California ISO

Stakeholder Comments Template

Energy Storage and Distributed Energy Resources (ESDER) Phase 4

This template has been created for submission of stakeholder comments on the Issue Paper Working Group Meeting for ESDER Phase 4 that was held on March 18, 2019. The paper, stakeholder meeting presentation, and all information related to this initiative is located on the initiative webpage.

Upon completion of this template, please submit it to initiativecomments@caiso.com. Submissions are requested by close of business **April 1, 2019.**

Submitted by	Organization	Date Submitted
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Please provide your organization's general comments on the following issues and answers to specific requests.

1. **Non-Generator Resource (NGR) model**
    a. SOC management – We have no detailed comments at this time. We support the idea in theory and will comment on any written proposal that comes from the CAISO team.
    b. Multi-interval optimization – We appreciate the detailed discussion of this topic at the working group. Our main concerns with Multi-interval Optimization with respect to NGRs fall into two categories: 1) that the result of the optimization is likely to result in more charge/discharge and earlier end of life of the batteries than would be the case without the Multi-Interval Optimization, and 2) that a discharge award from the Multi-Interval Optimization algorithm leaves the battery low on energy if the future very-low-price advisory interval does not materialize, which could have a range of negative effects. We discuss each of these scenarios in more detail below.
        1) Background: The physical effect of multi-interval optimization on a battery is a set of charge and discharge awards that do not align directly with the bid curves that were provided by the project's SC for the period. Specifically, the resource may be charged at a price higher than the bid curve indicates a willingness to charge at if the algorithm anticipates even higher prices later, or it may discharge at

a very low price if the algorithm anticipates much lower prices later that it can charge back up at (we have seen discharges at prices that our bid curve indicates that we would be happy to charge at, for instance, and later the system charges back up). *In either case, the result is more charging/discharging of the battery in a given day than would have resulted from the CAISO dispatch algorithm strictly adhering to the bid curve* and not attempting to position it to better profit from expected prices in the advisory intervals, which may or may not materialize.

We can see how this is a very desirable feature for conventional generation units, whose start and stop costs are very high, and the cost of delivering a MWh are very low. With batteries however there are minimal start/stop costs and relatively high VOM costs, as each battery has a finite cycle life and each MWh of throughput brings it that much closer to replacement. Therefore, any battery owner will be sensitive to the revenue earned on each incremental MWh charged/discharged. Our concern is that it is not clear to us today that there is any way to indicate to CAISO how big of a spread an NGR needs between the prices it charges and discharges at in order to cover the cost of wear and tear and eventual replacement. Without a way to convey this spread, we perceive that there is a possibility today of incremental cycling of the batteries where the revenue related to the LMP spread is not enough to cover the cost of that cycling.

To elaborate on this wear and tear cost, a typical battery energy storage system may be designed for 20 year life for all components, but the batteries themselves will lose energy storage capacity the more they are charged/discharged, and eventually must be replaced with new batteries. For example, a 100 MWh battery from one manufacturer might need to be replaced after the equivalent of 2000 deep discharge cycles (200 MWh of discharge), while another 100 MWh battery might be designed for 5000 cycles (500k MWh of discharge) before it needs to be replaced. In either case, the owner needs to earn revenues from each MWh in the market to cover the cost of battery replacement, which is a function of what technology is chosen, market conditions, and expected date of replacement. In most cases today the VOM will be a double digit $/MWh number, but there is a very large range, and as we discussed at the meeting it can be a non-linear calculation as well, such as when aggressive cycling reduces the originally estimated replacement time by multiple years, driving costs up dramatically.

One possible change to multi-interval optimization that would put our fears to rest would be if it were possible for the scheduling coordinator to directly provide CAISO with a minimum spread between charge and discharge prices that will be enforced in the

multi-interval optimization, similar to the way in which many generator types input a VOM value in $/MWh into their master file (we are aware that those traditional generator VOMs are not used for this purpose specifically, but both the terminology and method of conveying the parameter to CAISO are appropriate for comparison). The idea here being that resource owners would calculate their VOM, roughly as described in the paragraph above, and pass it to CAISO's multi-interval optimization algorithm directly. This would ensure that in the scenario where the algorithm anticipates a high price coming up in the advisory interval, it would only charge the resource in the binding interval if the spread between the two was at least greater than the wear and tear / VOM cost. It seems like a simple and relatively straightforward solution, and we hope CAISO is open to exploring this or something similar.

Staff did provide an example with a single charge and discharge bid price which led to useful discussion at the meeting. It was pointed out that this does not have the complexity of a real bid curve which may have up to 10 segments, and it is not clear how to extend the concept from the example to the arbitrary case of n segments in the bid (up to a max n = 10). We would ideally like to know how a more complex and realistic bid curve is treated.

2) Additionally, we question the wisdom of allowing the Multi-Interval Optimization algorithm to discharge a battery in the Binding interval, in hopes of later charging it at a lower cost in a future Advisory interval. Charging now in order to be able to discharge later at a time of high demand on the system makes complete sense to us. But discharging energy from a resource with a finite energy storage capacity in the hopes of making a few extra $ on a low price later seems risky, because what if the lower price does not materialize in the next few market periods and the resource is left close to empty? In this scenario the resource could be too empty to deliver during a sudden very high price or contingency event, which would be very bad for both the resource owner (lost potential revenue) and grid operators (with fewer available resources to meet a sudden need). Or it might have a contract with an off-taker where it is required to deliver a given quantity of energy during an upcoming hour, and now due to multi-interval optimization is does not have enough energy to do so, and how would the resource be able to convey its contractual requirements to CAISO or the damages resulting from a breach of that contract? For these reasons we encourage CAISO staff to consider limiting multi-interval optimization for NGRs to only allow the system to deliver charge awards at LMPs higher than the range of charge bids, but not to allow it to deliver discharge awards at LMPs lower than the range of discharge bids.

2. **Bidding requirements for energy storage resources**

   Default energy bids (DEBs) for energy storage resources are something that we are just starting to think hard about and look forward to collaborating more on this issue, recognizing that today there are less than 200 MW of NGRs in the CAISO market but that they are growing rapidly.

   1. Although long-duration storage projects (multi-hour batteries, compressed air, pumped storage) will mostly operate in the Day Ahead market, this is not true of shorter duration batteries, which will operate in the Real Time markets, which may have very different price dynamics.
   2. On “no touch” days with extreme weather, high prices, etc., it will be to the benefit of both market operators and NGR owners if bids are allowed to rise, potentially far above the normal “expected value” which was mentioned, depending on how “expected” ends up being defined. For example, although the LMP rarely exceeds $200/MWh most days, on an extreme day an NGR may need to offer to charge at $200 or even higher if it reasonably expects to see much higher prices later that it can discharge at. While we don’t have a simple proposal for CAISO here yet, this is an important and realistic scenario for consideration with respect to any proposed DEB scheme, one that directly relates to serving load on the peak hours/days of the year.
   3. It is important that even if a resource’s bid is mitigated, its spread between charge and discharge should never be compressed to less than its variable O&M cost which includes the wear and tear discussed above at the very least. For instance, if a big battery with the potential to exert local market power needs at least $80 spread between charge and discharge to cover cost, it could cause the resource considerable losses to have only its discharge bids lowered while charge bids stayed the same.

3. **Demand Response resources**

   a. DR operational characteristics – Please provide comments on the ISO’s proposal for DR resources to reflect a non-zero Pmin. – No comments at this time.

   b. Weather sensitive – Seeking feedback on potential forecasting methodologies and approaches for validating SC-submitted forecasts. – No comments at this time

4. **Discussion on BTM Resources**

   a. Potentially removing 24x7 settlement requirement for non-resource adequacy resources utilizing the DERA/NGR participation model. – This seems like it could open up opportunities to game the system by switching in and out of the market, and should be explored carefully.

b. Providing a forum for industry stakeholders to discuss potential QC methodologies for multi-tech type DERs for LRA consideration. – No comments at this time

5. Additional comments

Please offer any other feedback your organization would like to provide from the topics discussed during the working group meeting.

No additional comments at this time.