CESA
CALIFORNIA ENERGY STORAGE ALLIANCE

July 14, 2021

Email to: docket@energy.ca.gov
Docket Number: 20-MISC-01
Subject: CESA's Comments on Proposed Long Duration Energy Storage Scenarios Workshop

Re: Comments of the California Energy Storage Alliance Regarding the June 30th Staff Workshop on Proposed Development for Long Duration Energy Storage Scenarios

Dear Sir or Madam:

The California Energy Storage Alliance ("CESA") appreciates the opportunity to comment on the Staff Workshop on Proposed Development for Long Duration Energy Storage Scenarios held on June 30, 2021. CESA recognizes the leadership of the California Energy Commission ("CEC") in assembling a vast group of stakeholders and listening to their concerns and proposals regarding the complexities of integrating long duration energy storage ("LDES") into the models used to plan for the transition to a zero-carbon electric grid by 2045.

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 long duration energy storage ("LDES") 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 this workshop and moving forward the conversation of increasingly considering non-conventional and emerging technologies in the state's planning processes. In 2020, CESA partnered with Strategen Consulting to conduct analysis on the future need for LDES given California's ambitious climate goals and resource mix. This study, *Long Duration Energy Storage for California's Clean, Reliable Grid* (2020), leveraged first-class capacity expansion modeling capable of identifying the value of inter-day energy shifting through a 8,760-hour optimization and concluded that California will need between 45 and 55 GW of LDES by 2045 to achieve its decarbonization goals while retaining reliability.[1] In this study, CESA was able to integrate several modeling architecture elements and candidate resources that are not currently considered in California's planning venues. The results of this study demonstrate that consideration of emerging technologies, increased inter-temporal arbitrage opportunities, and extreme weather events have a substantial effect on incremental capacity results. To this end, CESA finds this effort by the CEC to be extremely valuable to inform planning processes across the state, including but not limited to the IRP proceeding and the SB 100 implementation process. Our comments are focused on the following areas:

- **The Project Team ("PT") should consider revising its preliminary list of key technologies and provide a framework for inclusion that is based on the Technology Readiness Level ("TRL") or a non-technology-specific method:** CESA appreciates the consideration of incremental energy storage technologies as candidate resources. However, the 2021 TRL should not preclude the inclusion of storage technologies that are not commercially available today since this modeling toolkit should serve to plan for the 2050 horizon. Moreover, the PT could consider, in parallel, technology-neutral means to integrate LDES candidate resources into the modeling, such as those developed by Strategen and the Massachusetts Institute of technology ("MIT").

- **The PT should characterize extreme weather events as conditions that increase load or decrease available supply:** Weather scenarios focused on extreme-weather events should consider high load in Summer and periods with adverse renewable generation conditions (low solar or wind).

- **The PT should consider the potential impacts of increased regional coordination in one scenario:** The potential for regionalization can be represented with increased interchange capacity among areas and/or added resource availability.

- **The CPUC and the CEC should closely collaborate to ensure the version of RESOLVE used in the SB 100 and IRP processes is as aligned as possible:** CESA urges the PT to complete the updated modeling toolkit in time for the next IRP cycle, especially as inter-day and inter-year value streams are essential to estimate the need for and benefits of LDES.

[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.

1. PT should should consider revising its preliminary list of key technologies and provide a framework for inclusion that is based on the TRL or a non-technology-specific method.

During the workshop, the PT highlighted that this project seeks to develop an updated publicly available dataset to characterize potential futures for California's grid in the context of deep decarbonization, including characterization of new energy storage and energy generation technologies. To this end, the PT has undertaken a thorough technology review to assess which emerging technologies could lower the overall cost of deep decarbonization. In order to determine which technologies should be considered in this process, the PT noted that they will screen out technologies that lack sufficient technoeconomic data for modeling. Technology selection is thus primarily based on technology readiness and data availability, which indicate potential for near- to medium-term deployment. For the purpose of readiness, the PT suggests utilizing the International Energy Agency's ("IEA") TRL to assess market experience. CESA welcomes the PT's consideration of additional LDES technologies, such as adiabatic compressed air energy storage ("CAES"), as it represents a significant improvement over the limited candidate technologies currently in RESOLVE. That being said, more modifications are necessary to bolster the planning capability of this model in a decarbonized future.

In the workshop, CESA expressed some concerns with this approach and shared a series of options for modeling. First, CESA considers the preliminary list of technologies shared by the PT is not complete as it fails to consider some commercially available technologies that are not currently included in the RESOLVE model, such as liquid air energy storage ("LAES"), additional flow battery chemistries, and thermal storage. Considering these technologies are commercially available, CESA recommends the PT clarify the use of the TRL as a filter for inclusion. Given the table shared during the workshop includes technologies with a score of 5 and above, CESA recommends that storage technologies that rank 5-7 to be considered Emerging Technologies (as to have them included in the modeling of sensitivity scenarios, per slide 46 of the materials) and technologies that rank 8-11 to be deemed Mature Technologies (as to have them included in the modeling of all scenarios, per slide 46 of the materials). This approach is reasonable given the timeframe that the CEC seeks to assess with this updated modeling assumptions and tools. Moreover, as the TRL ranking evolves, the PT will be able to continuously update candidate resources and their associated cost and performance metrics.

CESA's experience with modeling LDES has showed us the difficulty of establishing cost and performance characteristics for technologies that have been seldom deployed, despite their commercial availability. In order to mitigate this complexity, CESA and Strategen opted to move away from a technology-based approach to modeling LDES since it would be unnecessarily specific and arbitrary. In contrast, we included LDES options that were intended to capture trends of the technology characteristics and can be thought of as generic, technology-neutral resource options.[2] Our LDES options therefore developed for use in *Long Duration Energy Storage for California's Clean, Reliable Grid* (2020) were not representative of any single technology, but instead were intended to represent a class of storage solutions that have similar performance capabilities, tradeoffs, and cost profiles.

A similar, albeit more thorough, approach was recently used by a team of researchers from Princeton and MIT in their paper *The Design Space for Long-Duration Energy Storage in Decarbonized Power Systems* (2021).[3] For this paper, the research team modelled a total of 1,280 discrete combinations of cost and efficiency parameters encompassing performance levels that are consistent with projections for existing LDES technologies found in academic peer-reviewed studies as well as domains that are currently infeasible but that could be the focus of technology development efforts in the future.[4] This approach could bring substantial value for this effort because it would not only ease the inclusion of additional candidate resources, but it would also allow the CEC to identify the technology characteristics that better complement the Californian grid. As such, CESA recommends the PT consider non-technology-specific methodologies to amplify the set of LDES technologies that could be included into this project's datasets and models.

Finally, as discussed later, CESA believes this approach will bring better alignment with the IRP proceeding by identifying the resource attributes that underpin specific resource targets and requirements. For example, in the most recent IRP procurement decision, the California Public Utilities Commission ("CPUC") explicitly set procurement requirements for firm zero-emission generation to replace Diablo Canyon, as well as for long-duration energy storage defined as single resources with minimum eight hours of duration capability at its maximum power output. Given that procurement decisions are likely directed by defining minimum operating capabilities and characteristics, a similar approach should be pursued in modeling to better link planning and procurement.

In order to inform either of these approaches and accurately capture the characteristics of the diverse set of technologies available and under development, E3 should take action to gather representative data for multiple technology classes through an industry survey. CESA recommends that E3 reach out to and survey companies developing these technologies in order to gather additional data on technology parameters and costs. Data should then be aggregated and anonymized before inclusion in the study. These additional inputs will allow E3 to perform more accurate modeling of diverse technologies and to increase the value of study outputs. In the interest of maintaining sensitive market information confidential, CESA recommends that any sharing of competitive information should be protected by the appropriate measures, such as the signing of non-disclosure agreements ("NDAs"), to ensure no market participant has access to this data.

[2] Strategen Consulting, *Long Duration Energy Storage for California's Clean, Reliable Grid,* 2020, at 32.
[3] Sepulveda *et al*, *The Design Space for Long-Duration Energy Storage in Decarbonized Power Systems*, 2021.
[4] *Ibid.*

2. PT should characterize extreme weather events as conditions that increase load or decrease available supply.

CESA appreciates the PT's consideration of incremental weather modeling for the purposes of this project. As the effects of anthropogenic climate change become more prevalent across the West, California's electric sector must wrestle with increased weather variability, drier conditions, and longer, hotter summers. The experiences of the last year demonstrate that planning processes must not be bound by historical expected weather and should include the possibility of adverse load and/or supply conditions.

During the workshop, the PT noted that they will evaluate two weather-based scenarios: one focused on a wider range of weather years and one focused on "extreme weather events" which have yet to be characterized. In this section, CESA provides feedback on the characterization of "extreme weather events". Specifically, the PT should characterize extreme weather events as conditions that increase load or decrease available supply. The first scenario for California is closely related to the expected temperatures during summer months. Weather years with outlier summer conditions (*e.g.*, those that would fall in the 1-in-10 tails of the distribution) should be considered under this scenario as high temperatures are directly correlated with increased electric demand. In sum, CESA recommends that the PT consider a scenario based on outlier summer conditions.

Second, CESA recommends the PT consider the possibility of adverse supply conditions. Considering the increasing reliance of the state on weather-dependent generation, the most important supply limitations to consider in the extreme weather analysis relate to solar generation. For *Long Duration Energy Storage for California's Clean, Reliable Grid* (2020), Strategen explored how multiple days of low solar irradiance[5] and corresponding reductions in solar generation will affect grid operations and LDES deployment.[6] To test this sensitivity, Strategen extracted renewable generation profiles from 2010 from the historical SERVM dataset. Across all the historical SERVM weather years, the winter of 2011 saw the lowest contiguous solar generation across the year due to a particularly active storm season in California, and the associated cloud cover sharply reducing solar PV production. This sensitivity analysis showed that planning on the expectation of periods of low solar irradiance has a significant impact on the LDES requirement, increasing it from 46 GW in the Base Case to about 49 GW.[7] Since solar PV generation will be the primary source for charging energy in a deeply decarbonized California, CESA urges the PT to consider low solar irradiation weather years in the Extreme Weather scenarios. Finally, CESA encourages E3 to ensure that it conducts reliability assessments in a manner that will reflect grid conditions during these multi-day periods of

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[5] An emerging risk is around the impact of wildfire smoke to solar generation. Tthe US Energy Information Administration ("EIA") reported declined up to 30% from historical averages during some of the 2020 wildfires. With the risk of wildfires persisting on a seemingly annual basis since 2015-2016, impacts to the supply of solar generation could also come in this form and supports the case for this type of extreme weather-related modeling. *See* https://www.eia.gov/todayinenergy/detail.php?id=45336

[6] Strategen Consulting, *Long Duration Energy Storage for California's Clean, Reliable Grid,* 2020, at 36.

[7] *Ibid,* at 47.

high net load due to extreme weather or extended renewable energy lulls. We encourage E3 to ensure that it designs scenarios that capture multi-day periods of extreme weather or low renewable energy generation in both summer and winter.

3. **PT should consider the potential impacts of increased regional coordination in one scenario.**

During the workshop, the PT shared a series of scenarios that will be considered in the preliminary and final analysis. These scenarios include variations to assumptions regarding resources, demand, and weather. CESA generally agrees with these scenarios and provides feedback on them in these comments; nevertheless, other developments in the electric sector should be reflected in this project. Particularly, CESA recommends the PT to evaluate the potential for increased regional coordination across the West in one scenario.

Since the establishment of the Energy Imbalance Market ("EIM"), balancing authorities ("BAs") across the West have sought to further integrate their forecasting and planning practices. The events of August 2020 and the tight supply conditions coming into Summer 2021 have spurred additional talks regarding the benefits of and potential for regional planning in topics of sufficiency and transmission development. In this context, understanding the impacts of increased regionalization is relevant to identify potential tradeoffs in the realm of incremental capacity.

In the IRP proceeding, the CPUC has approximated increased regionalization by increasing the availability of out-of-state ("OOS") resources, particularly wind and solar. This modification could be part of the scenario proposed by CESA; however, a consideration of incremental transmission is required. If the PT were to only increase OOS resource availability, it would not capture the benefits of incremental interchange among regions for the purposes of storage charging. This factor is crucial when considering technologies that may charge seasonally to discharge months later. A scenario focused on the effects of regionalization should be informed by the ongoing 20-Year Transmission Plan being developed by the California Independent System Operator ("CAISO") and should be coupled with weather scenarios to account for the combined effects of high temperatures and low solar conditions across the West.

4. **The CPUC and the CEC should closely collaborate to ensure the versions of RESOLVE used in this project, the SB 100 docket, and the IRP processes are as aligned as possible.**

During the workshop, the PT commented that the project has faced some timing setbacks, but they still estimate the updated modeling toolkit will be finished by December 2021. In prior comments related to the IRP proceeding at the CPUC and the SB 100 Docket at the CEC, CESA has urged for consistency and alignment in the inputs, assumptions, and modeling processes used in planning venues across the state. Despite the methodological differences, the results of the 2021 SB 100 Joint Agency Report's modeling results and the 38 million metric ton ("MMT") compliant Reference System Portfolio ("RSP") developed as part of the IRP proceeding have shown a high level of alignment. Nevertheless, as the PT moves towards integrating additional features and candidate resources to RESOLVE with this project, that alignment could be eroded if the updated model is not utilized in the next cycle of the IRP proceeding and the SB 100 Joint Agency Report.

In this context, CESA is strongly supportive of the capacity expansion model reduction experiments detailed within the PT's presentation materials for the June 30th Workshop. These experiments will be essential to define a model architecture that is able to capture the value of multi-day and even seasonal arbitrage. Considering the state and federal governments have underscored the importance of LDES for our decarbonized future, the addition of these elements to the model architecture is timely.

As such, CESA recommends that the IRP modeling, assumptions, and inputs should be updated to reflect the work done in this project. In particular, CESA deems it essential to include inter-day and inter-year optimization as Strategen's analysis demonstrates these considerations have a substantial effect on the selection and utilization of LDES assets. To that end, CESA supports the PT's model reduction experiments. As the state moves towards directing procurement based on planning process designed to achieve our decarbonization targets, disconnects in modeling could create confusion among parties. Hence, CESA urges the CEC and the PT to timely complete the new modeling toolkit in a manner that ensures its utilization in the upcoming IRP cycle.

III. CONCLUSION.

CESA appreciates the opportunity to provide these comments and feedback on the LDES Scenarios the PT is considering. We look forward to collaborating with the CEC and other stakeholders in this docket.

Respectfully submitted,

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