California ISO

Stakeholder Comments Template

Energy Storage and Distributed Energy Resources Phase 4

This template has been created for submission of stakeholder comments on the Draft Final Proposal and associated May 27 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 **June 10, 2020.**

Submitted by	Organization	Date Submitted
Michael Kramek *Michael.kramek@betm.com*	*Boston Energy Trading and Marketing*	*June 10, 2020*

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

1. **Default Energy Bid for Storage Resources**

   Please provide your organization's feedback on the default energy bid proposal for storage resources, as described within the draft final proposal and discussed during the May 27 stakeholder meeting.

   As stated previously Boston Energy is generally supportive of the ISO developing a default energy bid structure for energy storage resources that accurately incorporate all costs incurred by storage resources. We continue to believe the that ISO's proposal is premature at this point given the limit number of storage resources participating in the market.

2. **End-of-Hour Charge Parameter(s)**

   Please provide your organization's feedback on the end-of-hour charge parameter(s) proposal, as described within the draft final proposal and discussed during the May 27 stakeholder meeting.

   Boston Energy has been supportive of the ISO's approach to implementing an optional end of hour state or charge parameter since it was first discussed in 2019. The development of this parameter has been a collaborative effort between stakeholders and the ISO from the very beginning. Unfortunately, that collaboration seems to have ended with the publication of the draft final proposal. The ISO has added, at the last minute,

vague language indicating that RA resource will not be able to utilize this end of hour parameter. This is because, as the ISO explained on the working group call, in order to use the parameter the storage resource must have at a minimum and maximum SOC range of at least 4 times its RA value. Given that 90+% of storage resources are RA resource this means in practice the ISO is developing a solution that nobody will be able to utilize. This last-minute change is very disappointing and seems to discount all the hard work and effort put in by stakeholders to develop a state of charge parameter. Boston Energy requests the ISO reconsider its proposal to restrict the use of this parameter to essentially non-RA storage resources only.

If the ISO insists on keeping this requirement in the proposal, then Boston Energy suggest removing the feature from the proposal all together. We see no sense of wasting time and energy on a market feature that nobody will be able to use.

3. **Variable-Output DR**

   Please provide your organization's feedback on variable-output DR, as described within the draft final proposal and in the ELCC study discussed during the May 27 stakeholder meeting. Please explain your rationale and include examples if applicable.

   Boston Energy has no comments at this time.

4. **Additional comments**

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

   Boston Energy has no additional comments at this time.

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Submitted by	Organization	Date Submitted
Luke Tougas *l.tougas@cleanenergyregresearch.com* *510.326.1931*	*California Efficiency + Demand Management Council*	*June 10, 2020*

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

The California Efficiency + Demand Management Council ("Council") appreciates this opportunity to provide comments in response to the CAISO's ESDER 4 Draft Final Straw Proposal and associated May 27, 2020 stakeholder meeting. These comments are limited to the Demand Response ELCC Study Preliminary Results and Operational Processes and Must Offer Obligations for Variable Output DR; however, the Council reserves the right to comment on other aspects of the ESDER 4 initiative in the future. In addition, by virtue of commenting on the CAISO's ELCC analysis, this does not indicate the Council's agreement that ELCC is an appropriate methodology to be applied to demand response (DR) resources for several reasons.

1. **Default Energy Bid for Storage Resources**

   The Council reserves comment on this issue.

2. **End-of-Hour Charge Parameter(s)**

   The Council reserves comment on this issue.

3. **Variable-Output DR**

The Council remains concerned about the efficacy of developing a single or even a handful of representative DR Effective Load Carrying Capability (ELCC) values with any degree of accuracy.

An ELCC analysis, regardless of how robust it is, risks providing false precision due to the significant variability among DR types. E3's analysis has not yet considered third-party DR in the form of Demand Response Auction Mechanism (DRAM) resources, bilateral Resource Adequacy contracts between DR providers and non-IOU LSEs, or DR resources contracted with the IOUs to meet a portion of the energy storage procurement target, which will greatly complicate the effort. Though IOU DR programs are relatively static, many third-party DR resources are not, so there will always be a lag in the relevance of an ELCC analysis involving third-party DR.

As the Council stated in its prior comments, any ELCC value is sure to over-value some DR resources and under-value others. This threatens to cause a downward spiral of performance and supply of DR resources if the best performing DR is consistently under-valued. This would incentivize the use of poorer performing, overvalued DR over better performing DR. The poorer performing DR would then push the ELCC factor down and further incentive the elimination of any under-valued DR. The CAISO should seriously consider the implications of this on the supply of DR in California

The E3 presentation was interesting in that it appeared to provide different potential approaches to developing a DR ELCC methodology. However, the complexity surrounding the question of how to incorporate DR ELCC into the CPUC's existing RA framework is overly complicated. The CAISO should carefully consider whether the effort and resources required to bring DR ELCC to fruition is warranted by the relatively small proportion of the overall resource portfolio that DR represents now and the even smaller portion forecasted by E3 in the future. On Slide 13, E3 forecasted very minor DR growth between now and 2030 (a few hundred MWs) but 24,000+ MW of additional solar and 11,000+ MW of additional energy storage. Based on E3's forecast, with peak load forecasted to grow from 49 GW to 53 GW during this time, this indicates a significantly lower proportion of capacity needs will likely be met by DR in the future. Therefore, it is not clear that this issue should be a priority at this time.

4. **Additional comments**

In Section 5.2.2 of the Draft Final Proposal, the CAISO would require that Proxy Demand Resources that utilize the Maximum Daily Run Time Parameter would be required to have a minimum 1 MW curtailment capability and a Pmax that is equal to or greater than 1 MW. This provision had been included in the Second Revised Straw Proposal but the Council admittedly overlooked it. This requirement would be highly problematic for DR providers, including IOUs, because it is sometimes difficult to create a 1 MW resource. For example, a DR provider may be unable to enroll a sufficient number of customers within a subLAP to provide the minimum 1 MW of load reduction. In addition, DRPs will often group their customers with comparable opportunity costs, notification times, and/or willingness to dispatch. If the CAISO adopts this provision, it could cause DR providers and IOUs to "strand" those participants that would otherwise be grouped into a sub-1 MW resource.

The CAISO's basis for proposing this minimum requirement is the load placed on its market systems by the 800+ registered PDRs. However, the CAISO has not indicated what impact this minimum requirement is expected to have on the number of registered PDRs. Furthermore, the CAISO may not be taking into account the likelihood of significantly more registered PDRs in the near future. With rules governing third-party DR being finalized in the current Resource Adequacy proceeding and based on the number of DR providers that recently submitted DR load impact evaluations to the Energy Division for Qualifying Capacity valuation of their DR resources, it seems clear that the number of PDRs will only grow as DRPs begin contracting with more non-IOU LSEs. Therefore, a more sustainable approach might be for the CAISO to upgrade its

systems to accommodate more PDRs. In the short-term, the CAISO should not adopt its proposed 1 MW minimum load curtailment requirement for PDRs utilizing the Maximum Daily Run Time Parameter.

Comments of the California Energy Storage Alliance on Energy Storage and Distributed Energy Resources Phase 4

Submitted by	Organization	Date Submitted
Jin Noh & Sergio Dueñas	*California Energy Storage Alliance (CESA)*	*June 10, 2020*

1. **Default Energy Bid for Storage Resources**

   Please provide your organization's feedback on the default energy bid proposal for storage resources, as described within the draft final proposal and discussed during the May 27 stakeholder meeting.

   CESA is partially supportive of the ISO's formulation of the Default Energy Bids (DEBs) for storage resources, but more work is needed before pursuing Board approval for this aspect of the final proposal. CESA understands the ISO seeks to have a framework to address potential market power issues in the context of increasing energy storage penetration. CESA appreciates the ISO's hard work in developing a thorough methodology that provides certainty to developers and operators. CESA, however, does have some areas of feedback for the ISO.

   First, it is not clear to CESA that the ISO's assumption that all storage assets will seek to charge during the day-ahead (DA) periods with the lowest prices. In the stakeholder meeting, the ISO showed graphs that signal there is a correlation between DA prices and real-time (RT) operation. While these graphs are useful to visually establish some relationship, the ISO has failed to show actual correlation metrics. Moreover, this assumption does not integrate the fact that energy storage resources may participate by providing different products and services within the ISO's markets. Ignoring this fact might overlook the occurrence of apparently "uneconomic" charging; that is, charging that occurs in hours that are outside the ones used by the DEB framework.

   Second, CESA is still concerned with the lack of means for operators to designate aa particular bid to a specific cycle. As stated in the Draft Final Proposal, the ISO has based some of the assumptions related to this proposal with a "one-cycle per day" framework. CESA believes that this approach may be reasonable in the short term, as many energy storage assets will have warranty and/or cycling and degradation costs of one cycle per day incorporated in their bids; nevertheless, when considering DEBs, the ISO should recognize that a bid could be higher due to incremental cycling costs, for

example, for storage assets that are able to cycle more than once. Thus, CESA urges the ISO to consider how to incorporate cycling costs incremental to one cycle in the calculation of DEBs as more information comes to the ISO as stated in section 4.2.2 of the Draft Final Proposal.

2. **End-of-Hour Charge Parameter(s)**

Please provide your organization's feedback on the end-of-hour charge parameter(s) proposal, as described within the draft final proposal and discussed during the May 27 stakeholder meeting.

CESA partially supports the ISO's proposal on end-of-hour (EOH) state-of-charge (SOC) parameters, but some revisions are needed before pursuing Board approval for this aspect of the final proposal. On the one hand, CESA is supportive of allowing operators and scheduling coordinators (SCs) to access an *optional* tool such as EOH SOC parameters to properly operate their assets. CESA is also supportive of the ISO's decision to eliminate the end-of-day (EOD) SOC parameter from this proposal, as it may potentially result in the inefficient use of storage resources. While some elements of this proposal are positive, there are other areas where CESA has deep concerns.

First, CESA opposes the ISO's determination that the use of self-scheduling and/or EOH SOC parameters could have implications on the resources unforced capacity (UCAP) value, effectively derating them. CESA appreciates the ISO's direction that these issues will be furthered discussed in the RA Enhancements; nonetheless, CESA considers it important to highlight that this would be a significant case of differentiated treatment to storage assets relative to other technologies that participate as RA providers. By reaching the conclusion that storage assets could face derates for using scheduling methods currently available to all resources, the ISO actively limits the market participation pathways to energy storage, thereby treating this resource class in an exceptional and potentially discriminatory manner. Furthermore, by preventing storage for resource adequacy (RA) from using this parameter due to concerns about the violation of must-offer obligations, many storage projects will be prevented from accessing this tool, especially as most current and upcoming deployments are for storage resources as RA. CESA advises against this differentiation and will continue advocating for its revision in all relevant policy initiatives at the ISO.

Second, regarding bid cost recovery (BCR), CESA is concerned with the likelihood for "under-recovery". The current BCR proposal does not take into account the SOC of the storage resource in the two hours prior to the EOH SOC parameter application. By broadly disallowing BCR in the timeframes before a self-schedule or the use of an EOH SOC parameter *without* considering the SOC of the storage resource prior to these periods, it is possible that the ISO would unduly penalize a storage resource that actually entered the periods in compliance to their self-schedule or EOH SOC bid. Hence, CESA supports revising the BCR proposal to ensure that SOC is contemplated as a factor that would determine its application.

Third, CESA is concerned with the interactions between the proposed BCR modification and the ability of energy storage resources to participate in markets other than energy. CESA asks for clarification on how this framework would consider the charging and discharging of storage related to regulation and ancillary services. CESA

recommends that the ISO to include an explanation and a set of examples on this issue in the next iteration of the proposal.

3. **Variable-Output DR**

Please provide your organization's feedback on variable-output DR, as described within the draft final proposal and in the ELCC study discussed during the May 27 stakeholder meeting. Please explain your rationale and include examples if applicable.

Generally, as dispatchable resources, among other things, CESA views the use of ELCC to measure the capacity variable-output of DR may not be appropriate. ELCC is also backward looking, based on a fixed resource future, does not reflect the value of providing energy during high-value hours, and does not reflect technology, program, and locational differences, where measured approaches are better alternatives to assess capacity value. Finally, with recent studies in the CPUC's 2019-2020 IRP planning process showing that there is no need to derate energy storage until 10 GW of storage penetration is reached, the need for ELCC of similarly energy-limited DR resources is premature at this time.

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Submitted by	Organization	Date Submitted
Kanya Dorland, CPUC *Kanya.Dorland@cpuc.ca.gov* *Michael Castelhano* *Michael.Castelhano@cpuc.ca.gov*	*California Public Utilities Commission, Energy Division*	*June 15, 2020*

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

1. **Default Energy Bid for Storage Resources**

   Please provide your organization's feedback on the default energy bid proposal for storage resources, as described within the draft final proposal and discussed during the May 27 stakeholder meeting.

   The CPUC staff continues to support the consideration of a dynamic Default Energy Bid (DEB) for energy storage given the significant issues with charging an energy storage system more than once a day. Please see prior ESDER Phase 4 comments for more details on this recommendation submitted on March 20, 2020. A dynamic DEB would also be a more precise tool to compensate energy storage systems for their costs to cycle. While the current CAISO DEB policies for generating resources do not allow for more than one DEB for a given day, different provisions are needed to address energy storage systems' unique operating requirements in the DEB formation design for energy storage.

2. **End-of-Hour Charge Parameter(s)**

   Please provide your organization's feedback on the end-of-hour charge parameter(s) proposal, as described within the draft final proposal and discussed during the May 27 stakeholder meeting.

CPUC staff appreciate the CAISO's work on refining Bid Cost Recovery (BCR) treatment for resources that take advantage of the proposed End of Hour state of charge (SOC) parameter. However, we continue to feel that the solution falls short. The BCR treatment in the proposal may be overly broad and may lead to storage resources receiving reduced BCR and subsequently reduced revenue and profit. The result arises from the fact that the CAISO plans to apply its proposed rules to a period of time instead of a quantity of energy, and the fact that the plan does not recognize the unique economics of energy storage. A more appropriate plan would explicitly count the energy used to charge the resource for the end of hour SOC requirement.

Energy storage resources are unique in that earning profit requires two transactions. Part of that market interaction means that the market software will schedule sets of transactions that are profitable on net. CAISO's plan will exclude costs from the BCR calculations that appear to be uneconomic during the period leading up to the End of Hour SOC need. Uneconomic charging to the specified SOC value will be excluded from the calculations that way. Charging that appears uneconomic by itself, but is part of a two-way profitable transaction optimally scheduled by the market software, will also be excluded. By excluding costs from optimal market schedules, this system of BCR counting will potentially short storage resources of their proper revenue levels.

3. **Variable-Output DR**

   Please provide your organization's feedback on variable-output DR, as described within the draft final proposal and in the ELCC study discussed during the May 27 stakeholder meeting. Please explain your rationale and include examples if applicable.

   At this time, CPUC staff does not have comments on this issue, but may comment on this issue at a later date.

4. **Additional comments**

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

Spread Bidding

LS Power,[1] Southern California Edison,[2] CPUC staff and other ESDER stakeholders have requested that the CAISO allow energy storage operators to bid into the

[1] *LS Powers comments on the Energy Storage and Distributed Energy Resources (ESDER) Issue Paper and Working Group Meeting held on March 18, 2019*, April 1, 2019, pp.2-3 "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."

[2] *Customized Energy Solutions, CAISO Energy Storage and Distributed Energy Resources Working Group Meeting*, June 27, 2019, p. 4. "SCE suggested that the CAISO may want to consider letting storage resources bid a price spread."

CAISO market with a spread bid that represents the costs of charging and discharging a battery. Currently, all resources participating in the CAISO market must submit bids for the price at which they are willing to buy energy, and/or for the price at which they are willing to sell energy. Energy storage's operation costs are recovered through the difference between the prices at which a resource buys energy and the prices at which it sells energy. To bid into the market, energy storage operators must predict future prices and then set bids to buy and sell energy according to their predictions to cover their costs. The aforementioned stakeholders and the CPUC argue that allowing energy storage resources to submit spread bids would enable greater energy storage resource participation in the CAISO markets because it would address issues with forecasting prices in the real-time market and the risks associated with market participation that does not cover an energy storage resource's cycling costs. CPUC staff recommends that energy storage resources be able to reflect their willingness to participate in the CAISO markets as the difference or desired spread between their buy and sell prices. This request has not been addressed in the current ESDER Phase 4 proposal.

Minimum Charge Requirement

The CAISO's proposed Minimum Charge Requirement (MCR), which was introduced at the March 3, 2020 ESDER Phase 4 stakeholder meeting, would enforce an MCR on energy storage resources in the real-time market to ensure energy storage capacity is available to meet day-ahead market awards. The California Energy Storage Alliance,[3] Department of Market Monitoring,[4] and the Western Power Trading Forum[5] all expressed that this proposal would make energy storage resources less flexible in the real-time market and as a result would

[3] *California Energy Storage Alliance (CESA)* comments on the Energy Storage and Distributed Energy Resources Phase 4 Second Revised Straw Proposal, March 16, 2020, p. 6. "the MCR could significantly strand the capabilities of storage assets by forcing them to sit idle; thus, foregoing revenues from markets aside the energy market. This policy …could in fact hinder the financing available for future projects, increase procurement costs as revenues may decline, and ultimately hurt ratepayers due to suboptimal utilization of assets."

[4] The *Department of Market Monitoring (DMM)* comments on the Energy Storage and Distributed Energy Resources Phase 4 Second Revised Straw Proposal, March 27, 2020, p. 8. "The ISO's proposal would likely result in storage resources becoming much less flexible in real-time. For example if a resource's minimum SOC must be set high after its last charging interval earlier in the day in order to maintain day-ahead discharge schedules starting hour 19, the minimum SOC constraint could prevent the resource from discharging and recharging in order to capture additional real-time revenue opportunities before hour 19. Additionally, if conditions in real-time are such that the storage resource's day-ahead energy awards starting hour 19 are no longer needed or would otherwise be uneconomic, it would be unnecessary to maintain a minimum SOC on the resource to meet day-ahead schedules."

[5] *The Western Power Trading Forum (WPTF) comments on the Energy Storage and Distributed Energy Resources Phase 4 Second Revised Straw Proposal*, March 16, 2020, p. 4. "WPTF does not support the minimum charge requirement element of this proposal as it will lead to inefficient market outcomes"

likely reduce the market value of energy storage resources. The aforementioned stakeholders also argued that the MCR proposal treats energy storage resources differently than other resources participating in the CAISO markets.[6,7] As an alternative, both the WPTF and CPUC staff recommend improvements to the CAISO's real-time market optimization such as extending the real-time market lookout horizon to 10 hours.[8] CPUC staff continues to support this recommendation instead of the proposed MCR.

Proposal Evaluation

Given the number of concerns raised with the ESDER Phase 4 proposals from a broad spectrum of stakeholders, CPUC staff suggests monitoring and evaluating the impact of the proposals during the implementation period to determine if the concerns raised in fact materialize. There are still issues to be resolved with the existing energy storage resources interconnected to the CAISO grid today to allow them to operate at full capacity.[9] The ESDER proposals collectively may represent another barrier to full participation of energy storage resources in the CAISO markets and specifically to energy storage serving the evening peak hours. There are also likely issues with energy storage operations that have not been identified that could impact the proposal outcomes.

[6] California Energy Storage Alliance (CESA) comments on the Energy Storage and Distributed Energy Resources Phase 4 Second Revised Straw Proposal, March 16, 2020, p. 6. "CESA sees the MCR as a market barrier to storage assets, a barrier that has not been placed for conventional thermal generators or any other technology within the CAISO footprint."

[7] *The Western Power Trading Forum (WPTF) comments on the Energy Storage and Distributed Energy Resources Phase 4 Second Revised Straw Proposal*, March 16, 2020, p. 4. "traditional generators that receive day-ahead schedules can rebid in the real-time market. The real-time market will then re-optimize the resources based on updated bids to meet real-time demand…Storage resources should be treated in the same manner such that based on updated real-time bids the market can re-optimize the use of storage resources and allow the market to determine when to charge and discharge the resource."

[8] The *Western Power Trading Forum (WPTF)* comments on the Energy Storage and Distributed Energy Resources Phase 4 Second Revised Straw Proposal, March 16, 2020, p. 5. "WPTF asks that the CAISO evaluate what extended horizons could be feasible. It may be the case that extending the horizon to, for example 10 hours, may be long enough to address most of the issues raised herein as well as during other previous stakeholder initiatives."

[9] G&E removed its energy storage projects from CAISO markets in 2019 to address maintenance, communication, and IT issues. PG&E also plans to upgrade its bidding platform for its energy storage projects to provide greater visibility of prices. PG&E expects to return its energy storage projects to the CAISO market in the second quarter of 2020. Energy storage interconnected on the distribution grid must also limit its activity to the capacity and load demands on the distribution grid.

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Submitted by	Organization	Date Submitted
Raeann Quadro *Rquadro@gridwell.com*	*EDF-Renewables*	*06/10/2020*

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

1. **Default Energy Bid for Storage Resources**

   EDF-R has no comment on this item at this time.

2. **End-of-Hour Charge Parameter(s)**

   EDF-R is generally supportive of the CAISO's ESDER 4 proposal, except the potential for RA changes as they relate to energy storage end-of-hour state-of-charge (SOC). The end-of-hour SOC proposal in the ESDER 4 paper is significantly changed in the draft final proposal from previous proposals. EDF-R supports CAISO moving ahead with developing SOC functionality in general, but requests the CAISO take a "first do no harm" approach with respect to the proposed SOC RA changes. In the ESDER 4 meeting CAISO indicated that the RA Enhancements initiative would identify changes needed for RA as it relates to end-of-hour SOC.

   EDF-R requests that the CAISO siphon the end-of-hour SOC RA changes off onto a development track separate from ESDER 4 and from the current RA enhancements track. The CAISO concerns may turn out to be unwarranted and EDF-R believes the RA changes should only be pursued if and when actual generator behavior indicates a problem.

   The CAISO made clear in the ESDER 4 meeting that RA resources that use end-of-hour SOC, may be penalized under RAAIM if they reduce their available capacity through the tool during RAAIM assessment hours, and that use of this tool during UCAP assessment

hours would lead to a derate with respect to the resources UCAP calculation. This essentially guts the usefulness of being able to use an end-of-hour SOC parameter because it would decrease RA revenues through RAAIM penalties and eventually the ability to sell RA capacity under the UCAP model.

Using end-of-hour SOC will be even less prudent for RA resources if the CAISO's UCAP proposal moves forward, as currently proposed using end-of-hour SOC may even limit a supplier's ability to sell future RA. If an RA resource did want to attempt to use end-of-hour SOC, the CAISO's proposal to define supply cushion retroactively using 20% tightest supply cushion hours based on actual conditions makes it almost impossible for RA resources to evaluate or quantify the risk of using end of hour SOC in any given hour – in this new paradigm no hour is safe, all hours are conceivably being tracked and assessed. These RA concerns are not unique to EDF-R nor are they rare.

RA revenue is a critical component of EDF's development model, and EDF's development model is representative of a large portion of energy storage development. If we use Transmission Plan Deliverability status as a proxy for identifying the portion of new generation coming online that have contracted for RA, per the CAISO generator interconnection queue, 99% of MW that declared COD in the last 4 years are under contract for RA. And resources are contracting *now* for the ~2000 MW of energy storage expected to come online in the next few years. The industry does not have a collective path forward for reconciling those existing contracts with new RA policy.

Given the magnitude small RA changes could have on the still-budding and much needed storage fleet, EDF-R is concerned about the pace of CAISO's policy development with respect to battery storage end of day SOC and RA implications. EDF requests that the CAISO act with an abundance of caution on this topic, and requests that the CAISO place on hold SOC RA changes until actual generator behavior indicates a problem.

3. **Variable-Output DR**

   EDF-R has no comment on this item at this time.

4. **Additional comments**

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

Energy Storage and Distributed Energy Resources Phase 4 (ESDER 4) Draft Final Proposal

Comments by Department of Market Monitoring
June 18, 2020

Summary

DMM appreciates the opportunity to comment on the ISO's *Energy Storage and Distributed Energy Resources Phase 4 (ESDER 4) Draft Final Proposal*.[1]

DMM supports the ISO's overall direction to apply market power mitigation to battery resources. While there is not a significant amount of battery capacity participating in the ISO markets currently, batteries continue to be sited in areas that are frequently downstream from non-competitive constraints. As battery capacity increases on the system and continues to replace capacity in local areas, it will be increasingly important that these resources be subject to energy bid mitigation.

DMM believes there are several enhancements that could improve the ISO's proposed default energy bid (DEB) calculations. For example, the ISO's proposal will not allow battery DEBs to vary across the day. This approach necessitates the use of the highest possible cycling cost that may be incurred in the day for all hours. Further, this approach does not accommodate an opportunity cost component of the DEB that accounts for storage resources' capability to charge and discharge potentially multiple times over a day. This can lead to overstated opportunity costs in the DEB. If the ISO moves forward with its simplified approach to calculating DEBs, DMM encourages the ISO to closely monitor the impact of its proposed DEB calculations and seek to refine its methodologies over time to address any shortcomings.

In the Draft Final Proposal, the ISO has also proposed changes to the price estimation methods in two components of the DEB calculation. Specifically, the ISO revised its methodology for calculating expected prices for the charging energy component of the DEB used in the day-ahead market. The ISO now proposes to use prices from the LMPM market run, which do not reflect the impact of any bid mitigation that may be applied in the subsequent market run. This would allow DEBs used in the day-ahead market to be elevated by the exercise of local market power.

For the opportunity cost component of the day-ahead market DEB, the ISO retained its price estimation approach from its prior proposal. As constructed, this approach results in a value that cannot decrease when bilateral prices drop from the previous day. This may lead to significantly overstated opportunity costs when bilateral prices decrease significantly from the previous day.

[1] *Energy Storage and Distributed Energy Resources Phase 4 Draft Final Proposal*, California ISO, May 20, 2020: http://www.caiso.com/InitiativeDocuments/DraftFinalProposalEnergyStorage-DistributedEnergyResourcesPhase4.pdf

The ISO proposal also creates new resource master file parameters which will be used to calculate DEBs for battery resources. DMM requests that the ISO clarify what information will be used to derive the new "storage duration" parameter. DMM also stresses the importance of the ISO actively validating the master file parameters that will directly impact DEB calculations.

DMM supports the ISO's proposal to introduce a biddable end-of-hour state-of-charge (EOH SOC) parameter for storage resources. As indicated by stakeholders, this feature could be a more flexible way for battery resources to manage schedules in real-time versus self-scheduling. DMM appreciates the ISO's efforts to address potential changes in schedules between 15-minute and 5-minute markets, bid cost recovery rules (BCR), and using the end-of-hour state-of-charge feature to exceptionally dispatch storage resources.

While DMM believes the ISO's proposals to address these issues have improved significantly over time, the ISO should consider more refined methodologies for preventing large swings in schedules between 15 and 5-minute markets. Other approaches could help maintain flexibility of battery resources in real-time, especially when the end-of-hour state-of-charge constraint does not impact a resource's dispatch. The ISO could also refine BCR rules so that resources could remain eligible for BCR when the end-of-hour state-of-charge constraint does not impact a resource's dispatch. DMM also suggests that the ISO provide more detail on how storage resources subject to exceptional dispatch using an end-of-hour state-of-charge constraint will be settled, particularly for exceptional dispatches that may be considered non-competitive.

Lastly, DMM supports the ISO's efforts to more accurately determine demand response resources' contributions towards meeting resource adequacy requirements. DMM has observed that bidding patterns of demand response resources which are not subject to must-offer obligations have mirrored underlying load profiles. These resources' availability often do not align with the ISO's availability assessment hours, or hours where the ISO relies on resource adequacy capacity the most. To the extent that these demand response resources are counted towards meeting resource adequacy requirements, these resources' contributions to reliability in peak net load hours should accurately reflect curtailable load available in such hours.

DMM also supports the ISO's efforts to enhance demand response modeling by allowing resources to submit a maximum run time parameter. Stakeholders have indicated that this parameter would allow the ISO to better model the way many demand response programs are designed and called. It will be important for the ISO to monitor suppliers' use of the maximum run time parameter in conjunction with other master file parameters to ensure that resources which are counted for resource adequacy are not using master file constraints to limit resource availability below resource adequacy commitments.

More detailed comments on the ISO's draft final proposal are provided below:

I. Default Energy Bid for Energy Storage Resources

The Draft Final Proposal includes cycling costs and opportunity costs as two of three cost categories for energy storage resources. DMM supports the inclusion of each of these cost components in a DEB for energy storage resources.

A DEB that can change by hour could allow more accurate estimation of cycling costs

In earlier versions of the ESDER 4 proposal, the ISO sought to estimate the cost per MWh of cycling a storage resource, varying throughout the day based on resource operation over that day. While the approach was focused on cycling costs of lithium-ion batteries, the general approach appeared promising as an approach to accurately estimate costs of storage resources at a point in time. Key components of this general approach include tracking characteristics such as state-of-charge and number of cycles over the day, and allowing cycling costs reflected in DEBs to vary accordingly.

In the Second Revised Straw Proposal, the ISO proposed a static DEB value over the day. This approach is retained in the Draft Final Proposal. Because the DEB value will not be allowed to change throughout the day, the ISO proposes to use an estimate of cycling costs that will capture the highest-cost cycling scenario that a resource could face in the day. While such an approach may be necessary with a static DEB value for the day, this creates the potential to significantly overestimate costs in some hours and highlights the need for a DEB value that can change through the day.

The proposed approach also necessitates the use of a more blunt and conservative estimate of maintenance costs that may be varying with battery usage over the day. To more accurately capture the dynamic nature of energy storage resource costs, the approach could be refined to allow for different DEBs in different hours of the day and include better opportunity cost calculations.

Opportunity costs are dynamic and should reflect opportunities to recharge

DMM highlighted the role of opportunity costs for energy storage resources in earlier comments and appreciates that the ISO has included this cost in the proposed default energy bid methodology. Specifically, it is appropriate to include opportunity costs from foregone future profit opportunities. Such opportunity costs may be incurred if an energy storage resource charges or discharges at a time that is not profit maximizing over the day or other time period. Some examples are when a higher priced discharge opportunity is expected in future intervals, or when a lower cost charging opportunity is expected before reaching a high value discharge opportunity. Like the cycling costs considered by the ISO, these costs are also dynamic and change over the day. Opportunity costs will vary over the day with respect to expected prices in upcoming charging and discharging opportunities.

In an effort to capture the type of opportunity costs described above, the ISO proposes to estimate the next day's prices, construct a price duration curve of expected prices sorted in

descending order, and then calculate the strike price on that curve corresponding to the discharge duration capability of the storage resource at maximum output. This approach may be appropriate for resources that have no ability to recharge within a day once discharged, as resources subject to these limitations would face static opportunity costs at the highest valued discharge opportunities expected in the day.

However, this approach does not reflect the actual physical characteristics of energy storage resources that may be capable of charging and discharging multiple times over the course of a day. The use of a simple strike price approach for these resources could overstate the opportunity cost for all but the intervals where recharging is not physically possible before reaching the highest valued discharging opportunities.

DMM discussed this issue at length in earlier comments, illustrating through example how the ISO's simplified DEB approach can significantly overstate opportunity costs when a resource can cycle multiple times per day.[2] Additionally, DMM's comments on the ESDER 4 Straw Proposal outline a generalized approach that more fully accounts for opportunity and other costs at different points in the optimization period.[3] This general approach accounts for the dynamic nature of energy storage opportunity costs at different points over a day, and accounts for the ability to charge and discharge multiple times over a day to maximize profit.

Should the ISO elect to implement a simplified approach for energy storage DEBs rather than a more general approach like that presented in DMM's earlier comments, DMM encourages the ISO to closely monitor the impacts of this choice on calculated DEBs. DMM encourages the ISO to consider a future enhancement to estimated opportunity costs that accounts for the ability of energy storage resources to recharge throughout the day.

Estimated day-ahead charging costs may be influenced by market power when using LMPM run prices

The Draft Final Proposal contains a number of changes to proposed approaches for estimating prices used in the DEB calculation. While DMM appreciates that some of these changes are likely improvements to earlier proposals, the new proposal to estimate day-ahead charging cost using prices from the day-ahead LMPM run may warrant further consideration.

The ISO explicitly states that LMPM prices are not an appropriate choice to estimate opportunity costs because they may be influenced by market power. However, the ISO appears to make an assumption that because the charging costs are estimated using the lowest prices in

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[2] *Comments on ESDER 4 Second Revised Straw Proposal*, Department of Market Monitoring, March 27, 2020: http://www.caiso.com/InitiativeDocuments/DMMComments-EnergyStorage-DistributedEnergyResourcesPhase4-SecondRevisedStrawProposal.pdf

[3] *Comments on ESDER 4 Straw Proposal*, Department of Market Monitoring, May 21, 2019: http://www.caiso.com/InitiativeDocuments/DMM_Comments-EneryStorageandDistribuedEnergyResoucesPhase4-StrawProposal.pdf.

the day, they would not be influenced by market power and would be acceptable for estimating charging costs.

DMM notes that binding transmission constraints can lead to local market power in any hour of the day, even if those hours are the lowest prices of the day—the lowest prices of the day can still be relatively elevated at a given node when congestion is present. The use of the LMPM run prices in any part of the DEB calculation can lead to a DEB that is influenced by the exercise of market power. DMM encourages the ISO to reconsider the use of LMPM run prices in the day-ahead charging cost portion of the DEB calculation to ensure that the DEB calculation is not influenced by market power.

Price estimation methods for day-ahead opportunity cost calculations should allow for possibility of falling prices day-over-day

DMM appreciates the ISO revising its methodology for estimating prices used in the opportunity cost component of the real-time DEB calculation. The use of actual day-ahead prices as inputs to the real-time DEB calculation represents an improvement to the previous proposal which considered only the possibility of flat or increasing prices day-over-day which could overstate opportunity cost estimates on days where prices fall significantly over the previous day. However, because day-ahead prices cannot be used as an input to the day-ahead DEB calculation, and because LMPM run prices may be influenced by local market power, the ISO retains the earlier approach to price estimation for the calculation of the opportunity cost component of DEB in the day-ahead market.

The ISO's proposed approach to estimating day-ahead prices for use in the day-ahead DEB opportunity cost calculation uses the current day's prices scaled by a ratio of bilateral prices for the next day and current day. The approach does not allow for a ratio of less than one as would occur when prices are expected to fall. The use of a price estimation approach that does not allow for the possibility of prices falling on the next day could overstate costs reflected in the DEB on days when prices fall significantly from the previous day. The ISO may be able to improve its proposed price estimation approach by allowing for the possibility of both rising and falling prices across days when calculating the opportunity cost component of the day-ahead DEB.

Storage duration parameter

The ISO proposes to model a new master file parameter called *storage duration* in its calculation of opportunity costs for energy storage DEBs. The ISO indicates this parameter will represent "Time the resource is capable of discharging, given energy (MWh) capacity at full output".[4] In the Draft Final Proposal, the ISO states "The ISO also collects the maximum

[4] *Energy Storage and Distributed Energy Resources Initiative (ESDER4) Draft Final Proposal*, May 27, 2020, Slide 22: http://www.caiso.com/InitiativeDocuments/Presentation-EnergyStorage-DistributedEnergyResourcesPhase4-May27-2020.pdf

amount of storage capability (in MWh) for each storage resource, this value combined with the resource Pmax value, will inform the storage duration parameter above".[5]

DMM requests that the ISO clarify whether the storage duration parameter will consider the daily Max Charge Limit parameter which is a biddable parameter that sets a daily max state of charge for a battery resource. Max charge limits are submitted into SIBR and can vary by day. Additionally, the ISO explains that a resource's Pmax will factor into the storage duration calculation. DMM asks the ISO to clarify whether the duration parameter will consider potential Pmax de-rates submitted to the ISO's outage management system. If the ISO does not consider max charge limit values which may vary by day or Pmax de-rates in its calculation of storage duration, the ISO's DEB calculations may not accurately reflect resources' actual physical capabilities.

Cycling cost parameter

The ISO proposes to include an explicit $/MWh cycling cost value in battery DEB calculations (applied to resources' discharge range). In the Draft Final Proposal, the ISO describes the higher end of cycling costs will be used in DEBs based on resources operating beyond their "design specification". The ISO describes that, "[m]any of the batteries are being built to optimally perform one cycle per day, which includes charging the battery once for four hours and discharging the battery for four hours later in the day" [6] and, "[c]onversations with a variety of battery manufacturers have been informative as to the costs of storage resources operating beyond their design specification, which may be between 2 to 3 times larger than those costs when operating within them." [7]

DMM appreciates the ISO explaining that cycling cost values will be validated by the ISO based on supporting documentation before these values can be used in DEBs. However, DMM has some concerns about the ISO's plan to simply accept the higher cycling cost values associated with a resource operating beyond its "design specifications". The ISO could better ensure that suppliers' estimates of cycling costs reasonably reflect how resources are actually being operated.

DMM has observed that based on resource meter data, batteries in the CAISO market cycled, on average, 0.5 cycles per day between July 2019 and May 2020 (where a cycle is reached when a resource's cumulative dispatch equals the resources' maximum state-of-charge). Some batteries have cycled on average up to 1.2 cycles per day in a single month. DMM has also observed that the average discharge bids of CAISO battery resources in 2019 were below $50/MWh in the second and third quarters of 2019[8], a trend which continued through the end of 2019. Suppliers presumably already reflect cycling costs within energy bids. If the ISO allows

[5] *Draft Final Proposal*, p. 29.
[6] *Draft Final Proposal*, p. 23.
[7] *Draft Final Proposal*, p. 24.
[8] *Q3 Report on market issues and performance,* Department of Market Monitoring, December 5, 2019, pp. 89-90: http://www.caiso.com/Documents/2019ThirdQuarterReportonMarketIssuesandPerformance.pdf

cycling cost adders to reach $60 to $90/MWh (i.e. 2 to 3 times the $30/MWh value the ISO mentions in the Draft Final Proposal) and applies these values to static daily DEBs, DEBs may routinely be too high for extended periods of time based on how resources have actually been bid into the market and cycled.

DMM suggests that the ISO could, instead, require that suppliers submit information to the ISO which estimate cost adders that may be incurred for various levels of cycling. DMM assumes that the "one cycle per day" design specification is derived from an overarching level of total cycling over a resource's lifetime. The supplier could submit costs associated with a resource operating to its "design specification" and stepped cost adders to operate beyond these design specifications to the ISO. The ISO could either modify cycling cost adders over time based on resources' cumulative discharge observed in meter data as the resource approaches different levels of cycling, or the ISO could allow suppliers to routinely update cycling cost adders and use supporting information to justify suppliers' submissions to the ISO.

II. End-of-hour state-of-charge parameter

DMM supports the ISO's proposal to introduce a biddable end-of-hour state-of-charge (EOH SOC) parameter for storage resources. The ISO's proposal would allow scheduling coordinators to submit EOH SOC values as a minimum and maximum MWh range. As indicated by stakeholders, this feature could be a more flexible way for battery resources to manage schedules in real-time versus self-scheduling.

While DMM supports the general framework of the ISO's proposal, the ISO's proposal for managing potential schedule changes between 15 and 5-minute markets could be enhanced to better preserve the flexibility of battery resources in real-time, particularly when the EOH SOC constraint does not impact a resource's dispatch. The ISO could also refine BCR rules so that resources remain eligible for BCR when the EOH SOC constraint does not impact a resource's dispatch.

End-of-hour SOC interaction between 15 and 5-minute markets

DMM appreciates the ISO's consideration of impacts that the end-of-hour state-of-charge (EOH SOC) parameter could have between 15-minute and 5-minute markets, given the difference in look-ahead horizons.[9] To address potential swings in schedules between 15 and 5 minute markets, the ISO will apply an EOH SOC constraint to the end of 5-minute market horizons, "adjusted for a resource's charging activity for intervals beyond the RTED time horizon as determined by the latest RTUC advisory instructions for that time period."[10]

DMM believes the ISO's proposed solution is an improvement over its previous proposals to maintain alignment between 15 and 5-minute market schedules. The ISO's proposed solution

[9] *Comments on ESDER 4 Revised Straw Proposal*, Department of Market Monitoring, November 25, 2019, p. 7: http://www.caiso.com/InitiativeDocuments/DMMComments-EnergyStorage-DistributedEnergyResourcesPhase4-RevisedStrawProposal.pdf

[10] *Draft Final Proposal*, pp. 9-10.

would help prevent potentially large swings in generation between real-time market runs, and increase the likelihood that EOH SOC targets will remain feasible through the real-time market when the EOH SOC constraint impacts a resource's dispatch in the 15-minute market. However, the ISO's proposal may also limit resource flexibility in real-time, particularly when the EOH SOC constraint does not impact a resource's dispatch.

DMM suggests that the ISO consider whether "end-of-*horizon*" EOH SOC constraints should only be enforced in the 5-minute market if EOH SOC constraints are actually binding in 15-minute market runs. Understanding whether an EOH SOC constraint is binding (i.e. constraint exhibits a positive shadow price) could also be used to refine the ISO's proposed BCR eligibility rules when the EOH SOC feature is used.

Consider the ISO's example 1 on page 10 of the Draft Final Proposal. Suppose the EOH SOC constraint was set between 75% and 90% (between 30 and 36 MWh). In contrast to the ISO's example, suppose that advisory prices in the last two intervals of the RTUC horizon (09:30-09:45 and 09:45-10:00) were high, such that it would be optimal for RTUC to fully charge the resource to 100% by 9:35 so that the resource could capture high prices and discharge economically between 09:30-10:00. The resource could still meet the SOC target by hour ending 10, even though it would be discharging between 09:30-10:00.

Under the ISO's proposal, it is not clear whether the ISO would set the corresponding 5-minute market end of horizon SOC target (in the 8:30 RTED run) at 100%, given the resource's *discharge* predicted in RTUC advisory intervals between 09:30 and 10:00. If the ISO does plan to set the 5-minute market end of horizon constraint at 100%, the ISO's proposal would attempt to exactly mirror RTUC advisory schedules any time an EOH SOC constraint is used regardless of the constraint's impact on a resource's dispatch. If the constraint did not impact the resource's RTUC schedule, the ISO's proposal may limit resources' flexibility to meet changing conditions between the RTUC and RTED runs. On the other hand, if the ISO sets the end-of-horizon SOC constraint between 75% and 90% at the end of the 08:30 RTED horizon (as the resource had no *charging* activity in RTUC between 09:30 and 10:00), the ISO may inefficiently limit the resource's ability to charge above a 90% SOC and capture economic discharge opportunities between 09:30 and 10:00.

DMM suggests that the ISO consider whether it could identify whether an RTUC EOH SOC constraint is binding and only enforce RTED end-of-horizon SOC constraints in the 5-minute market if the EOH SOC constraint was actually binding in 15-minute market runs. Under the ISO's current proposal, the market software may restrict economic movement of battery resources in real-time when EOH SOC constraints may not otherwise have impacted resources' schedules. By only enforcing end-of-horizon SOC constraints in the 5-minute market if EOH SOC constraints are binding in the 15-mintue market, the ISO could better preserve flexibility on battery resources in real-time. This approach could also be used to enhance bid cost recovery rules when the EOH SOC constraint is used.

BCR and settlement issues

DMM appreciates the ISO's consideration of BCR eligibility rules when EOH SOC parameters or self-schedules are used to manage battery resource schedules in real-time. The ISO proposes to remove revenue *shortfalls* incurred in the hour with an EOH SOC and hour prior from the real-time BCR calculation. The ISO also proposes that revenue surpluses incurred in these two hours would not be removed from the real-time BCR calculation. The ISO's revised proposal would significantly limit potential gaming opportunities in hours preceding the hour with the EOH SOC constraint.

However, as mentioned in prior comments, the ISO's proposal could result in excluding hours from BCR calculations where the end-of-hour SOC constraint did not impact a resource's dispatch.[11] For example, suppose an EOH SOC is set in hour ending 10. A resource may be charged and discharged between 8:30 and 10:00 based on price spreads observed in the market horizon with no impact from the EOH SOC constraint. Suppose the resource is charged out of the money in hour ending 9, and discharged in hour ending 10. Under the ISO's proposal, net costs incurred in hour ending 9 would be excluded from BCR calculations while net revenues earned in hour 10 would count towards offsetting revenue shortfalls in other intervals of the day. In this type of scenario, net costs incurred in hour ending 9 should be included in the BCR calculation and eligible for cost recovery if the resource's dispatch was not impacted by the EOH SOC constraint.

In line with DMM's suggestion for managing resource schedules between 15 and 5-minute markets, the ISO could first determine whether EOH SOC constraints enforced in the 15-minute market were binding and exclude hours from the BCR settlement only if EOH SOC constraints were binding in the 15-minute market. Identifying whether EOH SOC constraints are actually binding and impacting resource dispatch could help improve the precision of BCR eligibility rules.

DMM supports the ISO's proposal to also apply BCR eligibility rules to the hour preceding a battery resource's self-schedule. Since the ISO proposes to define minimum SOC constraints in 5-minute market runs in order for resources to meet self-schedules, DMM suggests that the ISO could also identify whether these minimum SOC constraints needed to support self-schedules are binding or not, and use these distinctions to determine BCR eligibility when a self-schedule is in place.

[11] *DMM November 25 Comments on ESDER 4 Revised Straw Proposal*, pp. 7-8.

Interaction with resource adequacy

DMM previously suggested that the ISO consider whether a battery submitting a max EOH SOC less than a resource's 4-hour resource adequacy value in availability assessment hours (or at the start of the assessment hour window) should constitute a type of outage or de-rate.[12] Alternatively, since a resource may still be able to reach its resource adequacy value or Pmax for less than 4 hours, DMM suggested that the ISO could consider an ex-post settlement process for batteries that is linked to RAAIM.

The ISO clarifies in the draft final proposal that this issue will be taken up in its RA Enhancements Initiative, and that use of the EOH SOC parameters that fall below resources' contracted resource adequacy values could potentially impact resources UCAP values.

DMM maintains that it will become increasingly important to reflect the actual availability of battery resources in capacity values as batteries begin to comprise a greater portion of the resource adequacy fleet. DMM has already observed that use of the daily Max Charge Limit parameter has limited the 4-hour availability of some resource adequacy battery resources and suggests that the ISO also address the use of the Max Charge Limit parameter when assessing impacts to resource adequacy availability.

Exceptional dispatch of battery resources

DMM appreciates the ISO providing additional clarification on how the EOH SOC feature could be used to exceptionally dispatch storage resources.[13] DMM agrees that resources subject to exceptional dispatch using the EOH SOC feature should remain eligible for BCR in intervals potentially impacted by the EOH SOC constraint.

DMM suggests that the ISO provide additional detail on how settlements for battery resources subject to exceptional dispatch will work. This includes how DEBs developed under the ESDER 4 proposal will be used in the settlement of exceptional dispatches.

In contrast to settlements for exceptional dispatches of traditional resources, settlement rules for batteries would likely have to extend beyond the hour of the exceptional dispatch instruction. Similar to BCR rules for batteries using the EOH SOC constraint, the impact of an exceptional dispatch issued to a battery resource by using a target SOC constraint could extend beyond the hour the actual dispatch is needed. Battery resources may have to charge or discharge in prior intervals in order to meet an ISO exceptional dispatch instruction. If a resource's exceptional dispatch is deemed non-competitive, the ISO should clarify how DEBs may be used in place of bids in determining resource settlements.

[12] *Comments on ESDER 4 Revised Straw Proposal*, Department of Market Monitoring, November 25, 2019, pp. 6-7.
[13] *Draft Final Proposal*, p. 13.

III. Demand response

DMM supports the ISO's efforts to more accurately determine demand response resources' contributions towards meeting resource adequacy requirements. DMM has observed that bidding patterns of demand response resources which are not subject to must-offer obligations have mirrored underlying load profiles.[14] These resources' availability often do not align with the ISO's availability assessment hours, or hours where the ISO relies on resource adequacy capacity the most. To the extent that these demand response resources are counted towards meeting resource adequacy requirements, these resources' contributions to reliability in peak net load hours should reflect actual curtailable load available in such hours.

DMM also supports the ISO's efforts to enhance demand response modeling by allowing resources to submit a maximum run time parameter. Stakeholders have indicated that this parameter would better model how demand response programs are designed and called. The ISO should commit to monitoring suppliers' use of the maximum run time and other master file parameters to ensure that resources which are counted for resource adequacy are not limiting resources' availability through use of various master file constraints. For example, a supplier could use the maximum run time parameter and maximum starts per day parameter to significantly limit a resource's availability below its resource adequacy value.

[14] *2018 Annual Report on Market Issues and Performance*, DMM, May 2019, pp. 43-44: http://www.caiso.com/Documents/2018AnnualReportonMarketIssuesandPerformance.pdf

California ISO

Stakeholder Comments Template

Energy Storage and Distributed Energy Resources Phase 4

This template has been created for submission of stakeholder comments on the Draft Final Proposal and associated May 27 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 **June 10, 2020.**

Submitted by	Organization	Date Submitted
Cody Hill, chill@lspower.com *Sandeep Arora, sarora@lspower.com*	*LS Power*	*6/10/2020*

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

LS Power appreciates the CAISO team's latest iteration on the concepts in the Energy Storage and Distributed Energy Resources Phase 4 stakeholder process. Progress is being made in the right direction on Default Energy Bids and End of Hour State of Charge management in particular, although some work is still needed, and we comment on those below. Importantly however, a critically important item is absent from the Draft Final Proposal despite requests from various stakeholders, and its absence is a major oversight.

Storage is not like traditional generation resources in that its variable costs are not determined by an outside factor like the cost of fuel, and the way that multi-interval optimization treats storage today has the effect of throwing away important information about the cost of these resources, creating suboptimal outcomes. CAISO should discontinue using the buy/sell "spread" concept in the Real Time market, and should instead use the actual bid prices submitted by a storage resource's scheduling coordinator. This issue is a problem today, unlike market power for storage resources, and addressing it is truly low hanging fruit that would improve the functioning of the market with respect to its dispatch of storage resources.

1. **Default Energy Bid for Storage Resources**

   Please provide your organization's feedback on the default energy bid proposal for storage resources, as described within the draft final proposal and discussed during the May 27 stakeholder meeting.

   At the previous straw proposal stage we commented that CAISO's Default Energy Bid proposal seemed to be on the right track as a means of applying storage-specific rules in the event that market power mitigation is needed. However, the initial analysis of the proposed default energy bid calculation raises red flags that some parameters need to be refined. Specifically, it appears that the calculated DEB prices on page 26 Table 1 are far too low almost across the board, that Opportunity Costs are generally calculated at a far too low number, and using the previous day's bilateral hub prices to calculate the operating day's opportunity costs is not the right choice, one that will perform at its worst on the very days when it matters most for reliability.

   We urge CAISO staff to specifically consider the likely results of taking a large storage project's bid curve down to a DEB in the stated $32-$60 range on an extreme day with a potential for sustained high prices, and heightened risk of a loss of load. Without market power mitigation, that resource would almost certainly be willing to charge at high prices in expectation of discharging at even higher prices when truly needed. As we have previously commented, it is not uncommon that a storage resource's opportunity cost on a high load day is well north of $100/MWh in our experience, particularly in the Real Time market. But if the DEB is applied and the unit discharged by the market at prices below $60 for example, it will likely end up empty and unavailable sooner than would otherwise be the case, including potentially at the height of the evening peak. CAISO should exercise caution to avoid such a scenario, specifically by calculating expected opportunity costs not off of average days, but off of the most extreme days when these resources are most needed for system reliability.

   Part of the problem is the choice to always look at the previous day's hub prices in the calculation. This is not a good idea, especially on days with heatwaves, wild fires, or other events driving high prices and volatility, although on an average day it is probably fine. When weather is extreme and/or load is high, the market power mitigation algorithm should take that into account instead of blindly following the previous day's results, and allow for reasonably high priced bids for both charging and discharging in order to maximize the likelihood that the CAISO operators have full batteries ready to be dispatched when they need them in the evening peak. We recommend that CAISO not risk reliability on scarcity days by running an optimization model based on a prior day or "average" value. Rather, it would be preferable to factor in price spikes from historical extreme days, as well as Real Time market price volatility during the same day, into DEB. To the extent possible, oversupply during the day and evening peak price volatility should also be accounted for and used to adjust the DEBs. Mathematically, one option for these adjustments is to dynamically adjust the scalar 1.1 in the Storage DEB formula, increasing it to a larger value when volatility/risk metrics are sufficiently high.

   Lastly, a minor issue noted in the meeting is that the choice of formatting of Equation 1 is confusing, and appears to have an exponential where there should not be one.

2. **End-of-Hour Charge Parameter(s)**

Please provide your organization's feedback on the end-of-hour charge parameter(s) proposal, as described within the draft final proposal and discussed during the May 27 stakeholder meeting.

The End-of-Hour State of Charge ("EOH SOC") biddable parameter is a very good idea, and we respectfully suggest that CAISO should both implement the EOH SOC biddable parameter, and concurrently make adjustments to the MOO rules allowing its use by resources that are providing RA. We agree and support CAISO in that "a scheduling coordinator should not submit an end-of-hour state-of-charge parameter that is below the resource's must offer obligation, or use it to withhold additional RA Capacity not scheduled in the IFM or RUC" as noted in Draft Final Proposal. However, as discussed at the stakeholder call, not allowing RA resources to use EOH SOC for Real Time markets risks rendering the tool useless and could lead to unintended consequences. Nearly all of the storage being built in CAISO is being brought online to provide RA. These resources will need to use EOH SOC in real time to better manage their SOCs to meet their Day Ahead schedules resulting from their RA obligations. If a resource's use of EOH SOC in Real Time markets is considered to be withholding capacity and that leads to a RA availability hit, then it undermines the cornerstone of most projects' long term contractual revenues and will not be used. As explained below there are several reasons why a RA resource would need to use EOH SOC in Real Time. These should not lead to counting against availability for the resource.

EOH SOC can be a valuable tool for Scheduling Coordinators to ensure that a resource's physical operation resulting from dispatches in the real time market is aligned with any schedules from the day ahead market. Doing so can cover off both the resource's market risks of the type discussed in the previous straw proposal's "Minimum Charge Requirement" section (without that proposal's many downsides discussed at the ESDER 4 meeting in March), where a unit ends up empty and exposed to extreme prices, and the grid operator's risk of not having enough generation to serve load in the evening due to a failure to maintain sufficient aggregate state of charge across the storage fleet.

The way EOH SOC would get used in practice is as follows:

1. A Non Generator Resource ("NGR") submits its Day Ahead bids to CAISO, with economic offers across all hours, thus meeting its RA Must Offer Obligation.
2. This NGR receives a schedule in the Day Ahead market, most likely with a discharge in the evening.
3. The NGR's SC would review the Day Ahead schedule, and develop the next day's Real Time bids for each hour of the day. In order to minimize risk of being empty during the hours with a Day Ahead discharge, it will be desirable to gradually increase the minimum EOH SOC during the hours leading up to the DAH schedule.
4. During the discharge hours of the Day Ahead schedule, the NGR's SC would logically submit an extremely low or no minimum EOH SOC to allow full operation and coverage of the market schedule. As long as the EOH SOC parameter does not prevent the resource from discharging during its DAH schedule, the goals of the CAISO grid operators, CAISO policy team, and the NGR's SC are all in alignment here.

The results are storage units meeting their RA Must Offer Obligations ("MOOs") in the Day Ahead, and then ensuring that it can physically meet its Day Ahead schedule, with reduced risk to the resource and entire system. The tradeoff of this sequence is that it

could somewhat reduce the MW available to discharge in the Real Time market during the hours immediately preceding a Day Ahead discharge. However, this reduction in real time flexibility in off peak hours will dramatically increase the certainty that a resource to be fully available for its Day Ahead schedules when CAISO needs it most, and is far less restrictive than the Minimum Charge Requirements proposal (which was aimed at that exact purpose) and should not affect resource's availability for RA purposes in any way.

There are truly no reasonably likely operational risks that should prevent CAISO from making this tool available to NGRs that have Resource Adequacy contracts. Scheduling Coordinators will naturally be incentivized by their resource's exposure to market prices to minimize the use of this tool, and the tool increases the certainty of resources showing up to hit their Day Ahead schedule. The RA rules for NGRs should therefore be adjusted to allow them to make use of this tool with no reduction of their availability as long as its use supports meeting Day Ahead schedules and is not being used to artificially limit availability in Day Ahead IFM or RUC. Implementing the EOH SOC biddable parameter, and concurrently making the necessary adjustments to the Resource Adequacy and Must Offer Obligation rules should be top priorities in CAISO's Final Proposal for ESDER4.

3. **Variable-Output DR**

Please provide your organization's feedback on variable-output DR, as described within the draft final proposal and in the ELCC study discussed during the May 27 stakeholder meeting. Please explain your rationale and include examples if applicable.

LS Power has no comments on the Variable-Output DR aspects of ESDER at this time.

4. **Additional comments**

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

LS Power has previously submitted these comments but since we have not received a response on this we are hereby resubmitting.

NGR resources providing Ancillary Services

Another issue that has not been part of this initiative but was being discussed as part of CAISO' Day Ahead Market Enhancements initiative is the issue of NGR resources not able to fully offer their Ancillary Services capability into the market due to the Day Ahead market construct. Currently NGR resources providing Ancillary Services get awards based on their 1 hour dispatch capability. This is primarily due to the current 1 hour optimization construct for the Day Ahead market and is not in line with CAISO's tariff and BPM definitions of Ancillary service, which state this to be a 30 min product. The issue for NGRs would have been resolved if CAISO proceeded to implement a 15 min market in Day Ahead. Since CAISO is no longer proceeding with a Day Ahead 15 min market, the NGR AS issue should be addressed in this ESDER initiative. Non-generating resources (NGRs) with a state of charge should be required to be capable of a 30 minute discharge to be awarded regulation-up, spinning reserves and non-spinning and 30 minute charge to be awarded regulation down and not 1-hour. We recommend that CAISO include this issue in the scope for ESDER4.

California ISO

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Submitted by	Organization	Date Submitted
Mike Pezone *mapz@pge.com*	*Pacific Gas & Electric*	*6/10/2020*

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

1. **Default Energy Bid for Storage Resources**

   Please provide your organization's feedback on the default energy bid proposal for storage resources, as described within the draft final proposal and discussed during the May 27 stakeholder meeting.

   PG&E is supportive of the CAISO's proposal for a simplified Default Energy Bid (DEB) equation which does not adjust dynamically with cycling costs. This was an important adjustment made in the previous draft proposal, and PG&E supports it being maintained in the draft final proposal.

   PG&E requests clarification on the use of the term "Variable Cost Component" in Section 4.3.

   PG&E understands the analysis in Section 4.3 as an attempt to study how two components of the DEB (Energy Costs and Opportunity Costs) compare to each other and may vary depending on the time of year. However, the analysis does not follow the framework provided in Section 4.2, which categorizes energy storage resource costs as either: (1) Energy Costs, (2) Cycling Costs and (3) Opportunity Costs. Instead it uses the term "Variable Cost Component." It is unclear whether the CAISO is intending to use Variable Cost Component interchangeably with the variable "En" defined in Equation 1 (page 21) as the "estimated cost for resource to buy energy." Furthermore, since the day-

ahead bilateral hub (DAB) variable in the Opportunity Cost equation (Equation 2 on page 25) is itself variable, the use of the term "Variable Cost Component" is confusing.

The CAISO should consider adding descriptors to any variables that change between the Day Ahead (DA) and Real-time (RT) markets

In Sections 4.2.1 and 4.2.3, the CAISO qualitatively describes how energy costs and opportunity costs are calculated differently in the DA market compared to the RT market. PG&E assumes that these differences are captured within the "En" variable of Equation 1 and the "DAB" variable of Equation 2. For transparency purposes, PG&E recommends the CAISO consider expanding how these variables are defined to include the important distinction of which prices are used in the calculations (e.g. MPM or IFM run prices). One way to do this is to create defined terms for: En^{DA}, En^{RT}, DAB^{DA} and DAB^{RT}.

2. **End-of-Hour Charge Parameter(s)**

Please provide your organization's feedback on the end-of-hour charge parameter(s) proposal, as described within the draft final proposal and discussed during the May 27 stakeholder meeting.

PG&E appreciates the CAISO's ongoing efforts to implement state-of-charge bidding parameters for NGRs. Although PG&E had initially advocated for an end-of-day parameter to be included as a part of ESDER4, PG&E recognizes that this request is a challenge given its complexity and the implementation timeline. PG&E recommends that the CAISO consider an end-of-day bidding parameter in future stakeholder initiatives.

PG&E recommends that the CAISO create tariff definitions for the "implied end-of-hour constraint" and "end-of-horizon constraint".

PG&E supports the CAISO's solution for the market application issue between the RTUC and the RTED. The example provided on pages 9-11 of the draft final Proposal were helpful to illustrate the need for the implied end-of-hour constraint at the end-of-horizon for RTED. As these market applications become more important, maintaining clear and consistent definitions benefits both the CAISO and stakeholders.

PG&E asks the CAISO whether the RT end-of-hour (EOH) charge parameter will be constrained by the minimum/maximum state-of-charge (SOC) values that are submitted in the DA market.

PG&E foresees situations occurring in RT which would warrant scheduling coordinators to set an EOH parameter which is outside of the minimum or maximum SOC range submitted in the DA timeframe. This is a concern because currently, the Outage Management System (OMS) can only be used to inform CAISO of a change in maximum SOC, not in minimum SOC. If the flexibility to use EOH charge parameters outside of this range is not already provided, PG&E requests that it be made available as a part of this initiative.

3. **Variable-Output DR**

Please provide your organization's feedback on variable-output DR, as described within the draft final proposal and in the ELCC study discussed during the May 27 stakeholder meeting. Please explain your rationale and include examples if applicable.

E3's analysis of PG&E and SCE's bidding data for demand response resources for 2018 and 2019 data suggests that the RA valuation for DR determined through the Load Impact Protocols (LIP) overvalues the capacity contribution of DR relative to the Effective Load Carrying Capability (ELCC) by at least 40%. They provide two reasons: 1.) DR does not bid into the CAISO market at levels equal to its NQC values, and ii) the times when DR is bid are either not at optimal times for not for long enough to earn full ELCC value. (Slide 14 of E3's presentation.) PG&E would like to provide a few points of clarification to inform the analysis:

- The comparison between today's NQC vs. a proposed ELCC is a false comparison that will naturally result in poor performance. The RA program today, as reflected in the LIP evaluations, is designed to look at peak contribution, while the ELCC methodology favors a resource that is available 24/7. To compare peak contribution to "optimal times", as defined by E3, will naturally produce poor results. Specifically, the NQC value is determined by the ex ante impact expected to be available during the RA measurement hours, i.e., 4-9 pm on the monthly system peak day. The "optimal times" defined by E3's analysis are not necessarily consistent with the RA measurement hours and conditions. In the event where the "optimal times" differ from the RA measurement hours, it is logical that the bids are lower than the NQC value. For a time-dependent resource like DR, the NQC, which is based on the impacts for RA measurement hours, is not a realistic expected value for the resource in other hours.

- What CAISO is proposing is a fundamental change to the purpose of DR. Accordingly, PG&E urges the CAISO to seek CPUC clarification on the purpose of market integrated DR – as it is valued from a capacity perspective. PG&E understands that a resource similar to a perfect generator which can provide the same capacity available for 24/7 is much more useful to the CAISO; however, DR is not designed to behave that way. Given CPUC's capacity credit design today, RA expects DR to be a peak-shaving resource primarily and awards RA credit based on DR's capacity on the monthly system peak day. Requiring DR to perform more like a perfect generator would fundamentally restructure DR programs, which will result in a different cost-effectiveness calculation. Thus far, E3 has only considered the capacity, which is only one side of the equation, ignoring the additional costs the restructured DR would incur. There is a long list of issues for holistic consideration. In short, it would be incorrect to simply characterize the change from the LIP to the ELCC as a methodological matter. Applying ELCC on DR fundamentally alters how DR is valued in RA. This is a significant RA policy issue, for which the CPUC should provide guidance on the purpose of market integrated DR.

- Lastly, contrary to statements on the call, PG&E's bids are not grossed up for line losses or planning reserve margin. Are these factors accounted for when the daily bids are compared with the NQC? If not, then the difference between the daily bids and the NQC may be overstated.

4. **Additional comments**

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

No additional comments at this time.

California ISO

Stakeholder Comments Template

Energy Storage and Distributed Energy Resources Phase 4

This template has been created for submission of stakeholder comments on the Draft Final Proposal and associated May 27 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 **June 10, 2020.**

Submitted by	Organization	Date Submitted
Beverly A. Brereton *beverly.a.brereton@sce.com* *Alan Wong* *Alan.Wong@sce.com*	*Southern California Edison*	*June 10, 2020*

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

1. **Default Energy Bid for Storage Resources**

Please provide your organization's feedback on the default energy bid proposal for storage resources, as described within the draft final proposal and discussed during the May 27 stakeholder meeting.

SCE acknowledges the CAISO's recent progress in determining a default energy bid (DEB) for energy storage resources. The CAISO's proposed structure of the cell degradation cost for the discharge operating mode of the resource begs the question whether too little discharge should be compensated at the same rate as deeper or higher levels of discharge. SCE recommends that the incentive structure for degradation costs for energy storage resources can be improved as the CAISO learns and understands more about the operations of storage resources. The idea behind this suggestion is the CAISO's potential access to a wider operating range of any resource is not necessarily guaranteed with the payment of a unitary fixed fee to all units of available capacity from the resource.

For example, a fixed per unit fee may incent resource owners to limit the operating range of the storage resource that limits flexible operation of the resource in a similar manner as an end-of-hour or end-of-day state of charge target or narrow range does. SCE requests clarification from

the CAISO whether the current proposed $30/MWh value for cell degradation costs is applicable to resources that are economically discharged beyond the manufacturer's operations specifications and whether information on the specific performance range for the resource will be an input to the Master File.

Secondly, while SCE supports use of the market clearing prices from the market power mitigation run in the day-ahead market as the input prices for the storage resource's energy costs within the day-ahead market DEB calculation , SCE requests that the CAISO clarifies whether the market clearing prices from the integrated forward market or the hour ahead scheduling process are the prices that will be used in establishing the purchased energy costs for storage resource. SCE suggests using the HASP locational marginal prices in the calculation of energy costs for charging the resource in the real-time market since those prices will include any updates to natural gas prices and changes in the temperature forecast relative to the information used during the day-ahead market clearing process.

SCE supports the CAISO's willingness to allow market participants to update their default energy bid and commitment costs during the day when a gas price increase is experienced. Also, SCE supports the availability of this option to update the information used in calculating the resource's DEB. SCE acknowledges the attempts by the CAISO to balance the likelihood of how often local market power mitigation is triggered. However, SCE notes that there may be occasions when the opportunity costs component and the energy cost components of the DEB may be limiting when significant price escalation occurs when there is the coincidence of forced outages of sizable plants and high temperatures on the same day which is a low probability high-risk event. Fortunately, the negotiated DEB option remains as an aid during such infrequent events.

2. **End-of-Hour Charge Parameter(s)**

   Please provide your organization's feedback on the end-of-hour charge parameter(s) proposal, as described within the draft final proposal and discussed during the May 27 stakeholder meeting.

SCE supports the CAISO's proposal for the end-of-hour state of charge. In particular, SCE agrees that requests by Scheduling Coordinators for an end-of-hour state of charge that requires uneconomic dispatch of the storage resource should disqualify the eligibility of the resource for bid cost recovery. Also, SCE concurs that energy storage resources with ancillary services awards should not be discharged to a lower charge level than allows full delivery of the ancillary service award whether the storage resource has an energy award.

In addition, SCE concurs that Scheduling Coordinators for resources with resource adequacy obligations should not be allowed to set an end-of-hour state of charge that results in the under-delivery of the resource's must offer obligation in the market. SCE reserves comment on the unforced capacity (UCAP) methodology and the potential use of dispatch outcomes associated with self-schedules and end-of-hour state of charge parameter(s) that result in the reduced availability of the storage resource relative to its contracted value for the Resource Adequacy Enhancement initiative.

Further, SCE supports the CAISO's proposal to use an end of horizon constraint in the real-time market to align the intervals in the real-time unit commitment optimization run with the intervals in the real-time economic dispatch run since absent this constraint these individual optimization processes terminate at different times on the clock. Since the CAISO's proposal seeks to adjust the end-of-hour state of charge to account for any charging activity that occurs beyond the RTED optimization horizon relative to the latest RTUC advisory instructions for the relevant operating hour for which the real-time dispatch is being determined, SCE requests clarification whether the likelihood exists for the occurrence of uneconomic dispatch of the storage resource when the constraint is enforced such that the resource's eligibility for bid cost recovery is disqualified.

3. **Variable-Output DR**

   Please provide your organization's feedback on variable-output DR, as described within the draft final proposal and in the ELCC study discussed during the May 27 stakeholder meeting. Please explain your rationale and include examples if applicable.

SCE appreciates E3's efforts to address stakeholder feedback by incorporating 2019 bid data and temperature day-matching into the ELCC methodology study. Even with these improvements, additional refinements are still needed before further consideration.

SCE believes using actual bid data may underestimate the availability of certain programs. For example, if a resource exceeded its maximum number of events per month, then the bid would be zero for the remainder of that month. By just looking at the 2019 bid data, it would be difficult to tell whether the resource's bid was adjusted to zero because it reached a maximum cap or not. A possible alternative is to utilize program year 2019 load impact profiles from the CPUC's load impact protocol models. These models generate monthly 24-hour load impacts under a 1-in-2 and 1-in-10 weather condition. Extrapolation of the load impact profiles, instead of actual bid data, would then provide E3 the desired availability for each DR program under different weather year conditions.

E3's presentation also introduced the "first-in" and "last-in" approach to measure ELCC for each resource type but provided very little detail of the calculation. SCE requests the CAISO and E3 to provide detailed examples by resource type and explain how the CPUC's loading order is factored into scaling of each resource types to the portfolio ELCC.

Lastly, SCE re-emphasizes the point that DR as a program was designed for peak conditions. SCE agrees that E3's utilization of DR as either last resort or optimal dispatch, to delay storage discharge, demonstrates how DR potentially can evolve as the grid needs change. However, this approach puts into question how DR should be treated in the future.

4. **Additional comments**

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

California ISO

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Submitted by	Organization	Date Submitted
Carrie Bentley *cbentley@gridwell.com*	*Western Power Trading Forum*	*June 10, 2020*

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

1. **Default Energy Bid for Storage Resources**

   Please provide your organization's feedback on the default energy bid proposal for storage resources, as described within the draft final proposal and discussed during the May 27 stakeholder meeting.

   WPTF is generally supportive of storage having a default energy bid but remains apprehensive on how mitigation will work in practice in real-time across optimization horizons. For example, consider the circumstance where a resource has a spread offer it wants to achieve and it is charged under its unmitigated offers, but then discharged under its mitigated offers. WPTF is unclear how the CAISO will preserve the resource's spread value. The paper states the mitigation will still preserve arbitrage value, but given the different time horizons in real-time, WPTF does not understand how this is functionally possible under a dynamic mitigation check that varies each hour.

   This concern is not inconsequential as many storage resources are specially being built in local pockets and it is likely they will experience local market power mitigation. WPTF encourages the CAISO to test the mitigation extensively prior to implementation and allow flexibility in the BPM to adjust parameters as needed. We also anticipate there will Bid Cost Recovery consequences that have not been discussed and will likely need to be immediately addressed once the DEB proposal is fully implemented.

2. **End-of-Hour Charge Parameter(s)**

Please provide your organization's feedback on the end-of-hour charge parameter(s) proposal, as described within the draft final proposal and discussed during the May 27 stakeholder meeting.

WPTF supports the CAISO's end-of-hour state of charge proposal; however, is concerned about the discussion surrounding the RA implications. The CAISO has communicated that these rules will be developed within the RA Enhancements stakeholder process, but as stated, they would significantly remove the usefulness of the end-of-hour state of charge.

WPTF views the stated potential RAAIM/UCAP implications of using the state-of-charge as similar to the CAISO proposal that states a battery must ensure it has sufficient state-of-charge to the meet their day-ahead schedule. Batteries are limited energy resources and the CAISO must decide whether they want a battery to meet its day-ahead schedule OR respond to real-time conditions. There will be many circumstances where real-time conditions may differ due to changing weather, load, outages, etc.

For example, a battery may have a discharge schedule over 4 hours in the day-ahead from hours 18-21. In real-time the optimization may show higher prices, indicating a greater need, in hours 17-20. If the battery responds to the high price in hour 17, it would be unable to meet its day-ahead schedule in hour 21. WPTF believes that one of the great benefits of storage its flexibility and ability to respond in real-time. It seems odd for the CAISO to specifically prevent this use through tariff prohibitions and RA penalties.

3. **Variable-Output DR**

   Please provide your organization's feedback on variable-output DR, as described within the draft final proposal and in the ELCC study discussed during the May 27 stakeholder meeting. Please explain your rationale and include examples if applicable.

   WPTF has no comments at this time.

4. **Additional comments**

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

California ISO

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Nu	Organization	Date Submitted
Nuo Tang Lizette Garcia-Rodriquez	SDG&E	June 10, 2020

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

1. **Default Energy Bid for Storage Resources**

   Please provide your organization's feedback on the default energy bid proposal for storage resources, as described within the draft final proposal and discussed during the May 27 stakeholder meeting.

   SDG&E generally supports the CAISO's proposal for the default energy bid (DEB) for storage resources. More practical experience and resources in the market may be needed in order to develop a fully fungible and functional DEB that will reasonably approximate energy storage costs for most resource types. As such, SDG&E requests the CAISO to revisit the DEB formulation and consider additional components as more experience is gained.

   Additionally, SDG&E requests the CAISO to consider what the opportunity cost component would be for the charging portion of the DEB. The examples provided by the CAISO are tailored for discharging the resource. However, there may be opportunity costs if the resource were able to charge at a lower price at a later time of the day as well.

   DEB is an important tool that helps mitigate market power, but energy storage resources are still very limited from an overall capacity standpoint and compete with conventional generation resources as a dispatchable energy resource. Therefore, energy storage resources won't be able to exert much market power for quite some time. The current proposal to mitigate market power is reasonable for the discharging portion. However,

SDG&E questions whether the formula is appropriate for the charging portion. Is it possible for a storage device with 0MWh state of charge to provide a bid curve to charge with a positive price, i.e. $50/MWh, and exert market power that would cause it to be mitigated to a lower price based on the formula? Unlike a traditional generator, in which the price of the output would be mitigated, the storage device's charging would also be mitigated. A storage device's charging bid may induce another resource to output energy and deliver more energy. That combination of creating demand to match with supply may require market power mitigation for both resources. Under traditional generator mitigation, that works to reduce the bid price for output. With storage resources being able to charge, it seems reasonable to increase a negative bid price. However, it does not seem logical to reduce a positive bid price to charge. Doing so would effectively lower the charging bid which would seem to exacerbate the market power issue.

2. **End-of-Hour Charge Parameter(s)**

Please provide your organization's feedback on the end-of-hour charge parameter(s) proposal, as described within the draft final proposal and discussed during the May 27 stakeholder meeting.

SDG&E supports the end of hour state of charge ("SOC") parameters and believes it would allow energy storage devices to better transition to match the beginning SOC for the following day. SDG&E is concerned with the interaction of resource adequacy requirements. Under the CAISO's resource adequacy enhancements initiative, the framework of what types of "outages" count towards the new Unforced Capacity Valuation Methodology ("UCAP") has not been defined. One possible scenario the CAISO has considered is to calculate the UCAP based on all 24 hours of the day. If that is the case, then it would seem that the end of hour SOC could not be utilized by energy storage devices at all in order to limit any effect on the UCAP amount. As such, SDG&E does not believe this option could be utilized as the majority of energy storage resources in the near future would be RA resources. Therefore, SDG&E believes the CAISO should ensure that energy storage resources that are committed as resource adequacy resources also can utilize this option. If the RA enhancements initiative does not resolve this issue, then the CAISO should include this in a future phase of ESDER.

3. **Variable-Output DR**

Please provide your organization's feedback on variable-output DR, as described within the draft final proposal and in the ELCC study discussed during the May 27 stakeholder meeting. Please explain your rationale and include examples if applicable.

SDG&E has long suggested that the CAISO should consider demand response resources similar to that of variable energy resources for purposes of market optimization. This is primarily because the CAISO's systems prevent a demand response resource from submitting outages which would partially derate the demand response resource's maximum output. As such, the alternative solution is to treat such resources similar to other variable energy resources. SDG&E appreciates the CAISO's willingness to further develop this option.

However, SDG&E is strongly disappointed by the requirement to have the CPUC adopt an ELCC methodology for demand response in order to move forward with the variable output option. SDG&E believes the CAISO should offer this bidding option because it can help

resources manage their availability to the CAISO, which it is currently unable to do because the CAISO's outage management system prohibits it.

4. **Additional comments**

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