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LDES Council Comments on SB 100 Draft Results Workshop

Additional submitted attachment is included below.

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March 20, 2026

California Energy Commission
Docket: 23-SB-100
715 P Street
Sacramento, CA 95814

Via Electronic Submittal

Re: Comments on SB 100 Joint Agency Report, Draft Results

Dear Commissioners and Staff,

The Long Duration Energy Storage Council ("LDES Council") thanks the California Energy Commission (CEC), California Public Utilities Commission (CPUC) and California Air Resources Board (CARB) for the Hybrid Workshop on 2025 SB 100 Joint Agency Report Draft Results. The LDES Council appreciates California's leadership in advancing a 100 percent clean electricity future. As discussed below, the modeling results strongly demonstrate the central role of long duration energy storage ("LDES") in achieving a reliable, affordable, and decarbonized electric system. The LDES Council offers several recommendations to strengthen the analysis and ensure that the SB 100 modeling framework reflects current market conditions and technological advancements.

I. The Draft Results Show that LDES is Essential and Cost-Effective

The Draft Results consistently show that achieving SB 100 targets requires significant deployment of LDES resources. Across modeled scenarios, storage is an essential portion of the resource mix, and the system increasingly relies on storage to manage variability and meet demand across seasons.[1]

[1] California Energy Commission, Presentations – Workshop on 2025 SB 100 Joint Agency Report Draft Results (Feb. 19, 2026) ("Draft Results Workshop").

Importantly, the analysis finds that solar generation paired with LDES represents the most cost-effective pathway to meeting the retail sales requirements under SB 100 only scenario.[2] This conclusion reflects the unique capability of LDES to shift energy across extended periods, particularly as demand profiles differ from summer conditions.

The modeling further demonstrates that by 2045 all scenarios require additional long duration storage capacity to meet increasing load and serve winter-peaking needs.[3] These findings confirm that LDES is not merely a supplemental resource but rather a foundational component of an affordable, reliable, and decarbonized electricity system.

II. Recommendations to Update Demand Forecasts and Import Assumptions

To strengthen the analysis, the LDES Council recommends that the Commission update its demand assumptions to reflect the most recent data from the 2024 Integrated Energy Policy Report ("IEPR") while currently the policy scenario modeling relies in part on earlier demand forecasts from 2023 IEPR.[4] The 2024 IEPR forecast of demand is higher due to the pace of load growth driven by data centers and reduced BTM distributed generation. It highlights that the 2024 IEPR projects baseline electricity sales in 2040 to be 13–16% higher than those reported in the 2023 IEPR.[5]

Additionally, recent analyses from the California Public Utilities Commission's Transmission Planning Process, 2026-2027, indicate that load growth is accelerating significantly due to increases in electric vehicles, building electrification, and large commercial loads such as data centers.[6] These trends are not limited to California and are occurring across the broader Western region.

Considering these developments, the Commission should also revisit its assumptions regarding import availability. The Draft Results assume a defined level of import capacity from neighboring regions.[7] However, emerging evidence, such as from the North American Reliability Corporation (NERC) Long-

[2] Id. at 40.
[3] Id. at 38.
[4] California Energy Commission, 2025 SB 100 Joint Agency Report – Inputs and Assumptions, TN 268979 (Mar. 9, 2026), at page 10.
[5] Final 2024 Integrated Energy Policy Report Update, at 3.
[6] CPUC, 2026–2027 Transmission Planning Process, RESOLVE Modeling Results (Slides 17–19).
[7] California Energy Commission, Presentations – Workshop on 2025 SB 100 Joint Agency Report Draft Results (Feb. 19, 2026), at page 20.

Term Reliability Assessment released in January of 2026, suggests that those regions may face supply constraints in the coming decade, which could reduce the availability of imports during critical periods.[8] Under such conditions, in-state flexible resources, including multi-day LDES, will become even more valuable for maintaining reliability.

Accordingly, the LDES Council strongly recommends that the Commission incorporate updated demand forecasts from the 2024 IEPR and evaluate sensitivities that reflect more constrained import availability.

III. The Modeling Should Reflect the Full Range of LDES Technologies

The Draft Results model LDES as a representative resource with fixed duration and round-trip efficiency assumptions. For energy storage, three tranches of duration, technology class, and RTE were chosen: 4-hour lithium-ion batteries with 92% RTE, 8-hour lithium-ion batteries with 92% RTE, and 25-hour long duration storage with 60% RTE.[9] While this approach provides a useful starting point, it does not capture the diversity of technologies currently under development and commercialization.

Therefore, the LDES Council requests that the Commission establish 2 tranches within the long duration energy storage technology category:

1. 8–25-hour resources
2. 100-hour resources

Additional Tranche: 8-25-Hour Resources

The model omits the efficiency and value of 8–25-hour storage technologies by only including a tranche for 25-hour long duration storage. The modeling assumes a round-trip efficiency of 60% for 25-hour LDES compared to 4- and 8-hour lithium-ion storage.[10] However, many 8-25-hour LDES technologies offer higher efficiency than those assumed in the model, including but not limited to commercially-

[8] North American Electric Reliability Corporation (NERC), 2025 Long-Term Reliability Assessment (Atlanta, GA: NERC, 2026), https://www.nerc.com/globalassets/our-work/assessments/nerc_ltra_2025.pdf.
[9] Id. at 22.
[10] Draft Results, Inputs and Assumptions, at 23.

available mechanical technologies of compressed air, liquid air, and liquid CO2 that respectively average up to 70%, 75%, and 80%, according to the 2024 LDES Council Annual Report.[11]

Furthermore, since the publication of the 2024 LDES Council Annual Report, continued innovation and commercialization have further improved the performance of LDES storage technologies. For example, Eos Energy Enterprises' zinc-based battery systems now report round-trip efficiencies of approximately 88% demonstrating that commercially available LDES storage can achieve both extended duration and high operational efficiency.[12] Other examples of live intra-day LDES systems generating revenue for customers, Invinity Energy Systems has been supported by the CEC Electric Program Investment Charge Program (EPIC) LDES grants in deploying non-lithium-ion flow battery technology at (i) Soboba Fire Station within Soboba Reservation in San Jacinto, CA, (ii) Viejas Casino within Viejas Reservation in Alpine, CA, and (iii) Harrah's Resort within Rincon Reservation in Valley Center, CA.[13] Because 8–25-hour non-lithium-ion technologies and their higher RTEs are not fully represented, the analysis may understate their ability to provide cost-effective, operationally efficient energy shifting, as well as optimal peak shaving services to renewable output.

Additional Tranche: 100-Hour Resources

The LDES Council notes that multi-day storage with durations of one hundred hours or more is also not included as a tranche, despite being commercially available and deployed in California. These technologies are particularly well-suited to address the winter reliability challenges identified in the Draft Results, including prolonged periods of low renewable output, and are already successfully demonstrated in California. For example, the CEC has already awarded $30 million to 100-hour LDES with Form Energy for its 5 megawatt (MW) iron-air battery storage project in Mendocino County.[14]

[11] Long Duration Energy Storage Council, 2024 Annual Report (Brussels: LDES Council, 2024), https://ldescouncil.com/wp-content/uploads/2025/05/2024LDESAnnualReport-1.pdf.
[12] Eos Energy Enterprises, "Eos Indensity™," https://www.eose.com/solutions/eos-indensity/
[13] https://invinity.com/usa/
[14] California Energy Commission, "CEC Awards $30 Million to 100-Hour, Long-Duration Energy Storage Project," December 13, 2023, https://www.energy.ca.gov/news/2023-12/cec-awards-30-million-100-hour-long-duration-energy-storage-project.

Noon Energy has successfully demonstrated more than 100 hours of capacity through its solid oxide fuel cell battery, also located in California.[15]

The LDES Council recommends that the modeling adds a tranche to storage for 100-hour LDES technologies with a RTE of 50%.[16] An average of 50% RTE for 100-hour LDES technologies is based on Noon Energy's multiday storage system of 60%, and the Commission's own assessment in 2024 that compressed air and pumped hydro capable of 100-hour durations give respective roundtrip efficiencies of 55-75% and 60 to 85%.[17] Additionally, the successful demonstration of multiday in California supports the inclusion of an additional tranche representing 100-hour durations. Incorporating these resources would more accurately reflect the full range of LDES technologies and their potential contribution to achieving zero-carbon electricity sales.

The LDES Council would like to highlight that California statute and regulatory policy already recognize the importance of the range of technologies beyond lithium-ion and durations of LDES not currently represented in the modeling assumptions. The California Energy Commission's Long Duration Energy Storage Program has invested over $247 million in non-lithium-ion LDES technologies for demonstration and deployment.[18] More recently, the California Public Utilities Commission has identified multi-gigawatt procurement needs for LDES to support system reliability and cost reductions through scale.[19]

Overall, the Commission should expand its modeling framework to include a broader range of LDES technologies, durations, and performance characteristics. In the future, the Commission should also consider moving away from assigning specific efficiency values given the wide range of round-trip efficiencies across LDES technologies. A single efficiency assumption would risk oversimplifying the

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[15] Marija Maisch, "Noon Energy demonstrates 100+ hour ultra-long-duration energy storage system," pv magazine International, January 21, 2026, https://www.pv-magazine.com/2026/01/21/noon-energy-demonstrates-100-hour-ultra-long-duration-energy-storage-system/.

[16] Skafte, Theis & Melkote, Sunjay & Liang, Allen & Piotrowicz, Pawel & Graves, Christopher. (2025). Noon Energy Demonstrating Rsoc-Based Long Duration Energy Storage. ECS Meeting Abstracts. https://www.researchgate.net/publication/397912135_Noon_Energy_Demonstrating_Rsoc-Based_Long_Duration_Energy_Storage.

[17] Kurtz, Sarah, et al. Evaluating the Value of Long-Duration Energy Storage in California. Sacramento: California Energy Commission, 2024, 7.

[18] California Energy Commission, Long Duration Energy Storage Program, https://www.energy.ca.gov/programs-and-topics/programs/long-duration-energy-storage-program.

[19] CPUC Decision 25-06-019.

diversity of LDES technologies and could distort long-term planning outcomes. Instead, the CEC should evaluate these resources using a broader set of performance and system-value attributes to ensure more accurate modeling across long-term planning efforts at the CEC, CPUC, and CARB, while also sending an appropriate market signal for technology development and deployment.

IV. Cost and Policy Assumptions Should Be Updated

The Draft Results rely on cost assumptions that could be updated in the future. In particular, the LDES cost projections are based on an earlier study, the public McKinsey report, "Net-zero power: Long duration energy storage for a renewable grid" (2021).[20]

The LDES Council recently published an updated cost benchmarking study in January of 2026, developed in collaboration with the Electric Power Research Institute (EPRI), which demonstrates that costs across a range of LDES technologies are declining and are expected to continue decreasing through 2030.[21] The Cost Benchmarking Report finds that technology costs decline up to 37% for intraday electrochemical storage, up to 25% for intraday compressed gas, and up to 47% for thermal energy storage.

As LDES costs decline, these resources can lower total system costs by reducing reliance on high-cost peaking generation, mitigating fuel price volatility, and deferring or avoiding transmission, distribution, and capacity investments. Incorporating these updated cost trajectories would improve the accuracy of the modeling and may further reinforce the conclusion that LDES is a least-cost resource.

In addition, the modeling does not incorporate recent federal policy changes affecting energy storage economics.[22] CEC's modeling continues to rely on an Inflation Reduction Act based subsidy regime, while only noting that H.R.1 partially repealed portions of that framework. The model does not fully reflect the most up to date federal tax credit treatment for all technologies following H.R.1 of 2025. As a result, the modeling may understate the value and competitiveness of LDES under the current federal

[20] Draft Results, Inputs and Assumptions, at 21.
[21] Long Duration Energy Storage Council & EPRI, *LDES Cost Benchmarking Study* (2025), https://ldescouncil.com/ldes-epri-cost-benchmarking-study/.
[22] Draft Results, Inputs and Assumptions, at 24.

policy landscape. The LDES Council recommends that the modeling updates the federal policy subsidy regime.

The CEC should update its assumptions to reflect these policy developments to ensure that the SB 100 analysis accurately represents the evolving economic landscape.

V. Conclusion

The Draft Results provide a strong analytical foundation and clearly demonstrate that LDES is essential to achieving California's SB 100 goals. The modeling shows that LDES is required to maintain reliability, meet winter peak demand, and provide a cost-effective pathway to deep decarbonization.

To further strengthen the analysis, the LDES Council respectfully recommends that the Commission update its demand forecasts, revisit import assumptions, expand the representation of LDES technologies, and incorporate the latest cost and policy data.

The LDES Council appreciates the opportunity to submit these comments and looks forward to continued engagement with the Commission.

Sincerely,

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