

DOCKETED

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Comments on the benefits of Thermal Energy Storage and recommended support from EPIC funding

Additional submitted attachment is included below.

**STATE OF CALIFORNIA
BEFORE THE CALIFORNIA ENERGY COMMISSION**

Development of the)	
California Energy Commission)	Docket No. 20-EPIC-01
Electric Program Investment Charge)	
Investment Plans 2021-2025)	
)	

COMMENTS OF STORWORKS POWER

Storworks Power is pleased to respond to the issues raised by the California Energy Commission ("CEC") in its En Banc Webinar with the California Public Utilities Commission ("CPUC") pertaining to the Preliminary Draft Renewable Energy Generation Research Roadmap. In the Webinar held on October 8, 2021, the commission reviewed the EPIC 4 Investment Plan.

Public comments were solicited.

I. COMMUNICATIONS

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II. ABOUT STORWORKS POWER

Storworks Power is an Arvada, Colorado based organization with over 10 years of experience in developing very low-cost storage technologies.

Our Concrete Thermal Energy Storage ("CTES") systems are currently being evaluated and demonstrated by the Electric Power Research Institute ("EPRI") through their research program. The initial phase of the program conducted a risk assessment of the technology and characterized the system performance. The second phase of the program involves demonstration of a 10 MWh CTES system at an operational plant owned by the Southern Company. EPRI

applied for Department of Energy (“DOE”) funding for this CTES pilot and was awarded \$4 million of the \$5 million cost of the project from DOE.¹

III. COMMENTS

Thermal Energy Storage (“TES”) is increasingly an attractive technology that can provide significant benefits to California as the State works toward the goal of 100% zero carbon electricity by 2045. As wind and solar PV have become more competitive than traditional generation resources and their costs continue to decline, it is clear variable renewables will represent the majority of new generation procurement. The challenge for California is to identify the best way to incorporate these carbon-free resources onto the grid while maintaining safety, cost effectiveness and reliability of the electric system.

Today, during these periods of surplus energy the ISO's market automatically reduces the production of energy from renewable resources, or “curtails” energy generation. In instances when economic bids from generators are insufficient, ISO operators manually curtail production to maintain the balance between supply and demand.

While curtailment is an acceptable operational tool, with increasing renewable resources, oversupply conditions are expected to occur more often.

The Commission has concluded that although lithium-ion batteries (“LIB”) offer good performance in terms of efficiency and response, but alone cannot satisfy the need for long duration storage required by the grid. Part of the cost problem is that the life of LIB systems are inversely proportional to the number of charge-discharge cycles, so as these systems are utilized to a greater degree their lives can drop quickly.

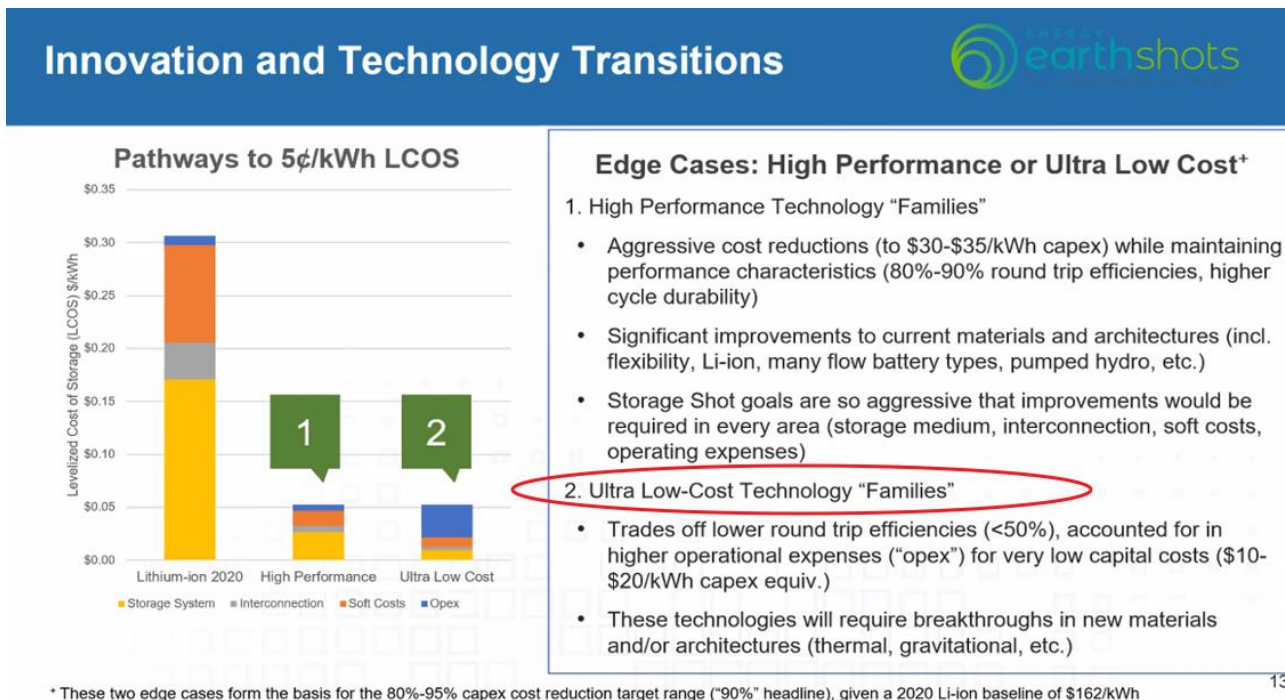
¹<http://www.globenewswire.com/news-release/2019/07/01/1876757/0/en/EPRI-to-Lead-5-Million-DOE-NETL-Project-to-Test-Concrete-Thermal-Energy-Storage-Technology.html>

There are thermal energy storage systems that can provide benefits for commercial and industrial applications such as making ice or chilled water to later provide air conditioning; these are well known.

The CTES is different in that it stores energy in the form of heat (up to and potentially above 600 deg C) and provides benefits to the bulk energy system. Providing long duration bulk storage with 20+ years of service life is where Thermal Energy Storage can play an important role, as outlined below. It is recommended that the Commission include thermal storage technologies in the EPIC program plan and demonstration programs.

A. We recommend that the ability of Thermal Storage to convert existing thermal plants into electricity storage facilities be included in the EPIC 4 program.

The use of thermal energy storage to recycle legacy assets and preserve the majority of the value of these assets results in the lowest cost solution for adding long duration storage to the grid. Even though the round-trip efficiency is lower than batteries, the much lower capital cost offsets this difference. The DOE recently published a graphic showing how this works:



The Department of Energy and many other entities have recognized the value of existing thermal facilities that will be lost if these facilities are simply allowed to close:

Table 1. Services typically provided by synchronous generators that will also be needed in largely inverter-based grids	
System stability	
Frequency stability	Ability of the system to automatically respond to deviations in system frequency
Voltage stability	Ability of the system to maintain voltage within safe limits
Rotor angle stability	Ability of synchronous machines to remain synchronized after being subjected to a disturbance
Power-system protection	Ability to detect and respond to overcurrent conditions (faults) such as short circuits
Voltage control	Ability to form and regulate a 60 Hz waveform at the appropriate voltage at multiple points on the power system
Black start	Ability to provide power and energy to start other generators and establish a reference frequency after a system outage

Another advantage of repurposing existing assets is preserving jobs and tax base while reducing or eliminating toxic emissions in disadvantaged communities where these generators often operated.

B. Thermal Energy Storage can transform carbon-free resources designed to operate as baseload generation into flexible resources while increasing their peak capacity. This provides needed balancing services while increasing the contribution to resource adequacy. It is precisely the type of firm zero-carbon resource envisioned by Senate Bill 423, signed into law by Governor Newsom last month.

Geothermal generation is carbon-free but not flexible in output. The addition of thermal energy storage would allow these assets to operate between zero output to nearly twice the

original output while keeping the actual thermal output of the source of heat (the geothermal field) at a constant level.

The addition of the CTES system allows the geothermal system to operate in accordance with the needed output to match the net generation requirements after the contributions from solar (the “duck curve”). This benefits the California grid by providing more carbon free peak capacity to meet resource requirements and benefits the economic viability of geothermal systems by providing for the sale of energy when prices are higher and also providing higher resource adequacy payments.

C. Thermal Energy Storage can dramatically improve the financial performance of Combined Heat and Power (CHP) systems by decoupling the schedules of electricity generation and steam generation in industrial and agricultural processing applications.

Many CHP systems have a fixed schedule for providing steam to various processes and are forced to generate electricity according to that schedule. In most cases, the generation schedule has poor correlation with the highest clearing prices resulting in lower revenues from the sale of electricity. Thermal Energy Storage allows the generation schedule to be optimized around prices while still meeting the steam schedule because the surplus heat from the electricity generation is stored until needed, at which time it is converted into steam.

IV. CONCLUSION

- There is an increasing need for flexibility and firm zero-carbon resources in the electricity system to support near-, mid-, and long-term reliability and resiliency of California’s electrical grid.
- TES costs are low and continuing to decline
- TES can provide low cost, long duration storage

- TES can minimize stranded asset costs
- TES can preserve jobs and tax base while eliminating emissions
- TES can help reduce localized air pollutants and emissions of greenhouse gases, including early priority in disadvantaged communities

Storworks Power appreciates the opportunity to provide these comments. Including support for the development and demonstration of Thermal Energy Storage systems advances California's policy that renewable energy and zero-carbon resources supply 100% of electricity to California customers by December 31, 2045.

Respectfully submitted,

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