EDAM Imbalance Reserve Costs: Market Design and Parameter Choices

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Overview

My assessment is that the overall level of imbalance reserve up prices and costs in the simulation models appears to be materially higher than they should be in an efficient market.

- The average imbalance reserve up cost of around $20 over the day in the October case appears very high to me for a normal day. [1]
- The average imbalance reserve up cost of around $40 in the high load case in the November slides appears to me to be even further out of line of line with the expected level of prices on a normal high load day in an efficient market. [2]

It is possible that the high level of simulated imbalance reserve up prices and costs is mostly a result of a result of simulation modeling choices that will not be reflected in actual EDAM prices and costs. However, these simulation results also may reflect market design choices that will drive up actual EDAM prices and costs.

1. California ISO, Day-Ahead Market Enhancements: Configurable Parameters Implementation Working Group, October 21, 2025, slide 33

2. California ISO, Day-Ahead Market Enhancements: Configurable Parameters Implementation Working Group, November 20, 2025, slide 56

Overview

Key market design choices impacting simulated imbalance reserve prices and costs are:

1) the 15-minute start time constraint,
2) the 30-minute ramp limit;
3) the .85 usage rate associated with imbalance reserve up schedules,
4) the market design and modeling assumption that storage energy usage for real-time balancing depends on imbalance reserve and flexiramp schedules, and
5) the level of imbalance reserve up procurement. MOSAIC modeling choices/flaws, and demand curve penalty prices.

Overview

Key modeling choices potentially impacting estimated imbalance reserve prices and costs are:

1) Imbalance reserve offer prices;
2) Energy offer prices for storage resources;
3) Characteristics of the modeled days;
4) Resolution of pricing indeterminacies;
5) Enforcement of deployment constraints;
6) Other things?

Market Design Choices

As discussed in the stakeholder process and in the Market Surveillance Committee opinion [1] the restriction that resources providing imbalance reserves must be dispatchable on a 15-minute basis (as well as the restriction to 30 minutes of ramp) has the potential to greatly increase the commitment costs associated with imbalance reserves.

- It is possible that high commitment costs driven by these market design features are a major cause of the high imbalance reserve costs and prices.
- These market design requirements would be appropriate if all imbalance reserves really needed to be dispatchable within 30 minutes, but that is not the case. Day-ahead to real-time net load uncertainty does not all show up with 15 or 30 minutes notice.

An alternative to flexiramp in real-time is reserves in the form of load conformance scheduled in RTPD. These reserves can be provided by hourly block interchange, and resources that can be committed in 30 minutes and ramped up over a longer period of time. EDAM design choices are more restrictive. Why?

1. James Bushnell, Scott Harvey, and Benjamin Hobbs, Opinion on Day-Ahead Market Enhancements, May 3, 2023 section 3.1.1.

Market Design Choices

These market design choices involving commitment costs raise the cost of using thermal resources to provide imbalance reserves.

- The optimization could avoid these high commitment costs for imbalance reserves up by scheduling imbalance reserves on storage resources, which do not have commitment costs.
- However, other market design and modeling choices may make storage resources an expensive source of imbalance reserves in EDAM.

Market Design Choices

Market Design and modeling elements raising the cost of using storage to provide imbalance reserves include:

- Use of a .85 attenuation factor.
- Both the EDAM simulations and the EDAM market design tie storage resource energy usage to imbalance reserve schedules.
  - In real-time operation, the dispatch of storage resources for energy in RTD, and hence their energy usage, is independent of their imbalance reserve or flexiramp schedule.
  - Tying energy usage and state of charge to imbalance reserve or flexiramp schedules is not accurate. It is an approximation whose impact needs to be considered in each context in which it is used.

In the context of EDAM optimization this assumption means that scheduling a megawatt of imbalance reserves on a storage resources incurs a cost of

[1] Attenuation Factor * (Marginal hour energy price- Energy offer price)

This cost will be high if the attenuation factor is high (such as .85) and the foregone energy margin is high (such as if the EDAM energy offer price is low relative to the EDAM price in the marginal hour).

Market Design Choices

The high cost of imbalance reserves up may also be materially impacted by the level of imbalance reserves procured in the simulations and the shape of the demand curve.

- These choices seem to be ballpark consistent with FMM but there is limited information in the presentations on the actual implementation in the market simulations.
- These choices may, however, interact with the modeling of congestion.

Market Design Choices

The high cost of imbalance reserves in the EDAM simulations may be an accurate prediction of the impact of EDAM market design features.

- Scheduling material amounts of additional imbalance reserves on thermal resources would incur high commitment costs. These incremental thermal resources would not be committed unless the commitment was economic based on the demand curve for imbalance reserves.
- Scheduling material amounts of imbalance reserves on storage resources may incur high opportunity costs on storage resources because of the high rate of energy usage modeled as associated with imbalance reserve schedules and perhaps high values of incremental storage energy in EDAM.

Modeling Choices

On the other hand, some of the modeling choices in the EDAM simulations may cause the simulation results to overstate the likely level of imbalance reserve prices.

- Low energy offer prices for storage resources in EDAM simulations may cause storage resources to appear to be a more expensive source of imbalance reserves than they will be in actual operation.
  - The impact of energy usage factors on imbalance reserve up schedules and prices suggests that this is the case, but the model interactions might be more complex.
  - The degree to which high imbalance reserve prices are due to low energy offer prices for storage resources could be tested by rerunning a case with all storage energy offer prices set based on the LMP price in the marginal hour, such as 90% of that price.

Modeling Choices

- High offer prices for imbalance reserves in EDAM simulations may cause storage resources to appear to be a more expensive source of imbalance reserves than they will be in actual operation.
  - The data on slide 22 of the November presentation suggests to me that there is a large amount of imbalance reserves offered at $5 or less, so this should not be a factor, but that should be confirmed. [1]
  - This could be tested by rerunning a case with all imbalance reserve offer prices set at $2. If imbalance reserve prices are still high, anomalous offer prices are not the cause of the high market prices.

1. California ISO, Day-Ahead Market Enhancements: Configurable Parameters Implementation Working Group, November 20, 2025, slide 22.

Modeling Choices

- There is something odd about the base case since this is an October day with north to south congestion even during the high solar hours. Data in the CAISO December report shows strong south to north congestion during the high solar hours in October 2024. [1]
- There is also something odd going on in the simulations to produce such high imbalance reserve prices and relatively low energy prices. Whatever is causing this disconnect may impact other aspects of the simulation results.
- The resolution of pricing indeterminacies may be different in the simulations than it will be in EDAM operation.

1. California ISO, Day-Ahead Market Enhancements: Configurable Parameters Implementation Working Group, November 20, 2025, slide 37. . California ISO, Market Performance and Advanced Analytics, Congestion Revenue Allocation, Stage 1 of Analysis, December 2025, p. 19.

Modeling Choices

- The modeling of constraints in the deployment scenarios may be different from what will be feasible in EDAM and FMM and also may differ in some respect from how the deployment scenarios are modeled in FMM today.
  - My understanding is that the simulation cases have not enforced contingency constraints which should produce outcomes similar to FMM and RTPD.
  - However, it appears that there is more deployment scenario congestion in the EDAM simulations than in production FMM/RTPD.
  - Is something else being modeled differently in the EDAM deployment scenarios?
  - Is the message that the constraints between PacifiCorp and CASIO are accurately modeled in EDAM, but constraints between the CAISO and other balancing areas are not modeled in FMM?
- Other?