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 for ESDER Phase 4 that was published on Feb 6, 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 **Feb 27, 2019.**

Submitted by	Organization	Date Submitted
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Please provide your organization's comments on the following issues and questions.

1. **Non-Generator Resource (NGR) model**

Please state your organization's position as described in the Issue Paper: *Support with Caveats*

If you support with caveat or oppose, please further explain your position and include examples:

LS Power considers the NGR model enhancements to be the most important and a high impact area that CAISO staff should focus on. Proposed enhancements should better integrate energy storage into the wholesale markets to improve results both for CAISO's operators and for resource owners. We support the staff's proposals in the Issue Paper as important areas to work on, and have listed "Support with Caveats" as there are several other items that we think are important to address in this stakeholder process. Below we offer comments on the proposals in the document, and then propose some additional areas that we recommend CAISO take up in the ESDER 4 proceeding.

Real-time State of Charge Management *– The Issue Paper proposes to explore the option of allowing Scheduling Coordinators (SC) to specify the SOC level of a resource at the end of an operating hour so the SCs can manage SOC throughout the day. We assume that this would work something like a Self-Schedule for that hour, but instead of submitting a MW output value the SC would submit an SOC and possibly a price cap, with the resulting awards for the hour being the lesser of A) the resource's Pmax and B) the number of MW that would cause the resource to end the period at the target SOC as a function of its parameters in the master file. It seems evident that this would only be a necessary addition to the Real Time market (as the Day Ahead market already co-optimizes across all 24 hourly intervals while taking modeled SOC into account), and we see considerable value from adding such functionality. A simple addition along these lines could be very useful and beneficial for grid reliability. We support CAISO's including this enhancement and look forward to further discussion on implementation details for this enhancement.*

Effects of Multi-Interval Optimization *– LS Power feels that Bid Cost Recovery as currently implemented does not work for NGRs. It is important to explore changes to its implementation. We understand both the intent and implementation of multi-interval optimization as it stands today. We can see how it is useful for minimizing the cost of serving load across the system, by avoiding unnecessary stops and starts for conventional units that could reasonably expect to be economical later in the next few market intervals. However, NGRs are currently unable to bid Variable O&M costs, which are substantial for battery energy storage systems, and there is no way that a battery can recover the cost of wear and tear that results from dispatch without CAISO having knowledge of these costs.*

As a result of the inability to bid in a VOM cost, today's Multi-Interval Optimization will see it as beneficial to discharge a storage resource during an interval at a price that is lower than the resource has offered to sell energy at if the optimization algorithm expects that there will be an even lower price sometime in the next several intervals to charge back up at. We understand this to be true even if the resource only comes out ahead by as little as a penny per MWh, based on our discussions with CAISO's engineers. In reality this will cause wear and tear on the batteries from charging and discharging, as batteries are electrical components with finite cycle life, and they must be replaced after a few thousand cycles with today's technology. The VOM cost per MWh of charge/discharge through a battery is at a minimum the cost of replacing batteries divided by lifetime of that battery in MWh, and this is a substantial cost ($10s of dollars per MWh in many cases) that CAISO today does not take into account for either the Multi-Interval Optimization algorithm or for Bid Cost Recovery. These operating costs should be considered in both of these places.

The issue paper also correctly identifies the fact that sometimes the Multi-Interval Optimization dispatches a resource based on an expectation of the future that does not materialize. What this means for NGR resources is that the resource may be discharged at a price lower than it offered to sell energy for, or charged at a price higher than it offered to buy energy for, both of which are financially undesirable outcomes. Given that most NGRs are Limited Energy Storage Resources (LESR), it is

easy to envision this occurrence having a negative effect on the resource's ability to meet any contractual obligations these resources may have outside CAISO's wholesale market, such as any hedging agreements or agreements to deliver power at a particular period which may be self-scheduled later in the day.

For example, consider a scenario where a NGR Resource has an obligation to deliver energy during the evening peak load period. Under CAISO market's current construct, the multi-interval optimization may discharge the resource in expectation of later lower prices. If expected lower prices do not materialize later, the resource may not get charged back up promptly, leaving the resource without enough energy to meet it's contractual obligation that evening. There may be contractual performance penalties incurred by the resource that CAISO would not reimburse via Bid Cost Recovery in this scenario. There is also risk of the resource incurring very large imbalance charges hours later when it winds up empty during a period it had self-scheduled energy, forcing it to settle large uninstructed imbalance energy charges at the volatile real-time LMP during the highest price time of the day, which can exceed $1000/MWh.

These risks are unique to LESRs and as such we propose that CAISO allow NGRs to have an option that would allow them to Opt Out of the Multi-Interval Optimization algorithm altogether.

***NGR Participation Agreements** – We like the idea of reducing administrative burden and consolidating redundant paperwork. We see no downside to this proposal.*

***Additional Item: Addressing Variable Pmax/Pmin of NGRs** – Most NGRs do not have the same maximum charge rate (Pmin) or maximum discharge rates (Pmax) at all times, and this change is a function of the resource's State of Charge. The physical explanation is that a battery physically cannot charge at its usual maximum rate when it is getting close to full, and it cannot discharge at its usual maximum rate when it is getting close to empty. Currently there is no way to convey this physical limitation to CAISO, and so the Energy and AGC engines assume that it is always possible for the resource to respond to a dispatch at +/- Pmax, which could result in infeasible dispatches sent by CAISO and imbalance charges incurred by the NGRs.We recommend that CAISO consider a change in plant telemetry and/or the master file of NGRs to address this issue.*

This is an item LS Power proposed in previous ESDER stakeholder processes, which led to some good discussions but was not taken up at the time. CAISO may recall that there was some debate whether this was a matter of Ramp Rates for storage, but it is not, rather it is a hard limit on the Pmax, which is an instantaneous value. We propose further discussion on this topic.

Today there are well over 100 MW of new NGRs in the market that have joined since ESDER 2, and over 1000 MW more have been contracted by the utilities, so it is a good time to address these issues. We look forward to working with CAISO on improving the market mechanisms that support what is already one of the world's most advanced markets for energy storage integration.

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

Please state your organization's position as described in the Issue Paper: *LS Power currently has no comments on this topic.*

If you supports with caveats or oppose, please further explain your position and include examples:

3. **Demand Response resources**

Please state your organization's position as described in the Issue Paper:

LS Power currently has no comments on this topic.

If you support with caveats or oppose, please further explain your position and include examples:

4. **Multiple-Use Applications (MUA)**

Please state your organization's position as described in the Issue Paper: *Under this item, among other things, CAISO is considering allowing storage resources being built to serve other (non CAISO) entities to participate on a limited basis into CAISO markets. While LS Power does not oppose this but we would like to have more discussion on this. One potential concern could be inadvertent creating of a non-level playing field by allowing some resources to selectively participate in CAISO markets whereas all other resources participate 24X7.*

If you support with caveat or oppose, please further explain your position and include examples:

5. Additional comments

Please offer any other feedback your organization would like to provide on the Draft Final Proposal

<u>Variable Operations & Maintenance (VOM) cost for Battery Storage Projects:</u>

As stated in previous section and comments previously provide by LS Power to CAISO, we believe Energy storage resources, and specifically battery energy storage resources should be allowed to bid VOM costs. Current VOM for such resources is "0" as proposed through Nexant report written for CAISO's VOM review.

Battery Storage projects incur variable costs from operation and should be able to submit these costs to CAISO in order to ensure cost recovery when these projects

operate. It is inaccurate to place them on the list of "Plants without Variable Operations and Maintenance Costs" as they currently are in the Nexant report[1], and CAISO should move to quickly remedy this.

Battery energy storage projects include long-lived components such as the buildings/enclosures, inverters and transformers that connect them to the grid, but the batteries themselves are replaceable and have finite cycle lives. Almost every battery experiences capacity fade (i.e. loses some capacity) and eventually needs to be replaced entirely or have components replaced as a function of how often and how heavily it is cycled, and this is a direct function of the MWh throughput that is charged and discharged. If CAISO's grid optimization engine charges a battery, and then discharges it later at a spread that is not sufficient to cover this VOM cost from the accelerated replacement of the battery cells, then the battery owner is harmed economically. At this time there is no way to inform CAISO of the $/MWh VOM cost of cycling a battery that is registered as a Non-Generator Resource (NGR), and this could and should be fixed easily.

This is an important input to CAISOs market engine, and will grow in importance as thousands of MW of energy storage resources are expected to be added to the grid in the coming years. We encourage CAISO to solicit the necessary expertise of the energy storage community and that of CAISO's market engineers to address this necessary but missing input to the market right away.

[1] Nexant VOM Review Report, Dec 2018: http://www.caiso.com/Documents/VariableOperationsandMaintenanceCostReport-Dec212018.pdf