

**Energy Storage Enhancements (Issue Paper)
Market & Infrastructure Policy**

California Community Choice Association (CalCCA) Comments

CalCCA thanks the California Independent System Operator (CAISO) for taking on this initiative. As the capacity from storage continues to increase, it will be important to ensure that the energy markets function as efficiently as possible in light of the technological differences presented by storage resources. CalCCA generally believes that the CAISO has appropriately scoped this initiative and provides the following comments for consideration as the CAISO continues its policy development.

Real Time Market Enhancements

Marginal Cost

The accurate reflection of marginal cost is critical to enabling efficient market operation. The evolution of storage is continuing, and more is now known about costs, including cycling costs, as the market expands. CalCCA supports the CAISO recommendation to continue investigating cycling costs, including the relative cycling cost dependent on the state of charge as outlined in the Issue Paper at pages 6-7, in the discussion of bid submission timelines. In addition, if the CAISO cannot extend the real-time market optimization horizon sufficiently forward to fully capture a charge/discharge cycle, the CAISO should consider an end of horizon opportunity cost as suggested by the Market Surveillance Committee. There is merit in such an approach; however, further evaluation is necessary to determine if such a mechanism is appropriate and if it can sufficiently address the need to constrain resources to ensure their state of charge.

The discussion of marginal cost would benefit from a minor expansion: the inclusion of physical resource characteristics within the system optimization. While some storage technologies can rapidly change from charging to discharging, this is not the case for all storage technologies and therefore should not be the universal expectation (e.g., some storage resources must “rest” for a period of time after fully charging or discharging). Modeling of such resources with inappropriate operational assumptions will place risk on the bidder that can and should be avoided. The CAISO should thus ensure through this process not only that the marginal cost of the resource is accurately reflected, but that the system algorithms and the master file data accurately represent the resource’s capability.

Advisory Intervals and Spread Bidding

It is important that the CAISO recognize the shortcomings of using real-time market advisory intervals when the time horizon of the real-time market is too short to be able to optimize storage charging and discharging. There is general consensus that storage will play an important role in energy arbitrage in the future. In a 65-minute real-time environment, the forward look is simply not long enough to enable meaningful energy arbitrage. If given only these short optimization horizons and associated price differentials within them, the dispatch of such resources may come to look like that of regulating and spinning resources, rather than efficient optimization of storage resource charging and discharging. Similarly, spread bidding may make little sense in a real-time environment where the spread may not be realized in any 65-minute look, but with an expanded look may be a viable method such as in the day-ahead market.

Ensuring State of Charge

The CAISO must examine closely the pros and cons of a long-term constraint on storage resources that is based upon elements other than price. Significant concern has been expressed about the potential for the day-ahead market to optimize resources and schedule storage to meet net load peaks only to have the real-time market change this optimization and result in reliability concerns. This problem is a theoretical concern that tends to ignore the realities of prices and profit maximization by storage resources. It also ignores the potential for not being able to address another reliability event if constraints are put in place that limit the flexibility and availability of storage resources.

Storage is not so dissimilar to a use-limited resource that must make choices between honoring its day-ahead award or deviating when real-time prices do not reflect the day-ahead expectations.

Economically, a storage resource will be faced with the following decisions when the real-time price is trending significantly higher than the day-ahead prices and awards when considering deviating from their day-ahead award:

- 1) Is there enough time and an expectation of prices becoming low enough to deviate now (assuming a discharging real-time event) while still enabling a sufficient state of charge to honor their day-ahead award?
- 2) Is the real-time price that is presently higher than the day-ahead price going to be sustained or is it a temporary spike that can be expected to subside later?

Clearly if the answer to #1 is yes, then the resource should follow the real-time price signal as doing so would make incremental profit and not prevent the resource from honoring their day-ahead award. If the answer to #1 is no, then the resource must address the second question. It is possible that the elevated prices are systematic and will remain higher than the day-ahead prices in all hours. If that is the case, then it may not be profit maximizing to discharge now and deviate from the day-ahead awards as the buyback of the day-ahead award in the real-time may result in less total profit for the resource. On the other hand, if the price spike is due to a local issue resulting in momentary high prices, signifying a reliability need in that area, it may not only be profitable to follow the real-time price but may also be the best option for reliability.

It is easy to conceive of a case in which a storage device is located in an area where prices are high due to an outage that is temporary in nature but is driving high prices. It is further possible that aside from the storage device, the next available resource has a lengthy start-up time. In such a situation, the storage device could address the immediate reliability need while the CAISO starts the other resource that can then provide for the later evening peak. Choosing which reliability event the CAISO should protect for is not an easy decision to make and should be investigated closely.

This investigation should consider that market participants are savvy or will become so quickly in the energy market and are likely very capable of making decisions to the two questions above that are in their best interest. As long as market prices depict the reliability needs on the grid, then the resource providers can make the best decisions on how to address such issues. If resource providers make the wrong choices about their offer prices, they will face financial consequences depending on the level of the future interval prices in comparison to the short-term interval prices.

Policy Direction

The CAISO listed in the Issue Paper three potential policy issues for consideration. The expansion of the real-time market to include a further look ahead, while it could avoid the need for workarounds to address the shortcomings of a limited real-time market optimization, appears to have been dismissed as not viable with current optimization tools. The CAISO should provide further information within this initiative of the nature of the issues that make a longer look ahead infeasible as well as what would need to be done to make such a look ahead feasible. Such a mechanism would not only make market optimization easier (e.g., limit exceptional dispatch, ensure sufficient state of charge, etc.) but would also provide information to resources to better enable them to offer their resources in the real-time market. The other two elements involve the potential for a new product and the potential for constraining resources in the real-time market to preserve their day-ahead award.

If the CAISO pursues a new product, the first question that must be asked is what entity(ies) creates the demand for the product? This is not a causation question but one of bidding. Will it be those serving load that submit demand bids or will the demand be created by the CAISO based upon its own criteria? The former is necessary for a properly functioning market while the latter may by chance reflect the willing interaction of buyers and sellers but is equally likely not to. This issue is raised in a number of environments (e.g., Residual Unit Commitment, Flexible Ramping, corrective capacity, etc.). In each of these cases, there is always a concern over the ability of the CAISO to accurately reflect the true needs of the system rather than having buyers reflect their own needs such as is done in the energy market.

With regard to constraints on resources based upon day-ahead expectations, as noted above, such a mechanism (i) may work in some cases, (ii) may not be constraining to what the resource owner would have done based on their own decision, or (iii) could stand in the way of the CAISO using a resource for reliability purposes due to an artificial constraint preventing such an action. Consideration of a constraint should therefore be an element that is used sparingly to protect against events that have a high probability of reliability impacts if not enacted.

The CAISO does note in the Issue Paper that the CAISO can exceptionally dispatch resources including an instruction for a storage device not to discharge. In such an event, there will be foregone profit by the resource that cannot be ignored as well as the fact that the exceptional dispatch is not reflected in the market prices.

The Issue Paper also discusses the potential for different charging rates depending upon the state of charge of the resource. This is an element that also deserves further examination.

Finally, the CAISO should consider whether there is additional information that could be made available to the market to allow resources to make better decisions without providing information that would present the potential for the exercise of market power. For example, if the CAISO is concerned that the fleet of storage resources will not be available for the net load peak, then perhaps examining the potential to publish the aggregate state of charge will help storage resources to make decisions about how likely the current real-time price is to continue to remain high. This of course should be tempered by consideration of the ability of any individual entity or small group of entities to use the information to manipulate the market.