



Stakeholder Comments Template

Energy Storage and Distributed Energy Resources Phase 4

This template has been created for submission of stakeholder comments on the Second Revised Straw Proposal and associated March 2 & 3 meeting discussions, for the Energy Storage and Distributed Energy Resources (ESDER) Phase 4 initiative. 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 March 16, 2020.

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. Demand Response (DR) ELCC Study Preliminary Results

Please provide your organization's feedback on the Effective Load Carrying Capability (ELCC) study preliminary results for DR resources, as discussed during the March 2 (day 1) stakeholder meeting. Please explain your rationale and include examples if applicable. Please also include any additional study results that would be helpful on this topic.

At this time, CPUC staff is monitoring this proposal and may have recommendations in the future.

2. Operational Processes and Must Offer Obligations for Variable-Output DR

Please provide your organization's feedback on the proposed operational processes and must offer obligations for variable-output DR, as described within the second revised straw proposal. Please explain your rationale and include examples if applicable.

At this time, CPUC staff is monitoring this proposal and may have recommendations in the future.

3. End-of-Day State of Charge

Please provide your organization's feedback on the proposed end-of-day state of charge, as described within the second revised straw proposal. Please explain your rationale and include examples if applicable.

CAISO has explained that they believe it will allow resources to reflect something more like a spread bid strategy in the day ahead market. CPUC staff recommends that CAISO should move forward on developing an actual spread bidding option for energy storage, as they have stated that this is an important strategy likely to be used by energy storage resources. It is unclear that the end of day state of charge parameter will be as effective as developing an actual spread bidding option.

4. End-of-Hour State of Charge

Please provide your organization's feedback on the proposed end-of-hour state of charge, as described within the second revised straw proposal. Please explain your rationale and include examples if applicable.

CPUC staff agree that resources which take advantage of the end of hour state of charge (SOC) constraint may need to have their bid cost recovery (BCR) calculations adjusted to ensure that they do not unfairly recover costs above bid. However, the CAISO's current proposal could create gaming opportunities. The current proposal will zero out all costs and revenue for a time period in which the end of hour SOC constraint may be binding. Not all of the transactions that take place in that hour are necessarily relevant for the SOC constraint though. Zeroing out the wrong transactions can lead to gaming opportunities.

We provide an example: Suppose a resource has bids to buy power when price is below \$50 and sell at prices above \$60. Starting in hour 1, the resource is at a 0 SOC. Advisory prices in hour 1 range from \$55 to \$60 and in hour 2 from \$80 to \$90. The market optimization will see that it can sell energy to the storage resource \$5 to \$10 above its bid, but make the resource "whole" when it buys that energy back \$20 to \$30 above its bid in the later hour. For this example, we can assume that binding interval prices turn out to be identical to advisory prices. The market will dispatch the resource to charge above its bid in hour 1 in order to sell further above its bid in hour 2. However, if hour 2 is ineligible for BCR because of a future end of hour SOC constraint, then only the charging segment of the schedule will be present in BCR calculations. The resource will receive BCR for charging above cost. Because the revenue from sales is excluded by the zeroing out the hour near the SOC constraint, the BCR calculation is not balanced.

CPUC staff recommend that the CAISO continue to work on a policy to exclude some costs and revenues from BCR that will avoid the issue described above. One possibility may be to use the shadow price of the SOC constraint, as suggested by DMM. Another idea would involve counting the energy necessary to meet the SOC constraint and only negating costs for a matching amount of energy. CPUC staff look forward to collaborating with the CAISO on this effort.

5. Default Energy Bid for Storage Resources

Please provide your organization's feedback on the proposed default energy bid for storage resources, as described within the second revised straw proposal. Please explain your rationale and include examples if applicable.

Based on interviews with the three major California investor owned utilities (IOUs) regarding energy storage costs and operations, energy storage projects are built to meet certain needs that may require an energy storage system to perform a ½ cycle per day or multiple cycles per day as

well as to charge and discharge a certain amount of megawatts (MW) per day. If an energy storage system is cycled more or has greater MW throughput in a given day than its built specifications, there are greater operating costs associated with this additional use since it would lead to greater degradation than anticipated.^{1,2,3} For this reason, the CPUC supports the proposal to have at least two Default Energy Bids (DEB) for energy storage systems, if not a dynamic DEB calculation that considers the costs of additional use beyond built specification.^{4,5} One DEB would consider the costs to use an energy storage system within its built specifications, and the second DEB would consider the costs associated with using energy storage systems out of the bounds of its built specifications.

Other considerations for a dynamic DEB or multiple DEBs include:

1. Opportunity costs are higher at the end of the day.

If an opportunity cost variable for the DEB cannot consider the timeframe to charge and discharge and energy storage system, there is reason to consider a morning and evening DEB. As the CAISO has stated, the possible spread prices for energy storage systems in the morning are lower than those possible in the evening, on average.⁶ For this reason, an energy storage system's lost opportunity to serve the evening ramp with energy or ancillary services and receive revenue, due to prior forced market participation via a DEB and the time frame necessary to charge and discharge before the evening ramp, should be considered in the DEB calculation.

Generally, four-hour lithium-ion energy storage systems may take up to four hours to charge and five hours to discharge. Certain energy storage project vintages may take longer to charge and discharge.

For this reason, the opportunity cost formula should be dynamic to account for the time-frame for an energy storage system to charge and discharge to meet the desired the state-of-charge, resource adequacy obligations, and or serve the evening ramp which has greater revenue potential.⁷

2. Varying Variable Operating and Maintenance Costs

¹ 8minute Solar Energy comments on the *Energy Storage and Distributed Energy Resources (ESDER) Phase 4 Revised Straw Proposal*, November 12, 2019, p. 2.

² Southern California Edison comments on the *Energy Storage and Distributed Energy Resources (ESDER) Phase 4 Revised Straw Proposal*, November 12, 2019, p. 4.

³ Customized Energy Solutions (CES Market IQ), California ISO (CAISO) *Energy Storage and Distributed Energy Resources (ESDER) Phase 4 Technical Working Group Meeting- Storage Costs*, December 3, 2019, p. 4.

Wellhead stated, "that there could be a quadratic relationship between the first and second cycle, with the second cycle impacting efficiency and resulting in much higher costs."

⁴ Pacific Gas and Electric comments on the *Energy Storage and Distributed Energy Resources (ESDER) Phase 4 Revised Straw Proposal*, November 15, 2019, p. 1.

⁵ California Energy Storage Alliance comments on the *Energy Storage and Distributed Energy Resources (ESDER) Phase 4 Revised Straw Proposal*, November 12, 2019, p. 2.

⁶ *Energy Storage and Distributed Energy Resource Phase 4 Second Revised Straw Proposal*, February 24, 2020, CAISO, pp. 15-16. "data showing that the average maximum possible spreads to move 4 hours of energy during the day are just over \$40/MWh, and the spreads in the morning hours – when present – are less than \$20/MWh on average."

⁷ *ibid*

During hot weather conditions, the variable operating and maintenance (VOM) costs of operating energy storage systems may be greater due to required additional air conditioning costs to avoid overheating energy storage systems.

3. If an energy storage system does not achieve the desired state-of-charge at the end of day, there may be penalties that should be factored into the opportunity costs variable for the DEB.
 4. Other energy storage technologies have different cost factors than cycling or throughput.
- 6. Minimum Charge Requirement**

Please provide your organization's feedback for inclusion of the minimum charge parameter in the ESDER initiative, and feedback on presented material at the stakeholder meeting on March 3, 2020.

CAISO's real time optimization is not able to forecast far enough in the future to see the primary charging and discharging periods for storage resources at the same time. Because of this short outlook, there is a risk that storage resources may be discharged earlier than optimal. In response, the CAISO has proposed requiring energy storage resources to hold a charge that will allow them to meet their day ahead schedule. The proposal constitutes a restriction to energy storage participation in the real time market that is not faced by any other type of resource. As numerous participants pointed out during the meeting, this would also likely lead to operational challenges for the CAISO.

The CAISO's proposal would strip away the value and flexibility of storage resources at some of the most important times. For example, if an energy storage resource had a day ahead schedule starting in hour 17, the minimum charge requirement would ensure that it maintains the charge necessary to meet that schedule until the beginning of hour 17. The resource may not be able to discharge in any part of hour 16 due to the minimum charge requirement. This would be particularly problematic in the second half of hour 16 where net load may be ramping upwards towards the levels expected in hour 17. The storage resource would not be able to discharge until the start of hour 17, according to the CAISO's proposal.

CPUC staff recommend that the CAISO should not pursue any version of this restriction to real time participation of energy storage resources. Staff believes it would be much more practical to pursue improvements to the real-time optimization that will allow the CAISO to utilize the flexibility that storage resources are capable of providing.

During their presentation, the CAISO suggested that energy storage resource owners should include avoidance bids in their day ahead bidding strategy in order to limit their exposure to the minimum charging requirement. CPUC staff request that the CAISO clarify a position on submitting bids that represent economic withholding. The opinion expressed during this meeting contradicts with CPUC staff's previous understanding of CAISO policy.

7. Additional comments

Please offer any other feedback your organization would like to provide from the straw proposal and topics discussed during the web meeting.

CPUC staff requests that the CAISO continue to monitor and evaluate the energy storage system costs associated with providing energy to serve the evening peak hours for a three-year period following implementation of the DEB proposal and to use any new cost information to revise the energy storage DEB calculation if necessary.

The CPUC is making this request because at this time energy storage systems are primarily providing regulation services not energy in the CAISO market. This is likely because energy storage systems can receive revenue to charge by providing “reg down service,” and in this manner receive substantial revenue with little wear or operating costs on an energy storage system. Based on recent interviews with the three major California utilities regarding energy storage systems operations and status, it is predicted that the CAISO’s regulation services market will likely be saturated by 2020-2021. Once this happens, there is an expectation that energy storage systems in the CAISO market will start to serve the evening ramp with energy not just regulation services. Providing energy consistently may involve additional and or different energy storage operating costs than those discussed in this stakeholder process and for this reason the proposed energy storage DEB calculation should be reevaluated annually for at least a three year period following implementation.