June 21, 2023

Email to: IRPDataRequest@cpuc.ca.gov
Proceeding: Rulemaking ("R.") 20-05-003
Subject: 2023 I&A - CESA's Informal Comments

Re: Informal Comments of the California Energy Storage Alliance Regarding the 2023 Draft Input and Assumptions Report

The California Energy Storage Alliance ("CESA") appreciates the opportunity to comment on the Draft 2023 Inputs and Assumptions ("I&A") document that was posted on June 6th, 2023, where Energy Division ("ED") staff of the California Public Utilities Commission ("CPUC") discussed updates to the inputs and assumptions that will be used in the 2022-2023 cycle of the Integrated Resource Planning ("IRP") proceeding. CESA recognizes the commitment of ED staff to engage with stakeholders on these fundamental matters since we are convinced that the modeling improvements discussed below 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 participates 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 given Senate Bill ("SB") 100 targets. Therefore, CESA"s experience is of material importance to ED's efforts and can substantially contribute to the development of the Draft 2023 I&A document.

I. INTRODUCTION & SUMMARY.

CESA appreciates the Energy Division's efforts in updating the inputs and assumptions that will be utilized for the 2022-2023 IRP. In particular, CESA commends the ED for updating the RESOLVE model to accurately reflect the impacts increasing penetration levels of variable energy resources ("VERs") have on the capacity contributions of energy storage. Updating the storage effective load carrying capability ("ELCC") curve to a solar-storage ELCC surface finally recognizes the symbiotic relationship between these two resource classes and sends the appropriate market signals for their continued synergistic procurement.

While CESA appreciates this and other improvements, there is still more to be done to ensure that the modeling undertaken as part of the IRP proceeding will identify an optimal portfolio from an environmental, reliability, and ratepayer perspective. As such, in these informal comments, CESA offers ED recommendations regarding the cost assumptions for storage assets, the optimization horizon of the model, and the representation of long duration energy storage within the resource counting methodology. CESA's comments, separated by section of the Draft I&A document, can be summarized as follows:

- **SECTION 5.3:**
  - Staff's recommendation to use the 2022 National Renewable Energy Laboratory Annual Technology Baseline ("NREL ATB") as the source for lithium-ion cost estimates is understandable given near-term supply chain conditions, but NREL's High-cost estimate is not adequate.
  - If staff wishes to update flow battery cost assumptions, the cost and performance data published by the Pacific Northwest National Laboratory ("PNNL") could be utilized.
- **SECTION 6.3:**
  - Staff should provide further clarification over the new "clustering approach" to capacity expansion optimization.
- **SECTION 7.1.6:**
  - ED is correct in updating the storage ELCC curve to a solar-storage ELCC curve, but more of these curves should be developed in a manner that tests different capabilities of storage around duration, roundtrip efficiency, and charge/discharge rate.

II. COMMENTS

SECTION 5.3: Staff's recommendation to use the NREL ATB as the source for lithium-ion cost estimates is understandable given near-term supply chain conditions, but NREL's High-cost estimate is not adequate.

The Draft I&A document describes the different data sources that would be used to inform the costs associated with candidate resources. For this cycle, ED proposes to use the 2022 NREL ATB for lithium-ion batteries and pumped hydro-storage ("PHS") since it is the most recent publicly available source of information and continue using Version 4 of Lazard's Levelized Cost of Storage ("LCOS") report for flow batteries given the lack of more recent data. Considering the increase in commodity prices due to inflation and supply chain issues, as well as the induced demand resultant from the Inflation Reduction Act ("IRA"), CESA understands the need to modify the rate of cost decline for capital expenditures assumed by NREL and instead model a flat trajectory through 2026. This modification captures the need for the market to adjust to recent federal policy changes and a volatile market environment. The proposed delay in cost reductions is justified because developers and manufacturers may struggle to meet the growing demand for storage, seeing as its projected that the IRA will increase energy storage demand due to its expanded investment tax credits ("ITC") for stand-alone storage.

In light of the uncertainty around future battery prices, ED staff chose to model Low, Mid- and High-cost options to reflect the range in possible cost trajectories. While CESA appreciates the effort to model the comprehensive cost impacts of policy and current market conditions, the High-cost scenario is redundant given the assumption that includes a delay for expected cost reductions. The aforementioned issues are temporary and reflect near-term challenges. In the long-term, cost reductions are expected to continue as supply chain issues are resolved, production capacity increases and economies of scale are achieved. The passage of the IRA continues to be the most groundbreaking piece of legislation for the clean energy transition, adding more than $80 billion in new investments for the battery supply chain[1]. Moreover, BloombergNEF sites that cobalt and nickel sulfate prices are already dropping as of 2022, and, while lithium costs remain elevated, they are also experiencing declines.[2] In addition, advances in battery technologies will also drive a

[1] *See* https://about.bnef.com/blog/top-10-energy-storage-trends-in-2023/

[2] *See* BloombergNEF, Battery Metals Playbook (web), Asian Metals Inc. Note: All prices are based on domestic spot prices in China

decline in prices, like lithium iron phosphate batteries and the reduced use of cobalt in nickel-base cathodes.[3] Thus, CESA requests that ED staff utilize the low- and mid-cost scenarios for future battery prices.

SECTION 5.3: If staff wishes to update flow battery cost assumptions, the cost and performance data published by the PNNL could be utilized.

Regarding flow batteries, CESA understands that the newest version of NREL's ATB does not include flow battery costs; nevertheless, we urge ED to consider alternate publicly available data sources. CESA recommends ED to consider cost estimates from PNNL's Energy Storage Cost and Performance Database, which seem to be the most up-to-date cost estimates for flow batteries.[4] In its consideration of PNNL's data, ED should note that PNNL's cost estimates are older than NREL's and thus skew towards overestimation of costs. As such, CESA recommends only considering PNNL's Low Estimate. Furthermore, ED should note that these estimates are also disaggregated by the expected MW size of assets. Given that the cost estimates are sought for the purposes of CEM, CESA recommends utilizing the 1,000 MW sizing to reflect the impacts of economies of scale.

SECTION 6.3: Staff should provide further clarification over the new "clustering approach" to capacity expansion optimization.

Historically, RESOVLE has co-optimized new resource investment and dispatch for 37 independent days over a multi-year horizon in order to identify least-cost portfolios. This has been problematic to the valuation of storage, notably long duration energy storage which has the capability to move energy through multiple days. In the past, RESOLVE's 37 representative days have not been intertemporally connected nor modeled in chronological order; therefore, storage balancing decisions have been limited to a horizon of a single day. For the 2022-2023 IRP cycle, ED staff will be using a new clustering approach to select a subset of representative units (or "exemplars") from the raw 23-year load, hydro, and renewable profiles in the updated IRP dataset. These exemplars represent the variability and characteristics of the electric system across an

[3] *See* https://about.bnef.com/blog/lithium-ion-battery-pack-prices-rise-for-first-time-to-an-average-of-151-kwh/

[4] *See* PNNL, Energy Storage Cost and Performance Database, available at https://www.pnnl.gov/ESGC-cost-performance

extended time period. From CESA's understanding, employing this clustering approach in RESOLVE reduces the complexity of the modeling, making it more computationally efficient while still capturing the characteristics of the load profiles and the diversity of different representative units.

CESA appreciates ED staff's commitment to updating their capacity expansion modeling in an effort to more accurately reflect the system's volatility and diversity. CESA requests that ED staff provide further clarification over this new clustering approach to CEM modeling because it is unclear whether this new approach identifies and resolves the issues CESA has previously commented on.[5] CESA is most concerned with the model's ability for multi-day optimization. RESOLVE's previous methodology has severely limited the potential benefits to the grid that would be provided by energy storage technologies, as it excludes the intrinsic benefits of long duration energy storage ("LDES") that sets it apart from other clean, firm resources. Energy storage resources have different durations and charging requirements that should be accounted for. Thus, CESA is inclined to ask that ED staff use exemplars of "weeks" rather than "days" to ensure the effective dispatch of LDES (which can provide energy arbitration across multiple days). Weeks can capture a broader range of system conditions, including seasonal variation, weather patterns, and the longer periods of high demand that have become a common occurrence in California summers. Moreover, Strategen Consulting's *Long Duration Energy Storage for California's Clean, Reliable Grid* (2020), which used 8,760-hour CEM, revealed that 45-55 GW of LDES will be required to support California's electric grid by 2045, highlighting the importance of extending the exemplar timeframe to optimize for LDES.[6] Understandably, expanding the time horizon from representative days to weeks adds to the demands of the model, but it is crucial for staff to include this feature so as to properly estimate the type and amount of resources California will need to achieve its decarbonization goals.

SECTION 7.1.6: ED is correct in updating the storage ELCC curve to a solar-storage ELCC curve, but more of these curves should be developed in a manner that tests different capabilities of storage around duration, roundtrip efficiency, and charge/discharge rate.

[5] *See* CESA's Informal Comments on September 22, 2022, Modeling Advisory Group Meeting at 2022-10-06 CESA's Informal Comments on I&A MAG Meeting - FINAL.pdf

[6] *See* Strategen Consulting's Long Duration Energy Storage for California's Clean, Reliable Grid, available at https://www.storagealliance.org/longduration

CESA commends the Commission for updating the RESOLVE model to include a storage-solar ELCC surface, alleviating some of the concerns CESA has held over the methodologies and assumptions used to derive storage ELCC values.[7] Utilizing a solar-storage ELCC surface acknowledges that storage peaking capacity contributions are a function of the penetration of storage and the availability of other renewables, as noted by a 2019 National Renewable Energy Laboratory ("NREL") study.[8] In said study, NREL demonstrated that higher solar penetrations increase the amount of four-hour energy storage that can be added at 100% ELCC. The Commission's new assumptions are consistent with findings from NREL and others, appropriately capturing the diversity benefits of storage plus storage.

Although this update is a step forward in properly representing the reliability contributions of different resource classes within the IRP proceeding, there is more work to be done. Today, the solar-storage ELCC surface calculated for 4-hour lithium-ion assets is used to derive ELCC multipliers for other types of storage with longer durations. This ultimately assumes that the shape of the solar-storage ELCC curve would persist following additions of resources with different operating characteristics, such as longer durations or different RTEs. While this assumption is valid as an initial approach, it could be materially improved upon.

CESA recommends that the Commission update their model to reflect the differences in durations *and* operational characteristics of storage resources, not only under different levels of renewable penetration assuming the underlying solar-storage (4-hour) surface, but by estimating surfaces for different types of storage. CESA believes ED staff must move forward at the pace of emerging technologies so as to not limit their commercialization any further. Storage assets, mature in the market and emerging technologies, with durations of 8-, 10-, 12- and 24-hours would greatly benefit from having their own surfaces developed. Furthermore, ED staff should consider storage assets with different round-trip efficiencies ("RTEs") other than those assumed for lithium-ion batteries. Long duration energy storage resources are increasingly being used to hedge against the uncertainties on climate-change induced events and better ensure grid reliability. Modeling storage

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[7] *See* CESA's comments: https://docs.cpuc.ca.gov/SearchRes.aspx?DocFormat=ALL&DocID=387951294

[8] *See* NREL, The Potential for Battery Energy Storage to Provide Peaking Capacity in the United States, available at: https://www.nrel.gov/docs/fy19osti/74184.pdf

assets with RTEs across the 35%-85% range can better represent the diversity and heterogeneity of existing and emerging LDES technologies that can be utilized to ensure reliability of the grid. At minimum, staff should consider RTEs of 35%, 50%, 70%, and 85%. As such, the Commission should work with its consultants and ED staff to develop these surfaces for future modeling assessments.

III. CONCLUSION.

CESA appreciates the opportunity to provide these comments and feedback on the Draft 2023 Inputs & Assumptions Report. We look forward to collaborating with Energy Division and other stakeholders in this docket.

Respectfully submitted,

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