Comments of the California Energy Storage Alliance (CESA)
on
CAISO ESDER 4 Issue Paper

Submitted by	Company	Date Submitted
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CESA appreciates the opportunity to comment on the Energy Storage and Distributed Energy Resources (ESDER) Phase 4 Straw Proposal.

ESDER remains a critically important stakeholder initiative to the energy storage industry. CESA recognizes how the CAISO has shown strong leadership in supporting market participation paths for Energy Storage and distributed energy resources. This work, although still in progress in multiple ways, continues to set the CAISO up for reliable and competitive operations for both the current and future fleets. As storage penetrations increase, the CAISO will naturally need to consider market power mitigation concepts for storage, which CESA also supports. The CAISO will need to continue to focus on honing and improving market participation pathways for energy storage to promote non-discriminatory and viable market participation.

CESA provides the following comments:

1) Customizable pathways are needed for Market-Power Mitigation (MPM) and Default Bid (DEB) calculation.

CESA recognizes the importance of MPM and supports it. Market power mitigation is an important aspect of wholesale electric markets and is appropriate for preventing any exercise of market power. For a time when the CAISO anticipates a growing penetration of energy storage resources, it makes sense to develop a market power mitigation solution. The main CAISO approach for mitigating market power is to calculate when generator market power conditions may apply through a pivotal-supplier test, and then to mitigate or modify bids to an acceptable

level, such as a calculated bid or DEB. This DEB can also be used for bid-insertion related to compliance with must-offer obligations, which are not scoped into ESDER 4.

In developing MPM approaches for storage, the CAISO and stakeholders must recognize that MPM for energy storage solutions may be unique, and that opportunity costs for storage, including multi-use storage, could be non-obvious. For instance, a storage resources' costs can sometimes be reflected through the spread of bids, not just a discharge, a.k.a. 'generation', bid. To illustrate, consider cases where storage system charging is designed to occur during periods of negative prices. In these circumstances, a calculation of *discharge* costs solely based on a price above $0 may be insufficient to cover cost. Additionally, some storage operations may not focus on arbitrage strategies, and some storage resources are focused more on regulation bids as a way of addressing costs and risks. Some storage resources have out of market opportunity costs, e.g. customer services. All of these points highlight that major-maintenance adders (MMAs) and Variable Operations and Maintenance (VOM) adders may not fully reflect the costs of a storage resource.

For all these reasons, customizable paths are essential. While customizable paths are standard for many MPM calculations, CESA expects there may be higher usage of these paths until more basic MMA and VOM adders can be assured to accurately reflect costs.

CESA recommends a workshop to work through this. A workshop should address how the MPM for energy storage resources could work under various conditions, and with varying opportunity costs in the form of out-of-market opportunity costs, basic major maintenance assumptions, warranty provisions, and considerations of non-linear maintenance costs that link to dispatches at different states of charge. For instance, if a storage device is dispatched to provide 1 MWh while at a low state of charge, the maintenance impacts can be materially different to the useful life of a storage device such as a battery than a similar dispatch when the storage device is at a high state of charge.

Finally, MPM for *charging* bids is inappropriate at this time. While a consideration of charging costs is appropriate for determining the equivalent of fuel costs associated with generation, MPM should not apply to charging energy at this time. The concept of MPM is generally focused, as CESA understands it, on mitigation of generation market power, not of load market power. CESA needs to better understand from the CAISO why load-side MPM for energy storage is a priority now, and how it fits with the goal of having storage as a generator generally operated under MPM rules.

2. Steps to authorize state-of-charge (SOC) management at the end of an interval seem helpful but additional considerations need to apply.

CESA appreciates that the CAISO seeks to develop participation paths that reasonably guarantee a state-of-charge at the end of an applicable interval, e.g. hour-ending 11. This functionality is important for storage as transmission resources, along with storage acting in multi-use applications or with schedules and services that the CAISO optimization may not readily 'see' or that cannot be reflected sufficiently in bids. While the CAISO is taking many useful steps to augment the ability for storage resources to participate in ways where the full suite of costs can be reflected, it seems prudent to allow resource to instead (or also) optionally direct an ending SOC.

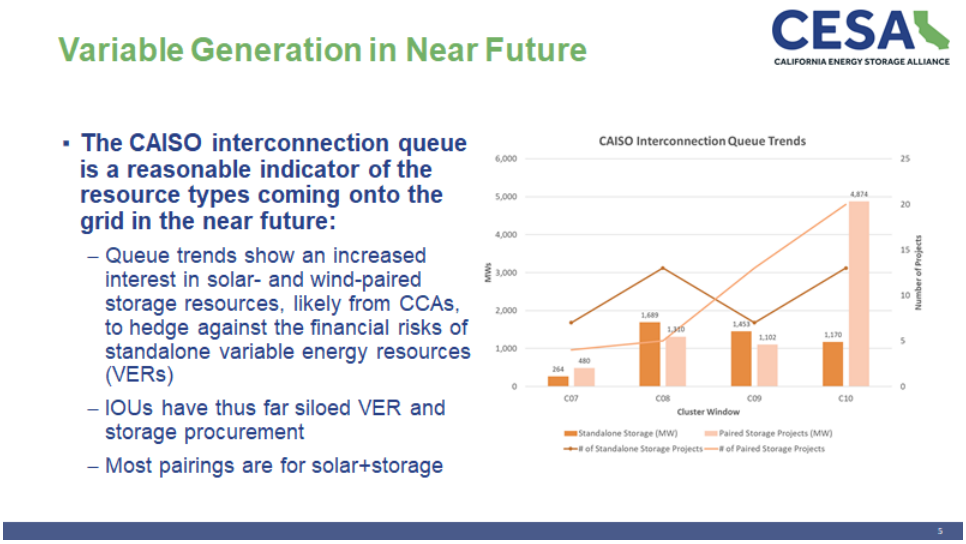
CESA agrees that resources subject to the binding SOC should not receive BCR if the binding SOC directive leads to economic losses in the applicable period. CESA does, however, have concerns about the effects of SOC directives in the later or final intervals of an hour, in which case the binding SOC may 'jerk' units seriously to meet the SOC. As such, CESA also suggests the ability to have ramp rates that can be applied when the end-interval SOC is used. An assessment of the dispatches of existing storage resources, including if operating through the REM dispatch, should inform this discussion. This analysis might highlight the severity of 'jerks' to units and how often such dispatches may run counter to both REM dispatches and/or be uneconomical compared to energy bids.

Finally, a challenge with the SOC directive is that some storage resources, as illustrated in the next section, may have additional constraints on how the unit is operated. It will be important to evaluate these issues and risks, especially since they appear to have material implications for a storage resource's economics, especially if charging from solar to capture the solar investment tax credit (ITC).

3) Scheduling pathways for solar plus storage should be available at the CAISO and should recognize a resource's operational plans to maximize solar-based charging.

The concepts discussed in this section apply to both the DEB calculation and to the consideration of SOC parameters.

Solar plus storage resources are a growing part of the CAISO fleet. This chart shows how the CAISO interconnection queue has a large quantity of solar plus storage resources.



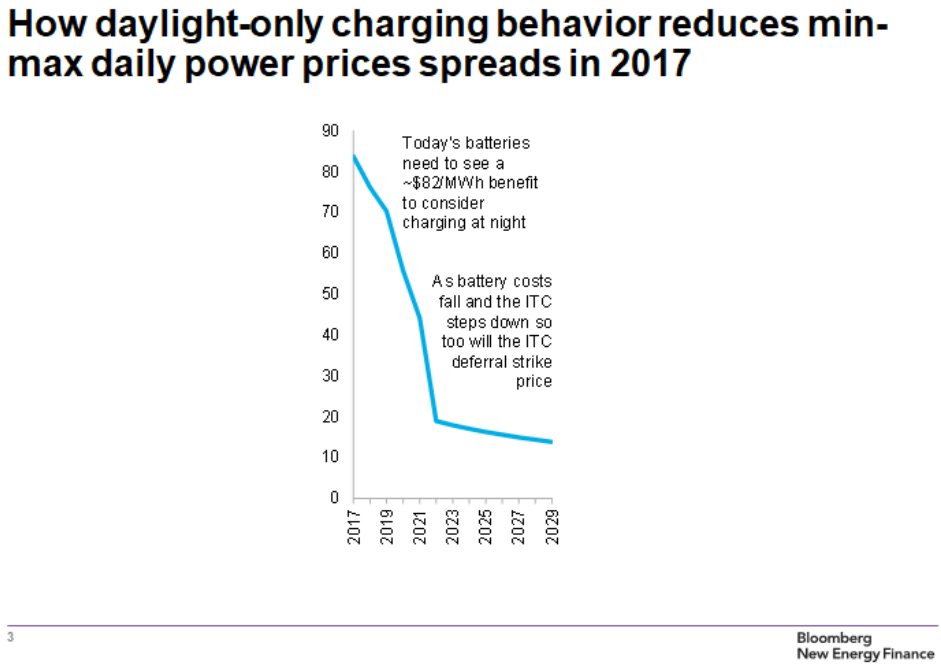
Source: "Estimating the impact of energy storage on capacity values", CESA-AWEA Webinar, California Energy Storage Alliance, W. Nelson, April 24, 2019, slide 5

These solar-plus-storage resources can be economical and smart for ratepayers because i) such resources can provide for more valuable and 'better behaving' output from variable energy resources, e.g. through firmer operations and production in more valuable periods, ii) such resources may be able to materially improve their RA value through the ELCC calculation (if allowed)[1] and iii) such resources can be more economical through capture of the solar Investment Tax Credit (ITC), cost reductions associated with the construction and operation, etc.. The ITC calculation generally works in such a way where the ITC is linked to the percentage of solar energy stored in the storage device. A minimum of 70% of the energy must come from the co-located storage. If 100% of the energy comes from the solar, the ITC applies 100%. If 95% of the energy comes from co-located solar, only 95% of the ITC applies to the storage resource, and so on. This means that resources have strong financial incentives for charging from solar power. This strong economic signal in turn means that storage dispatches may differ from those expected under unconstrained conditions, and that default assumptions about storage operations, or about the opportunity costs of charging a storage device from the grid rather from co-located solar, must be factored in.

This chart from Bloomberg New Energy Finance highlights how storage resources have opportunity costs linked to the ITC for some years, but not for years in which an ITC may no longer

[1] In R.18.XX.XX, Resource Adequacy Proceeding Track 3, evaluations of ELCC modifications for solar resources are being considered. CESA is recommending that the California Public Utilities Commission (CPUC) authorize resource-specific ELCCs for solar plus storage resource since such resources can operate with generation profiles that warrant a *higher* ELCC count. As of the date of these comments, the CPUC has not determined if it will authorize this concept.

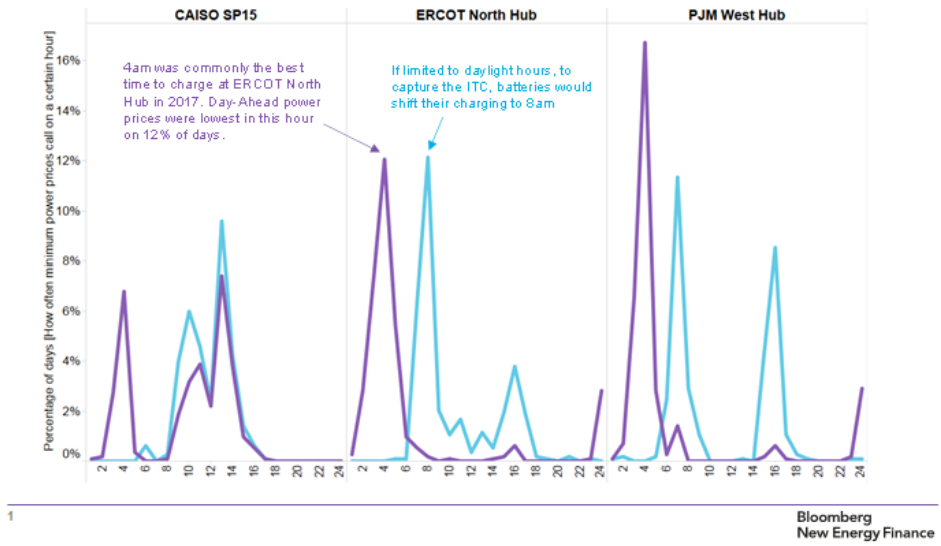
apply, I.e. if the ITC is not extended. The ITC opportunity costs is referred to as a 'strike price' in this chart.



Source: "When Should U.S. Solar Storage Systems Charge at Night: Exploring optimal charging patterns at U.S. hubs" Bloomberg New Energy Finance, W. Nelson, August 30, 2018, slide 3

Further, the Bloomberg evaluation highlights that ITC capture directs some storage resources to charge at times of the day (during solar production hours) when such resources might otherwise charge at night when energy costs may be less expensive.

Ideal charging times for batteries – with and without ITC considerations



Source: "When Should U.S. Solar Storage Systems Charge at Night: Exploring optimal charging patterns at U.S. hubs" Bloomberg New Energy Finance, W. Nelson, August 30, 2018, slide 1. The purple line is the unconstrained (No ITC) charging optimal schedule, while the blue line is the ITC-charging constrained value.

How to factor this concept in? CESA recommends the CAISO consider several solutions to address storage ITC charging. First, hybrid resources should be able to schedule and participate using the NGR model. The NGR model, while still having some limitations (such as lacking a field for commitment costs), is a useful model for many resources, especially ones with a negative p-min capability. Such capability may be found on all stand-alone storage and on some hybrid storage solutions. Second, the ITC opportunity costs or 'strike price' should be factored into any calculations of opportunity costs and default energy bids. Third, the SOC parameters should be developed with the capability to 'honor' or 'consider' the ITC. For instance, the Day-Ahead Market may not realize a solar plus storage resource only seeks to charge during the day, perhaps under contractual obligations that cannot be readily reflected in energy bids.

With respect to safeguarding the ITC capture for solar plus storage, CESA, along with its members, have explored how an adjustment to the Pmin could address this challenge. Specifically, CESA believe the p-min could be adjusted to guarantee the resource is charging with co-located solar energy. This p-min adjustment could then inform the optimization in a way where the storage resource is guaranteed to absorb the solar for ITC capture purposes. Further, CESA believes it may be viable to link the adjusting P-min to renewable resource forecasts. This latter step then helps integrate and leverage the CAISO's VER-forecasting tools.

Finally, CESA believes this conversation is timely. While the CAISO has developed stand-alone VER participation models that use CAISO VER forecasts, the prospect of D.C.-coupled solar plus storage is leading to cases where the output of the storage versus the solar may be difficult to distinguish. In these cases, the resource seeks to provide cost-savings to ratepayers by using only a single inverter – it may be inviable to establish two Resource I.D.s for such resources. CESA believes the CAISO should seek to provide non-discriminatory access to such resources by establishing participation paths, in contrast to a path in which the CAISO limits participation of single-inverter hybrid resources.

4) A less than 24-by-7 hour settlement of the NGR model is appropriate for multiple reasons.

CESA appreciates that the CAISO needs to balance its directives to host a non-discriminatory market with staff and implementation-team limitations such that the number of market modifications that can be made at any one time may be limited. As such, the CAISO reasonably seeks further information on potential uptake or barriers related to the a less than 24x7 settlement for NGR resources, with the understanding that behind-the-meter resources (BTM) would be the ones pursuing this functionality for the most part. Specifically, the CAISO inquires about three aspects of this issue:

- As a BTM resource under NGR, any wholesale market activity will affect the load forecast. How will LSEs account for changes to the load forecast due to real time market participation?
- How would a Utility Distribution Company (UDC) prevent settling a resource at the retail rate when the BTM device is participating in the wholesale market?
- If a BTM resource is settled only for wholesale market activity, what would prevent a resource from charging at a wholesale rate and discharging to provide retail or non-wholesale services? How would this accounting work?

CESA generally recommends the CAISO continue to pursue participation models that work for part-time market participation. This market participation expansion fits well with the CAISO's role in operating deregulated wholesale electric markets, stemming from FERC Order 888 which explicitly lists a goal of non-discriminatory market participation and a "statutory obligation under section 205 and 206 of the Federal Power Act to remedy undue discrimination."[2]

CESA anticipates that multiple users exist that could avail themselves of this market participation path, including EV fleets, multi-use applications, and others. The concept of EV fleets, many of

[2] FERC Order 888, RM95-8-000 and RM94-7-001, April 24, 1996, pg. 3

whom may not seek to provide Resource Adequacy or all-day services, are particularly likely users for this functionality.[3] Additionally, DER aggregations of other resources, including storage, are strong candidates to use this capability. Further, the RA Enhancements discussion has teed up opportunities for discussions of must-offer obligation periods, with some discussion regarding when, if, and why a less-than-24 hour a day MOO may be reasonable.[4]

Another reason for developing this functionality is to allow for more competition in Frequency Regulation services. Currently, BTM resources do not have a frequency regulation participation path. The alternative path, using the NGR model, is restrictive to multi-use resources since it would require 24x7 settlements, including settlements for acting as a normal retail resource during which time retail rates are borne for energy uses.

While the CAISO's questions can be further explored, they may not be deemed as threshold matters for moving forward on market design in this area. On May 16, 2019, FERC reaffirmed key directives of FERC Order 841 regarding the intent and authorization of allowing Distributed Energy Resources to participate in wholesale markets, and that retail authorities may not prohibit wholesale market participation, even if they can state that retail program participation may preclude wholesale participation.[5] To CESA, this signals that FERC jurisdictional RTOs need not wait for retail service regulators, nor for UDCs, in developing market participation paths. Woohoo!

The CAISO's practical questions should be answered. CESA provides preliminary responses below and believes further or more data-backed responses can be provided with more time.

- CAISO Question: As a BTM resource under NGR, any wholesale market activity will affect the load forecast. How will LSEs account for changes to the load forecast due to real time market participation?
    - CESA Response: As CESA understands it, this issue is similar to challenges that exist with PDR models or with the basic DERP model. Input from LSEs on how to differentiate retail electric procurement from wholesale directed actions should be considered in ESDER. CESA looks forward to additional discussion and solution-building on this matter.
- CAISO Question: How would a Utility Distribution Company (UDC) prevent settling a resource at the retail rate when the BTM device is participating in the wholesale market?

[3] CESA represents Emotorwerks, Honda, Mercedez-Benz, Nuuve, Tesla, and other electric transportation focused companies. At the February, 2019 ESDER 4 workshop, ElectrifyAmerica explained how this functionality would be important for their fleets and goals. CESA also commented on this in its February 2019 comments.
[4] See CESA comments on RA Enhancements.
[5] FERC Order 841-A, "Electric Storage Participation in Markets Operated by Regional Transmission Organizations and Independent System Operators," RM 16-23-001, AD 16-20-001, May 16, 2019.

- CESA Response: UDCs could use several options for this. There could be ex poste settlements, there could be reporting to UDCs throughout an applicable billing cycle, or potentially estimation methodologies or other tools could be used to remove inapplicable retail settlements. CESA looks forward to additional discussion and solution-building on this matter. CESA further elaborates on existing or possible solutions in the next paragraph.

- CAISO Question: If a BTM resource is settled only for wholesale market activity, what would prevent a resource from charging at a wholesale rate and discharging to provide retail or non-wholesale services? How would this accounting work?
  - CESA Response: CESA believes that retail activities should incur retail charges and that workarounds to that structure should be prevented. FERC Order 841 acknowledged that accounting methodologies have been proposed and offered to address these issues, particularly within the Multi-use Application (MUA) context, since 2016.[6] Other RTOs, such as PJM, have also developed accounting methodologies to address this issue. CESA looks forward to engaging on this discussion and encourages ESDER to leverage these previous ideas.

5) The CAISO should include pathways to authorize participation from a single customer in multiple resources, where appropriate.

CESA notes that the Straw Proposal omits the concept of authorizing Re the multiple resource IDs for a single service ID. CESA understood from the ESDER workshop that there was interest in resolving this matter, perhaps through a workshop and ongoing ESDER work. A CESA member has described a specific scenario – the BIP-DRAM multi-use scenario which is currently prohibited because one cannot assign multiple resource IDs to the same service ID. When that scenario was presented at the workshop, CAISO staff acknowledged that this prohibition keeps some resources out of the market.

The CAISO acknowledged that it is technically capable of introducing multiple resource IDs under a single service account for the approved PDR-LSR mechanism since this functionality is used under the ESDER 1 Net Generator Output Meter (NGOM) approach. Since this issue is technically feasible to resolve and will promote more market participation in line with CAISO objectives, CESA believes this issue should be added into ESDER 4 and addressed.

Conclusion:

[6] FERC Order 841, paragraph 303

CESA appreciates the opportunity to comment on these important issues and looks forward to further work with the CAISO and stakeholders to develop or improve energy storage participation paths.

About CESA:

CESA is an industry advocacy association focused on grid-connected energy storage. CESA's mission is to make energy storage a mainstream resource that accelerates the adoption of renewable energy and promotes a cleaner, more efficient, reliable, affordable, and secure electric power system. The CAISO's ESDER initiative specifically addressed market participation pathways for energy storage in select applications and is a core priority of CESA's.

CESA is a 501(c)(6) non-profit that represents over 70 member-companies and leaders in the energy storage industry.[1] www.storagealliance.org.

[1] 8minutenergy Renewables, Able Grid Energy Solutions, Advanced Microgrid Solutions, AltaGas Services, Amber Kinetics, American Honda Motor Company, Inc., Axiom Exergy, Brenmiller Energy, Bright Energy Storage Technologies, Brookfield Renewables, Carbon Solutions Group, Centrica Business Solutions, Consolidated Edison Development, Inc., Customized Energy Solutions, Dimension Renewable Energy, Doosan GridTech, Eagle Crest Energy Company, East Penn Manufacturing Company, Ecoult, EDF Renewable Energy, ElectrIQ Power, eMotorWerks, Inc., Enel, Energport, ENGIE, E.ON Climate & Renewables North America, esVolta, Fluence Energy, GAF, General Electric Company, Greensmith Energy, Ingersoll Rand, Innovation Core SEI, Inc. (A Sumitomo Electric Company), Iteros, Johnson Controls, Lendlease Energy Development, LG Chem Power, Inc., Lockheed Martin Advanced Energy Storage LLC, LS Power Development, LLC, Magnum CAES, Mercedes-Benz Energy, NantEnergy, National Grid, NEC Energy Solutions, Inc., NextEra Energy Resources, NEXTracker, NGK Insulators, Ltd., NRG Energy, Inc., Parker Hannifin Corporation, Pintail Power, Primus Power, Range Energy Storage Systems, Recurrent Energy, Renewable Energy Systems (RES), Sempra Renewables, Sharp Electronics Corporation, SNC Lavalin, Southwest Generation, Sovereign Energy, Stem, STOREME, Inc., Sunrun, Swell Energy, True North Venture Partners, Viridity Energy, VRB Energy,Wellhead Electric, and Younicos. The views expressed in these Comments are those of CESA, and do not necessarily reflect the views of all of the individual CESA member companies. (http://storagealliance.org).