Energy Storage and Distributed Energy Resources Phase 4 - Stakeholder Comments

Submitted by	Company	Date Submitted
Aditya Chauhan aditya.chauhan@sce.com	Southern California Edison	5/17/19

Southern California Edison (SCE) offers the following comments on the California Independent System Operator (CAISO) Energy Storage and Distributed Energy Resources Phase 4 (ESDER 4) Straw Proposal[1].

1. **Decisional Classification for the Initiative**

SCE concurs with the decisional classification of an advisory role for the Energy Imbalance Market (EIM) Governing Body in this initiative. While there may be non-generator resources within the EIM that desire participation in the CAISO markets, the policy development within this initiative will support the greenhouse gas (GHG) goals of California. Many EIM entities have no state-imposed GHG obligations though their transacting with California utilities requires their compliance with the state's GHG rules.

2. **Non-Generator Resource (NGR) model – SCE opposes the CAISO proposal**

SCE appreciates the CAISO's intent and direction. However, due to serious flaws in some parts of the CAISO's proposal, SCE is compelled to oppose those components. Specifically, while SCE supports the CAISO's proposal to not provide BCR for uneconomic dispatches, the foundations of the proposal have enough problems that would make it untenable. The key concerns are that the proposal may: (1) Inappropriately impact market prices (2) Reduce fleet flexibility – contrary to the CAISO's consistent push toward more flexible resources, and (3) Cause inefficient dispatch thereby leading to lower revenues and higher costs for resources.

The CAISO proposal may inappropriately impact market prices

In the case of charging, as a resource is uneconomically dispatched, prices will likely rise due to increased demand. This can preclude the infra marginal resource from having the opportunity to charge. Similarly, the same lost opportunity can result on the discharge side as a resource, uneconomically supplies power. In both cases, there are uneconomic dispatches affecting market prices. These uneconomic dispatches do not reflect actual system conditions. Rather, they're the assumptions of a few market participants that can distort market signals.

[1] http://www.caiso.com/Documents/StrawProposal-EnergyStorageandDistributedEnergyResourcesPhase4.pdf

The CAISO proposal may reduce fleet flexibility

Allowing Scheduling Coordinators (SC) to set end-of-hour State of Charge (SOC) enables them to hour-after-hour determine the amount of energy that is supplied to the grid and withdrawn from the grid. This is akin to self-scheduling. It is contrary to the goals of the CAISO, in every other policy initiative, to increase the economic participation of resources. Instead, this proposal reduces the incentives for resources to economically participate.

The CAISO proposal may result in inefficient market dispatch

See Appendix A at the end of the comments.

The optimal direction is to have the CAISO manage SOC

Together, the understanding from these key shortcomings support the best-case scenario as the one in which the CAISO manages the SOC for all resources, rather than have SC-defined SOC goals[2].

3. Market Power Mitigation (MPM) for Energy Storage

SCE is encouraged with the CAISO's finding that there is a need for development of a default energy bid (DEB) for storage resources.
SCE requests the CAISO provide details on their proposals to apply MPM to charging of storage resources. At this point, the CAISO seems to only focus on the discharge side of the service.

SCE requests the CAISO clarify if it intends to propose specific round-trip multipliers for individual storage technologies. For example, will lithium chemistry storage have a different round-trip multiplier than other electrochemical storage technology? Regarding depth of discharge and cycling observations, studies seem to support the CAISO's understanding that both of these factors impact resource life[3]. However, inclusion in DEB may not be appropriate given that these factors are not relevant to incremental energy costs, less so if a resource is dispatched uneconomically.

The CAISO's Commitment Cost and Default Energy Bid Enhancements (CCDEBE) initiative, allows for hourly bidding of fixed costs[4]. This should accommodate the fixed cost representation concern, once CCDEBE is implemented.

---

[2] A concern was raised during the May 7, 2019 call regarding IOU-resource contracts that may impede CAISO SOC management. Such contracts effectuate distribution deferral and allow IOUs to maintain distribution reliability by dispatching through the CAISO market when IOUs are not the SCs. SCE does not see any impediment toward a market based CAISO SOC management solution.

[3] https://batteryuniversity.com/learn/article/how_to_prolong_lithium_based_batteries

[4] "Minimum load costs will continue to represent the combined costs associated with power production as well as short-term fixed costs for a run hour. (e.g., major maintenance adders)" Page 19.

Proposed DEB calculation

Option: A semi-customizable default energy bid eligible for all storage resources

The CAISO's proposal to use the maximum MWh charge and the Pmax of the resource should be further explored. In particular, the CAISO should consider the following:

1. There appears to be a significant assumption made under this option, i.e., a battery resource under consideration is only capable of cycling once daily. With this assumption, it may be appropriate to calculate the DEB for the battery resource considering its opportunity cost corresponding to the highest prices during the day[5]. As stated by the CAISO, "Bidding at these levels and following dispatches would generally run a storage resource less than half of one cycle per day"[6]. However, for a storage resource that can cycle multiple times daily, setting its DEB at this level may unnecessarily undermine the intended function of the local market power mitigation (LMPM) as currently designed. For instance, a battery resource that is located in a constrained area with its DEB always configured at a level at or close to the highest prices during the day, when mitigation is triggered and the battery resource is the marginal resource, the clearing price for the area would be the resource's DEB, approaching the level of the highest prices during the day. Since the clearing price would apply to all resources within the area, this could significantly undermine the effect of the LMPM when the battery is indeed capable of cycling multiple times a day.
2. While the reasoning behind the proposed 50% of the calculated discharge duration[7] may be to strike a balance between various storage energy limitations, it would help if the CAISO provides details on such to the stakeholders.
3. Details on how the CAISO will estimate future prices for both Day-Ahead Market and Real-Time Market. This is crucial for the DEB development given that the CAISO states its optimization does not consider conditions beyond an hour and five-minute horizon[8].

Finally, while SCE appreciates the CAISO's consideration to minimize depth of discharge and cycling, the focus in the DEB design should remain the accurate cost representation for the resource, rather than minimizing resource usage. SCE believes it is more appropriate for resources to economically represent their own cycling preferences rather than rely on a benchmark that may not be as reliable. As mentioned earlier, there could be other reasons,

---

http://www.caiso.com/Documents/SecondRevisedDraftFinalProposal-CommitmentCosts-DefaultEnergyBidEnhancements.pdf

[5] Figure 3, page 14, Straw Proposal.

[6] Page 13, Straw Proposal.

[7] Page 13. Straw Proposal.

[8] Page 5. Straw Proposal.

such as total energy limitations, for the CAISO's assumptions. The CAISO should be explicit about its intent, whether to more appropriately represent costs or to guide behavior (or any other reason). While SCE is encouraged by the CAISO's direction, it urges the CAISO to make its own understanding and assumptions clearer to stakeholders.

Option: The current variable cost option combined with new adders
This proposal is more in-line with using actual empirical data. SCE notes that this may also be more accurately measured for performance by a market power mitigation (MPM) instrument, since industry data would provide a reliable benchmark. The robustness of such an approach would, again, depend on the quality of the data used.

Option: An updated variable cost option specific to individual resources
SCE agrees with the CAISO that this option is less efficient than the other options. SCE also has concerns over the feasibility of certain aspects of the proposal, such as the ability of the CAISO to actually validate cell and resource replacement costs.

4. Demand Response Resources

It is unclear why the CAISO opposes implementing a maximum run time parameter

The CAISO accurately captured and assessed the issue with some Demand Response resources that are not able to receive an instruction to curtail load in one hour, receive an instruction to curtail to its Pmin at 0, and then receive an instruction to curtail load in the next hour. SCE agrees that the current and soon-to-be implemented functions will be a solution to address this issue. However, the CAISO has not addressed the issue that the maximum daily energy limit is not a sufficient parameter to manage demand response resources that have hourly run time limitations. SCE requests that the CAISO clarify its explanation of why it believes maximum daily energy limit is sufficient to represent a resource's limitations. SCE had specifically asked the CAISO how the maximum daily energy limit serves a resource when maximum run time is the binding constraint – i.e., when the maximum daily energy limit has not been reached but the maximum hourly run time has been reached.

In SCE's earlier comments, SCE stated, "The already existing constraint, Maximum Daily Energy Limit (MDEL) can help some of the event (dispatch) time/duration limitations of Demand Response resources, but it is not effective for DR resources whose output varies throughout the day and have daily [hourly] run time limitations that must be managed. For these types of resources, a maximum run time parameter is a better determinant of the binding condition of operation rather than daily energy limit and as such allows for more accurate representation of the characteristics of the DR resource."[9]

[9] Page 2. http://www.caiso.com/Documents/SCEComments-EnergyStorage-DistributedEnergyResourcesPhase4WorkingGroup-Mar18-2019.pdf

The following comment by the CAISO does not address the maximum run time parameter, "In response to Southern California Edison's comments of the limitations of the maximum daily energy limit, if the resource identifies its Pmin at .01 MW below its Pmax, the CAISO will consider the minimum load cost and non-zero Pmin in the residual unit commitment process. If the resource is committed, it will be dispatched to its Pmin, and the CAISO will respect the maximum daily energy limit. Additionally, inflexible demand response resources that are not able to respond to varying dispatches will receive a consistent award at the non-zero Pmin value."

SCE is providing in Appendix B, at the end of these comments, an illustration of the issue where the MDEL parameter falls short of representing the time/duration limitations of Demand Response resources, where a max hourly run time parameter can help address this issue. In this illustrative example, to highlight the concern with managing run time with MDEL for resources with varying MW availability throughout a trade day (e.g. the Scheduling Coordinator would bid in a different MW amount for HE 17 @ 5 MW vs. HE 20 @ 2 MW), SCE made an assumption that the CAISO's straw proposal Option one ("Using existing and soon to be implemented functions") can help avoid the concern of Scheduling Coordinators receiving hours with non-zero MW quantity awards gapped by hours with zero MW quantity in between. The illustrative example shows how a Scheduling Coordinator may bid in the available MW for the resource for HE 10 through HE 21 allowing CAISO to award the resource subject to its limitations. In the example, SCE shows two potential outcomes representing the CAISO awards. Both outcomes are consistent with the resource limitations as seen by the CAISO (primarily the MDEL, where in the example the MDEL is equal to 15 MW). However, the second outcome is not consistent with the example resource's demand response event duration limitation. It is this second outcome that can be effectively addressed if the CAISO implements a maximum run time parameter. Enabling this parameter in the CAISO model would provide Scheduling Coordinators more certainty that their awards will not exceed resource's event duration limitation, while also providing the CAISO more certainty that resources can perform to their awards.

The CAISO expressed an implementation challenge in adopting a maximum run time parameter: "Option three would require the most implementation effort in comparison to option one or two and raises concerns of introducing an additional parameter, further stressing the market optimization engine. More importantly, if a proxy demand resource maintains a Pmax of zero and has a maximum run time parameter, the market may commit a resource to its Pmin of 0 MW and keep the resource "on" until its max run time hour is reached. This would result in a demand response resource instructed to a Pmin of 0 MW and not providing any curtailment to the CAISO."
SCE notes that it was mistakenly referred to "Pmax of zero" (underlined in paragraph above), and rather meant "Pmin of zero".

The CAISO has numerous self-initiated proposals. Some of these include DAME (where it had proposed radical new changes with 15 minute granularity and procurement of new day ahead capacity) and CCDEBE (where it had proposed commitment cost mitigation and bidding, supported with dynamic MPM) – major undertakings that will demand much of the CAISO

optimization. Given the substantial magnitude of such proposals, SCE questions how the CAISO claims that adding a single additional maximum run time parameter, which is already an existing field in the Resource Data Template (RDT), will "further stress" the optimization engine in any significant way.

The CAISO is concerned that if a resource has a 0 MW Pmin and is committed by RUC, it may be kept at Pmin until it hits maximum run time. RUC is a capacity commitment process that does not determine dispatch. Given the market data and system conditions, if the CAISO's optimization finds it preferable to leave a 0 MW Pmin resource at its Pmin, then unless the CAISO can demonstrate that a 0 MW dispatch is not optimal[10], the concern may be unwarranted. Once the CAISO has demonstrated that such a concern can materialize, it could consider the option of including logic that mitigates or, if necessary, precludes the dispatch of a resource with Pmin = 0.

Additionally, it is SCE's understanding that Option one as presented by CAISO can help mitigate and reduce the likelihood of awards at Pmin = zero(0) MW in between hours with non-zero MW awards, but it is no guarantee. Depending on the magnitude of commitment cost in relation to CAISO market prices there can still be hours with zero(0) MW awards in between hours with non-zero MW awards.

Finally, the CAISO mentions Option two where Pmin is very close to Pmax to prevent the dispatch of a resource to its Pmin of 0. SCE would like the CAISO to clarify its vision as to how a Scheduling Coordinator would implement this for a resource whose output could range from 0 MW to 100 MW in a day, as is the case for variable output demand response resources.

Under current CAISO rules, the RDT requires 5 business days to update while DR resources have the potential to frequently change capacity. For output invariant resources that update on a time frame greater than 5 days, this would be plausible but administratively burdensome. For output invariant resources that update on a time frame less than 5 days, it would be impossible—forcing the scheduling coordinator to choose between inaccurately representing the resource or leaving it out of the market. Option two may be in particular impractical for resources that are weather sensitive (i.e. the expected output varies for each hour during a day) where a Pmin equal to or close to Pmax may prevent a Scheduling Coordinator from bidding MW levels that vary by hour.

It is unclear why the CAISO believes that an ELCC approach is superior to LIP for DR

Currently, the Qualifying Capacity (QC) for DR resources is determined through Load Impact Protocol (LIP) studies performed by third-party independent consultants, with results reviewed by the Investor Owned Utilities (IOUs), other stakeholders, and ultimately approved by the CPUC Energy Division. LIP studies rely on actual historical data, including both unannounced

[10] Furthermore, RUC will consider the min load cost of the resource and will most likely reduce instances when the resource is awarded at pmin=0.

tests and market dispatches (as available by program/resource) to determine the expected load reduction performance under future temperature and load scenarios (e.g. 1-in-2 and 1-in-10). LIPs are currently the best available tool for forecasting expected load reduction performance on a year-ahead basis.

Applying a probabilistic reliability contribution measurement approach such as the ELCC does theoretically make sense for a variable resource such as weather-sensitive DR, however, we must caution that an effective DR ELCC methodology has not been developed yet. Therefore, it is premature to assume that it would be an improvement over the current LIP based QC determination approach. Furthermore, the currently used ELCC methodology for Wind and Solar resources took several years of discussion, development, review and refinement prior to developing meaningful results that could be adopted by the CPUC. In fact, per Energy Division's own recommendation, the methodology was phased in over a period of time, as there were questions on its results.

The CAISO states concerns on the alignment between the LIP measurements and the loss of load expectation (LOLE) hours, and the reliability value that a measured (or forecasted) load drop would have, especially considering the shifting net peak. This is a meaningful conversation to be had for the CPUC, CAISO, program providers and other stakeholders – however, unlike with other intermittent resources, load drop potential tends to be highly correlated with load. If it's hotter than usual, and A/C units are running at full force, then the A/C load potential will also be at its theoretical max.

Current DR QC determined though the LIP represents the expected (1-in-2) load reduction, and in fact SCE has seen days where its weather sensitive programs have delivered more load drop than their assigned QC; just like there are cooler, lower load days where they deliver less. Load Impact Protocols also consider sub-hourly impacts[11], and look at a variety of program design parameters and limitations, and include a comprehensive stakeholder review process.

SCE is open to exploring improvements in the QC determination process for weather-sensitive DR resources, and looks forward to a productive collaboration with the CPUC and the CAISO.

Must-offer obligations for variable-output demand response

SCE appreciates the CAISO constructively attempting to move the discussion forward in terms of improving the resource adequacy must offer obligations and associated performance mechanisms for variable-output demand response resources, and agrees it will need further vetting by stakeholders.

The stakeholder group should also discuss who defines what a variable-output demand response resource is, and on what basis. An obvious example may programs like SCE's A/C cycling program, however some programs may have weather sensitivity but should not be

[11] Page 25. http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/81979.PDF

considered variable-output resources – similar to how gas turbines may have a temperature derate, but are not considered Variable Energy Resources.

5. Behind the Meter Technology Applications

Any design addressing non-24x7 participation for non-RA behind-the-meter (BTM) resources raises a threshold jurisdictional question. Specifically, what is the FERC-required interconnection that allows such participation?[12] SCE has consistently taken the position that any distribution-interconnecting wholesale resources[13] must use SCE's FERC-jurisdictional Wholesale Distribution Access Tariff (WDAT).[14]

SCE notes that the CAISO's BTM NGR model will not affect SCE's load forecast because that forecast estimates retail load, whereas the CAISO's model impacts wholesale load. SCE agrees with the CAISO that the CAISO and the CPUC need to maintain consistent rules for the metering and settlement of storage resources. SCE understands the CAISO's guidance as "all energy drawn from the grid to charge energy storage resources for later resale, and including energy associated with efficiency losses, for later resale, should be subject to a wholesale tariff."[15] This would require a separate meter (in addition to the customer's load meter) for energy drawn from the grid to charge for later resale.

Finally, SCE calls to attention that it has already undertaken initial analysis on any future design of wholesale-retail participation and filed comments at the CPUC[16]. Even the limited ideas presented in those comments underscore the magnitude of complexity involved after answering the jurisdictional question. Further, SCE's comments only pertain to the generation aspect of participation. Work still needs to be done to consider the distribution and transmission aspects before any effective participation design can be achieved that prevents double-counting for services.

---

[13] Other than Qualifying Facilities (QF) that are only permitted to sell to the host utility.

[14] ER16-1085, SCE Comments, Page 3 (March 25, 2016) ("it is the interconnecting utility that may be penalized for a failure to ensure that a FERC-jurisdictional interconnection agreement is properly filed with FERC."). *See also,* R.15-03-011, *Comments Of Southern California Edison Company On Joint Staff Proposal On Multiple Use Applications For Energy Storage,* Appendix A, p. A-2 (June 16, 2017); ER18-1248, *FERC Order on Tariff Revisions,* p.1314 (August 23, 2018).

[15] *Order Instituting Rulemaking to Consider Policy and Implementation Refinements to the Energy Storage Procurement Framework and Design Program,* "Decision on Track 2 Energy Storage Issues, CPUC Docket No. R.15-03-011 (May 8, 2017), available *at* http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M185/K070/185070054.PDF; *see also* ER19-468, Order No. 841 Compliance Response to Request for Additional Information, p. 24-25 (May 1, 2019).

6. Appendix A

Consider a market with the variables: discharge price (p), charge price (c), quantity awarded (q), economically dispatched resource index (subscript i), uneconomically dispatched resource index (subscript j), dispatch state (superscript U for uneconomic, superscript E for economic), power balance goal (Q). Assume that all resources have the same physical characteristics but varying bid price-quantity pairs that result in varying value from dispatching them.

I. Scenario – discharge: The CAISO's optimization problem is the maximization of $\sum p_i^E q_i + \sum p_j^U q_j$, under the constraint $\sum q_i + \sum q_j = Q$.
Here, p_j^U, p_i^E, q_j are exogenous since prices materialize as system conditions change and q_j is determined by the scheduling coordinator's (SC) defined SOC.
Comparing an efficient scenario, where the CAISO discharges without a SC-set SOC to the scenario where the CAISO discharges with a SC-set SOC, we have: $\sum p_i^E q_i + \sum p_j^U q_j$ vs $\sum p_i^E q_{\forall q} \left(= \sum p_i^E q_i + \sum p_j^E q_j^E\right)$, where in the latter term on the right, we now have all "j" resources also being dispatched economically.
We can simplify to $\sum p_j^U q_j$vs $\sum p_j^E q_j^E$.
We know that for the uneconomic dispatch to have value over a fully economic dispatch, $\sum p_j^U q_j > \sum p_j^E q_j^E$.
In the case of a single resource, $p_j^U q_j > p_j^E q_j^E \rightarrow q_j > q_j^E \frac{p_j^E}{p_j^U}$, or the uneconomic quantity dispatched has to be sufficiently large enough. We know also that $\frac{p_j^E}{p_j^U} \geq 1$ since the price at which the uneconomic dispatch occurs for the discharge is lower than the bid price for the resource. Thus, the quantity supplied in support of the uneconomic dispatch, q_j, has to be sufficiently larger than the economic dispatch with a multiplier greater than unity.
There are two concerns with this scenario. First, q_j is not within the control of the CAISO, it is determined by SOC. So, there is no guarantee that the CAISO can ensure a large enough uneconomic dispatch to sufficiently benefit the market. Larger dispatches for discharge will necessitate deeper charges for the resource to be available. Second, in the case that the uneconomic dispatch is large enough, this may further exacerbate power balance concerns – the market signal is against supply, yet a resource is supplying. This is also contrary to the CAISO's goal for more flexible resources and to optimize the resources by avoiding deep discharges.

II. Scenario – charge: The CAISO's optimization problem is the minimization of $\sum c_i^E q_i + \sum c_j^U q_j$, under the constraint $\sum q_i + \sum q_j = Q$.
Here, c_j^U, c_i^E, q_j are exogenous since prices materialize as system conditions change and q_j is determined by the scheduling coordinator's (SC) defined SOC.
Similar to the discharge scenario, for a single resource's uneconomic charge to benefit relative to an economic charge, $q_j < q_j^E \frac{c_j^E}{c_j^U}$, where $\frac{c_j^E}{c_j^U} \leq 1$. Thus, the uneconomic charge

has to be sufficiently small, and is exogenously determined by SOC. This result can only be supported by frequent shallow charges which will be unable to support the deep discharges that are uneconomic.

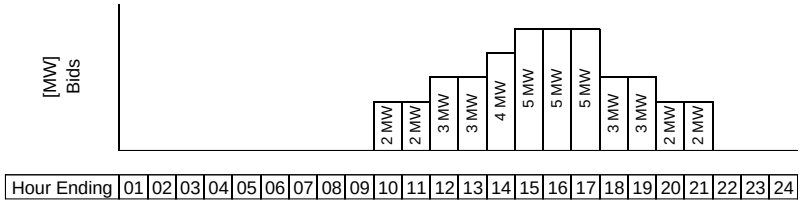
In sum, the only way for uneconomic discharges to benefit the market, relative to economic treatment of all resources, is for the discharges to be sufficiently large. These discharge values will be controlled by the SOC goal, hence determined more by SC than by the CAISO. Similarly, uneconomic charges would have to be sufficiently small, and these will also be controlled by the SC rather than the CAISO. Thus, any benefit from this proposal is moot.

7. Appendix B

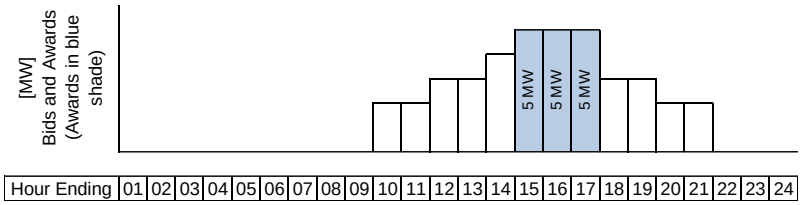
Illustrative Example

- Resource with available load drop that varies by hour: DR program rules limit: max three hour event time per DR program rules. Offered to CAISO with MDEL = 15 MWh

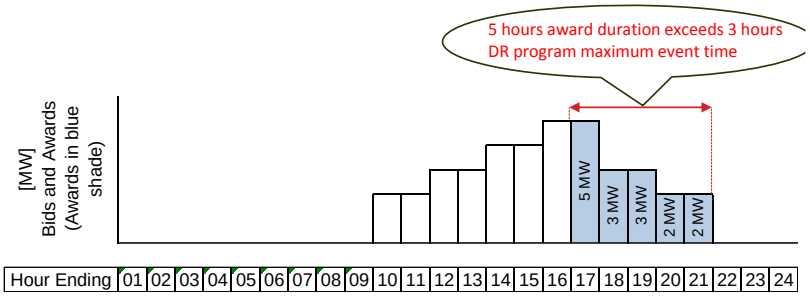
- Resource offered(bid) into CAISO for all available hours:



- CAISO awards three adjacent hours in compliance with MDEL and DR program rules:



- CAISO awards multiple hours in compliance with MDEL, but not in compliance with DR program rules:



End Appendix B