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Berkeley Lab Comments - Understanding the Role of LDES in CAâ€™s Evolving Energy System

Please see comments attached.

Additional submitted attachment is included below.

BERKELEY LAB
Bringing Science Solutions to the World

October 23rd, 2023
Jonah Steinbuck
California Energy Commission
715 P Street
Sacramento, California 95814

Re: Lawrence Berkeley National Laboratory Comments Re: Workshop on Understanding the Role of Long Duration Energy Storage in California's Evolving Energy System

Jonah Steinbuck,

On Monday, October 9th, Commission staff hosted a Workshop on Understanding the Role of Long Duration Energy Storage (LDES) in California's Evolving Energy System. Berkeley Lab is pleased to present our comments in response to the aforementioned workshop.

Comment 1:
A diverse set of energy storage solutions will be needed to meet the full demand of future LDES. Compared to mature technologies of LDES such as hydroelectric and compressed air energy storage and emerging options with batteries, Thermal Energy Storage (TES) has a key critical role to play. TES-based LDES promises to be a low-cost solution, without geographical constraints and with the advantage of utilizing abundant, safe, and humanely mined materials. Three kinds of TES systems are known: the sensible heat storage, the latent heat storage, and the thermo- chemical heat storage.

The energy density of a thermochemical TES system, at 500 kWh per cubic meter, surpasses latent heat and sensible heat storage systems by a factor of 5 to 10, respectively. Thermochemical TES systems are emerging as the most promising solution for long-term solar thermal energy storage. One of their unique advantages lies in their ability to store energy with theoretically unlimited storage periods and transport distances, as there is no loss of thermal energy during storage. A key focus of current research centers on optimizing the temperature levels during the charging and discharging phases. The primary goal is to minimize the temperature differential between these steps to enhance efficiency and facilitate process control, particularly in downstream applications like turbines. As of now, only laboratory and pilot experiments have been conducted, and the challenge ahead is to scale up the technology. Large-scale experiments are imperative to demonstrate the feasibility of thermochemical TES systems for both short-term and long-term energy storage. Furthermore, the process must exhibit reversibility with a consistent conversion rate and should not degrade even after numerous cycles, as the stored products can be retained at ambient temperature.

Comment 2:
Berkeley Lab is interested in further elaboration on the background and thinking for identifying California's storage needs at more than 50GW. Baseline scenario developed by NREL's Cambium (mid case), indicates a need for 31 GW of installed batteries (up to 8h duration) by 2050. Preliminary studies from Berkeley Lab further indicate that an extra 14 GW would be needed if we want to remove the gas contribution.

Berkeley Lab is also interested in additional elaboration on the sweet spot for duration mentioned in slide 8? According to this statement, will it be unnecessary to have storage technologies that can provide 100h duration? Could it be the case that the range between 8 and 12 hours is selected as preferable because only representative days of the year are selected in the studies? A study considering a whole year (with at least an hourly granularity) could have increased the value of longer duration storages such as the 100-hour options.

We would also like to understand how the results may change if planning reserve margins are considered and it would be good to see the projected costs for LDES not only relative to Li but also in actual $/kW or $/kWh because the costs of Li can also vary, and the reference is not clear.

Berkeley Lab appreciates the opportunity to provide these comments in response to the CEC's Workshop on Understanding the Role of Long Duration Energy Storage in California's Evolving Energy System.

The following individuals contributed comments: Sumanjeet Kaur, Alexandre Moreira, and Miguel Heleno.

Sincerely,
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