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CESA's Comments on Proposed Final Scenarios to Assess Role of LDES Workshop

Additional submitted attachment is included below.

July 26, 2022

Email to: docket@energy.ca.gov
Docket Number: 20-MISC-01
Subject: CESA's Comments regarding the Public Workshop on the Proposed Final Scenarios to Assess the Role of Long Duration Storage

Re: Comments of the California Energy Storage Alliance Regarding the July 12th Public Workshop on the Proposed Final Scenarios to Assess the Role of Long Duration Storage

Dear Sir or Madam:

The California Energy Storage Alliance ("CESA") appreciates the opportunity to comment on the public workshop held on July 12, 2022 ("Workshop"), where consultants to the California Energy Commission ("CEC") presented the proposed final scenarios to assess the role of long duration energy storage ("LDES"). CESA recognizes the insight of the CEC in assembling an experienced analytic taskforce to shed light on the value of LDES resources while considering the feedback of a vast group of stakeholders. CESA is convinced that the modeling improvements and tools discussed at the Workshop are vital to the achievement of California's energy and environmental goals.

CESA is a 501(c)(6) organization representing over 100 member companies across the energy storage industry. CESA is involved in a number of proceedings and initiatives in which energy storage is positioned to support a more reliable, cleaner, and more efficient electric grid. Moreover, CESA has actively engaged in first-in-class modeling studies to better understand the need and opportunity for energy storage, particularly for LDES resources, given Senate Bill ("SB") 100 targets. As such, our background and experience providing technical and policy insights are of particular relevance to this subject.

I. INTRODUCTION & SUMMARY.

CESA appreciates the CEC hosting the Workshop to provide updates to stakeholders on the preliminary findings of the analyses performed by the University of California, Merced and the University of California, San Diego ("UC Merced" and "UCSD", respectively). The results presented during the Workshop underscore the importance of developing modeling tools that are able to identify long-duration arbitrage needs and include a wider array of candidate resources and their resource/operational characteristics. Moreover, the research presented at the Workshop highlights the value proposition of LDES resources as a viable path towards a decarbonized, affordable, and reliable grid of the future.

As underscored during the Workshop, only through enhanced modeling and planning will California ensure the cost-effective deployment of resources and an equitable transition to a

decarbonized electric sector. In this context, the modeling improvements associated with this initiative should be incorporated and adopted in planning venues across the state, not only in those led by the CEC. Such coordination will yield substantial benefits, especially considering the efforts of UC Merced with regards to increasing RESOLVE's optimization time-horizon and its candidate resource pool.

While CESA is supportive of the methodological approach utilized by CEC's consultants and the takeaways shared during the Workshop, we find that the variable-cost candidate storage resource proposed by UC Merced could be enhanced if it considered a wider range of roundtrip efficiencies ("RTEs"). CESA agrees with the utilization of technology-neutral variable-cost storage candidate assets to identify the tipping point at which emerging technologies will be competitive relative to lithium-ion; nevertheless, we find that the RTE used to exemplify this approach during the Workshop (81%) would be representative of only a limited set of storage technologies. As such, CESA recommends an expanded range of efficiencies to consider in the development of these variable-cost storage candidate resources.

This being said, CESA is wholeheartedly supportive of the efforts to increase RESOLVE's optimization time-horizon. CESA appreciates the consideration of deep decarbonization scenarios, as these tend to underscore the value proposition of LDES more concisely. Using an 8,760-hour capacity expansion model, Strategen Consulting's *Long Duration Energy Storage for California's Clean, Reliable Grid* (2020), for example, concluded that California would need 55 GW of storage by 2045 to achieve full decarbonization while retaining reliability.[1] Finally, while also supportive of the different sensitivities proposed by UC Merced, we recommend the consideration of different lithium-ion price sensitivities, as well as others that consider low renewable energy scenarios. As such, CESA's comments can be summarized as follows:

- UCSD's research demonstrates the urgency of considering longer optimization time-horizons within capacity expansion models across California's planning venues.

- UC Merced's proposal to include variable-cost storage candidate resources should consider RTEs that range from 35% to 85%.

- UC Merced should include a high-cost lithium-ion sensitivity and a low solar sensitivity to their proposed scenarios and studies.

[1] *See* Strategen Consulting, *Long Duration Energy Storage for California's Clean, Reliable Grid,* 2020. Available at: https://static1.squarespace.com/static/5b96538250a54f9cd7751faa/t/5fcf9815caa95a391e73d053/1607440419530/LDES_CA_12.08.2020.pdf

II. COMMENTS.

A. UCSD's research demonstrates the urgency of considering longer optimization time-horizons within capacity expansion models across California's planning venues.

During the workshop, UCSD presented research that used the SWITCH model, a capacity expansion model that covers the whole WECC, including approximately 50 load areas from British Columbia, Canada, to New Mexico, U.S. During their presentation, UCSD researchers noted that the SWITCH model's temporal resolution is simplified, focusing only on about 4 hours per day, for a sample of days per year. This temporal simplification is directly related to the added geographic complexity, two factors that, combined, can significantly affect computational runtimes.

In the context of this ambitious model, researchers wanted to better understand the effects of increased optimization horizons on the selection of LDES. In the paper "*Effect of modeled time horizon on quantifying the need for long-duration storage*", UCSD researchers underscore that the U.S. future requirement of energy in storage or its duration for a growing electrical demand with high levels of reliability for a zero emissions grid is still unclear since, due to computational complexity, studies simplify the temporal resolution by modeling representative days or season of the year of interest. In other words, since most capacity expansion models only focus on a subset of days or hours to optimize building decisions, the research team wanted to model longer ranges (*i.e.*, number of consecutive hours or days) for storage balancing and see what type of storage gets selected.

In their results, researchers note that, for their lowest storage cost scenario in the model with up to 7 consecutive days for storage balancing (*i.e.*, the optimization horizon is 7 consecutive days), the model selected up to 10 hours of duration. When they extended the number of consecutive days for storage balancing to 60, the storage duration jumped to 200 hours. Even longer timeframes (365 days for storage balancing) yielded storage selections of up to 620 hours in duration.

These results are consistent with CESA's experience with *Long Duration Energy Storage for California's Clean, Reliable Grid* (2020), where Strategen Consulting employed 8,760 capacity expansion modeling to better model and approximate the value and need for LDES. It is logical that models that are unable to leverage seasonal or even multi-day arbitrage in their optimization could overlook the value of LDES assets. As such, CESA underscores the results shared by UCSD team as they highlight the urgency to have RESOLVE do full 8,760 hour optimization in order to ensure resource selection is methodologically sound, aligned with cost-effectiveness goals, and fair in their representation of the value provided by all resources, including all types of storage.

As such, CESA urges the research team closely collaborates with E3 to update RESOLVE's modeling, assumptions, and inputs as soon as possible and in advance of the upcoming Integrated Resource Planning ("IRP") cycle at the California Public Utilities

Commission ("CPUC"). CESA deems it essential to update said horizon as Strategen's and UCSD's analyses demonstrates these considerations have a substantial effect on the selection of LDES assets. CESA believes that it is feasible to timely incorporate full-year optimization into the IRP proceeding; as UC Merced noted during the Workshop, E3 has rewritten RESOLVE to allow for full-year modeling. Hence, CESA urges the CEC, the research teams, and E3 to timely complete the new modeling toolkit in a manner that ensures its utilization across all planning venues in the state, including the in the upcoming IRP cycle at the CPUC.

B. UC Merced's proposal to include variable-cost storage candidate resources should consider RTEs that range from 35% to 85%.

During the workshop, UC Merced presented an overview of their approach to modify RESOLVE in order to better assess the role LDES will have in a future decarbonized Californian grid. UC Merced underscored that they seek to develop a method for efficient full-year modeling. This is now possible as E3 has rewritten RESOLVE to allow for full year modeling. As such, UC Merced will be building off that new RESOLVE toolkit to conduct its scenario analysis.

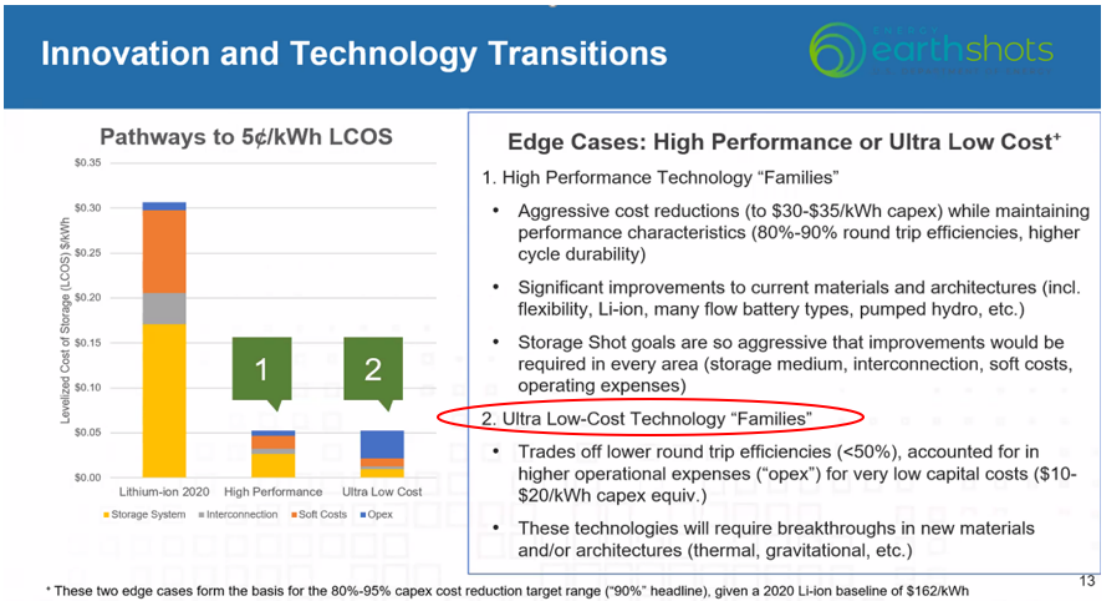
In their presentation, UC Merced noted that feedback to date regarding the modeling of LDES technologies had focused on two factors. First, both potential buyers and sellers of LDES were curious about the optimal duration needed. Second, both potential buyers and sellers were interested in the tipping point, in terms of both cost and duration, at which a particular technology would become cost-competitive relative to lithium-ion batteries. In this context, UC Merced sought to develop a method to model emerging technologies while addressing these questions.

Recognizing CESA's recommendation to develop a technology-neutral parameter-centered modeling approach, UC Merced proposed the establishment of variable-cost storage candidate resources that would capture different points of the parameter space. UC Merced proposes including new storage candidate resources with a defined duration and RTE, but with variable total costs. The creation of these candidate resources will allow the model to better capture the tradeoffs between storage assets and the cost tipping points by duration and RTE. In addition, this approach would allow for expedited sensitivity analyses as only one variable needs to be modified.

Overall, CESA is supportive of the approach proposed by UC Merced. The proposed approach is consistent with the one employed by Strategen Consulting in *Long Duration Energy Storage for California's Clean, Reliable Grid* (2020). This method offers a technology-neutral alternative to better understand the need for LDES in a context of limited public data availability. Moreover, the proposed approach will provide important insights for both public and private investments regarding the price points LDES should strive for in the coming years. While supportive of the proposed methodology, CESA recommends that the variable-cost LDES candidate resources modeled consider RTEs in addition to those presented in the Workshop.

In the Workshop materials, UC Merced focused on explaining the proposed approach using two variable-cost LDES candidate resources: an 8-hour asset with an 81% RTE, and a 12-hour resource with the same RTE. While the use of that RTE might have been for illustrative purposes only, CESA recommends that the variable-cost LDES candidate resources included in UC Merced's final scenarios consider a wider range of RTE values. Specifically, CESA recommends modeling RTEs across the 35%-85% range, as this better represents the diversity and heterogeneity of existing and emerging LDES technologies. This expanded consideration of RTE would be consistent with the perspective of the Department of Energy ("DOE") in their Earthshots initiative. DOE has shown that there are two pathways to achieving the 5 cent/kWh levelized cost of storage ("LCOS") goal. The first is the well-established high-cost and high-performance family of lithium-ion batteries, while the second is the ultra-low-cost family, with much lower capital cost and RTEs. While these are different, either can successfully achieve the LCOS goal as noted by DOE in Figure 1. As such, *ad minimum,* UC Merced should consider RTEs of 35%, 50%, 70%, and 85%; although modeling more points within said range would be desirable.

Figure 1. DOE Pathways to 5 cent/kWh LCOS [2]



[2] *See* DOE, *Long Duration Storage Shot Summit*, September, 2021, https://www.energy.gov/oe/long-duration-storage-shot-summit

C. UC Merced should include a high-cost lithium-ion sensitivity and a low solar sensitivity to their proposed scenarios and studies.

During the workshop, UC Merced presented a series of sensitivities that they will evaluate using their modified version of RESOLVE. These sensitivities include a zero-emissions future in California by 2045, cases with and without new pumped hydro, cases with varying electric vehicle ("EV") charging profiles, different import and transmission cases, and other scenarios that include electrolyzers, geothermal assets, and biogas resources with oxycombustion. While supportive of the sensitivities presented by UC Merced, CESA recommends considering two additional cases that are essential to better identify the future need for LDES and the economics behind its selection. Namely, CESA proposes consideration of a high-cost lithium-ion sensitivity and a low solar sensitivity.

First, consideration of a high-cost sensitivity for lithium-ion resources is warranted considering a key factor behind LDES selection is its cost relative to that of li-ion batteries. The study of this sensitivity is crucial as potential buyers and sellers of LDES continue to study storage alternatives given recent commodity price spikes and the growing long-term demand for lithium-ion batteries and materials from the automotive industry. In this context, inclusion of this sensitivity is warranted.

Second, a low solar sensitivity was included in Strategen Consulting's *Long Duration Energy Storage for California's Clean, Reliable Grid* (2020). The case where the model was asked to meet a 0 MMT carbon target and was simultaneously presented with renewable generation reflective of a year with prolonged periods of low solar irradiance saw a 20% increase in solar deployment and a 14% increase in storage deployment relative to the 0 MMT case with typical meteorological year ("TMY") weather.[3] Notably, these analyses were performed prior to the presentation of E3 and Form Energy's analyses regarding the likelihood of renewable lulls in California. On a workshop held by the CEC on June 30, 2021, E3 noted that analysis of 35 years of SERVM resource profiles from CPUC's "Hybrid Conforming Portfolio 2030" from the 2018 IRP preferred system plan revealed data that 50-hour renewables lulls occur once every 2 years and 100-hour renewables lulls occur once every 10 years.[4] In this context, CESA recommends the UC Merced team leverage the findings shared by E3 and Form Energy in order to develop a low solar sensitivity that can capture the impacts of dunkelflaute events on LDES deployment.

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[3] Strategen Consulting, *Long Duration Energy Storage for California's Clean, Reliable Grid,* 2020, at 49. Available at: https://static1.squarespace.com/static/5b96538250a54f9cd7751faa/t/5fcf9815caa95a391e73d053/1607440419530/LDES_CA_12.08.2020.pdf

[4] E3, *Assessing the Value of Long Duration Storage - Data & Scenario Selection Public Workshop*, June 30, 2021, at 24. Available at: https://efiling.energy.ca.gov/getdocument.aspx?tn=238659

III. CONCLUSION.

CESA appreciates the opportunity to provide these comments and feedback on the Workshop. We look forward to collaborating with the CEC and other stakeholders in this docket.

Respectfully submitted,

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