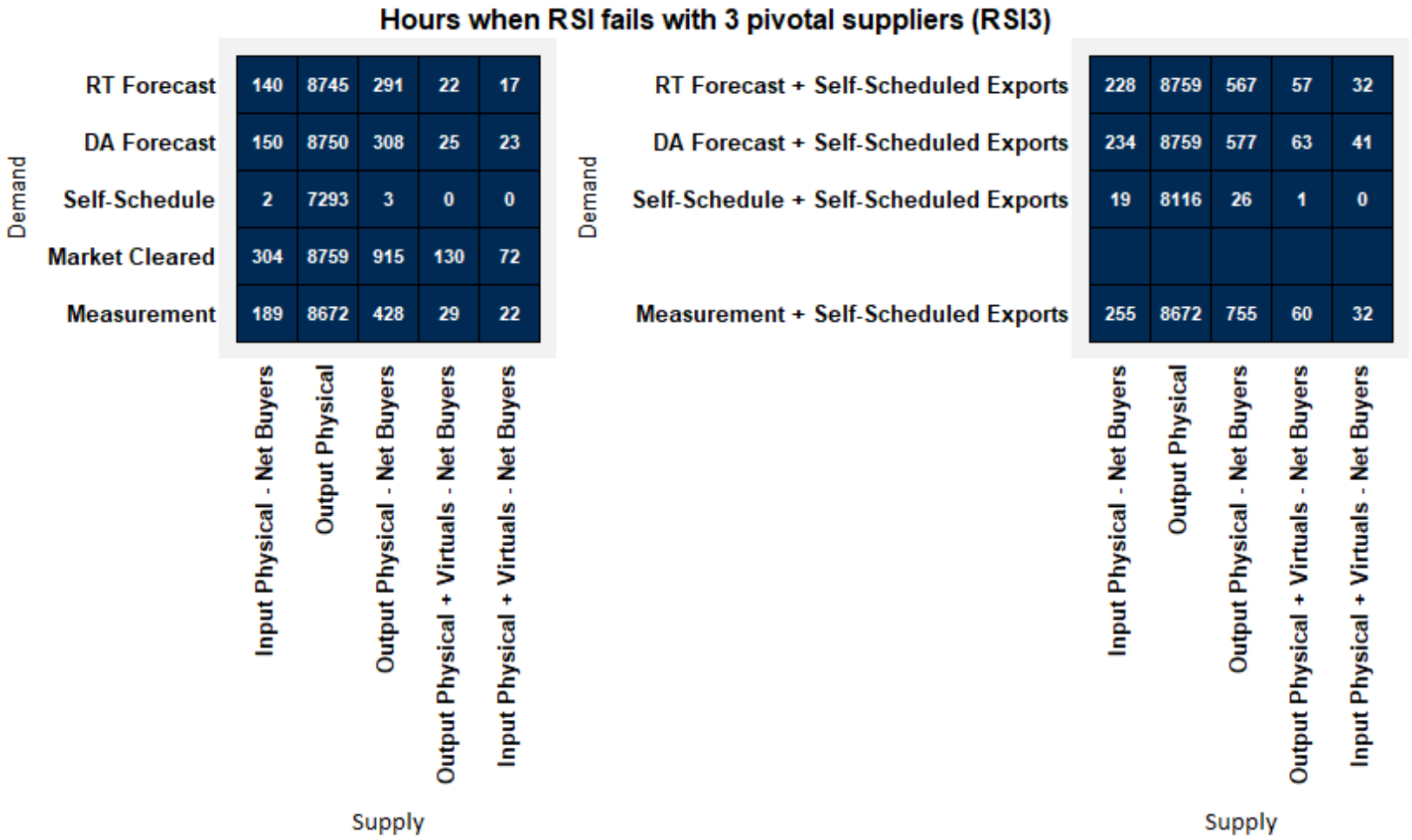

Further refinement to select scenarios with system losses

- For two scenarios, added losses to the demand assumption
- As expected, observed more hours of structural conditions for uncompetitiveness

Demand Assumption	Supply Assumption	RSI1	RSI2	RSI3
DA Forecast+SS Export	Output+Virtuals-NetBuyers	5	20	63
DA Forecast+SS Export**+Losses**	Output+Virtuals-NetBuyers	8	31	98
DA Forecast+SS Export	Input+Virtuals-NetBuyers	5	15	41
DA Forecast+SS Export**+Losses**	Input+Virtuals-NetBuyers	6	20	55

Potential policy implications

- CAISO energy market design
  - System-level market power mitigation measures
  - Import offer cost verification
- Load serving entity energy procurement implications
  - Forward contracting for energy significantly mitigates supplier market power
- Resource adequacy implications
  - Monthly demonstration quantities
  - Must-offer rules (day-ahead and real-time)
  - Resource availability

Next steps

- Please provide comments on the analysis report to initiativecomments@caiso.com by COB May 20
- CAISO is planning to publish an import bid cost verification issue paper and straw proposal this month
- CAISO is evaluating various measures in its RA Enhancements initiative