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RCAM Comments on EPIC 2021-2025 Investment Plan Scoping - Draft Initiatives for EPIC 4

Please see the document uploaded with this comment.

Additional submitted attachment is included below.

Comments on
Electric Program Investment Charge 2021-2025
Investment Plan Scoping - Draft Initiatives for EPIC 4

Research Idea Exchange, Docket Log (20-EPIC-01)
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RCAM Technologies, Inc. (RCAM) is a growing international energy storage and renewable energy technology development company with offices in California, Colorado, and Scotland. We offer the following public comments regarding the Draft Initiatives for EPIC 4 Workshop held on August 4, 2021.

Response to Question 1: ***What is your top-priority initiative where you believe the most funding and emphasis should be placed because it could have the most significant impact?*** RCAM's top priorities are:

> ***Initiative 1. Floating Offshore Wind Energy Technologies.*** According to California's SB 100 Joint Agency Report, at least 10 GW of floating offshore wind (FOW) capacity will be needed to meet California's 100% by 2045 clean energy target. However, no utility-scale floating wind has been installed so far in California or the US. EPIC Investments are necessary to advance technologies that reduce the cost of floating wind and maximize the manufacturing benefits to Californians.
>
> ***Initiative 5. Long Duration Energy Storage*** *(LDES)* is an equally high priority for California from RCAM's perspective. Although the need for LDES may be less pressing than FOW, LDES is a tougher problem to solve with no cost-effective LDES solutions commercially available today that can be quickly deployed in California or abroad. LDES is essential to high penetration levels of renewable energy, however, low cost, abundant LDES remains a grand challenge for California and internationally.

Response to Question 2: ***Are there any gaps in the proposed research?*** RCAM believes that the Investment Plan, as written, may have two potential gaps:

> **Potential Gap 1: Advanced and innovative forms of Pumped HydroElectric Storage (PHES).**
>
> Conventional Pumped Hydroelectric Energy Storage (PHES) is the most prevalent long duration storage (LDES) in California and internationally due to its low cost, proven operation, high energy capacity, and efficiency. California has the most pumped storage capacity, with 3.9 GW, or 17% of the national total, and approximately 93% of California's total storage capacity.[1] However, new deployments of PHES are limited by lack of suitable geography, environmental concerns, and challenging financing due to high capital costs, long development times, and limited ability to scale up manufacturing and deployments horizontally.[2]

[1] California ISO Discussion Paper "*ENERGY STORAGE, Perspectives from California and Europe"* 2019. *https://www.caiso.com/Documents/EnergyStorage-PerspectivesFromCalifornia-Europe.pdf*

[2] Horizontal scaling (aka scaling out) refers to adding additional energy storage units (such as M-PHES) or renewable energy units (i.e. wind turbines or solar panels) to infrastructure to cope with new demands.

RCAM is developing an innovative Marine Pumped HydroElectric (M-PHES) solution that has potential to provide all the benefits of conventional PHES, but addresses the geographic and scaling limitations of conventional PHES. M-PHES is a disruptive LDES technology that expands pumped hydro potential resource capacity approximately 200x in California and can be deployed gradually as needed either independently, or synergistically with new offshore wind deployments as wind/LDES hybrid power plants.

The US has approximately 75,000 GWh and 3,750 GW of M-PHES capacity,[3] most of which exists in the deep waters of California. RCAM refers the Commission to its July 30, 2021 response[4] to the *EPIC Investment Plan 4 Long Duration Energy Storage Workshop* for more details about M-PHES and its benefits to California.

RCAM requests that staff add "*innovative pumped hydro storage*" as a possible LDES solution for California's LDES needs. The absence of the any text describing M-PHES in Initiative 5 of the Staff's *Draft Initiatives* may indicate a gap in the proposed research. For reference, the Draft Text presently lists technologies that need development and demonstration as:

> "such as, but not limited to flow batteries, advanced battery chemistries, flywheels, compressed air, liquid air systems, molten salt, molten sulphur, and chemical storage of green hydrogen and green methane"

Given PHES is the dominant form of energy storage in California, and the vast potential of the innovative M-PHES technology, **RCAM believes it is critical that the CEC explicitly include innovative pumped hydropower technologies in the list of example LDES technologies in Staff's Proposed Draft Initiatives to help ensure M-PHES can be considered in future EPIC solicitations.**

Potential Gap 2: The combination of energy storage and renewable energy systems into Hybrid Power Plants: Recent R&D and commercial interest into utility scale hybrid energy systems is a timely R&D opportunity that is not explicitly mentioned in the Draft Initiatives and appears be a second R&D gap. In short, hybrid energy systems would allow California to synergistically combine and deploy the most efficient and smallest carbon footprint technologies (i.e., pair the-best-with-the-best) such as offshore wind and pumped hydro storage to solve the State's clean energy and energy reliability needs. As an example of the importance and timeliness of hybrid power plants, in CAISO, 89% of all solar capacity and 37% of all wind capacity in the queues is proposed as a hybrid as reported in a recent report by Lawrence Berkeley National Laboratory.[5] Combining emerging systems, such as offshore wind energy and Marine Pumped Hydro Electric storage as hybrid power plants, will likely result in new opportunities to reduce overall system cost by sharing electrical infrastructure, operations and maintenance systems, and improve overall grid reliability. However, CEC EPIC funding needs to explicitly allow for and potentially encourage the generation and storage systems to be co-designed and developed together in EPIC projects to realize these mutual benefits.

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[3] H. Hahn, D. Hau, C. Dick, and M. Puchta, "Techno-economic assessment of a subsea energy storage technology for power balancing services," *Energy*, vol. 133, pp. 121–127, Aug. 2017, doi: 10.1016/j.energy.2017.05.116.

[4] RCAM e-comment titled 'RCAM Technologies, Inc. Comments - RCAM Technologies' Long Duration Energy Storage Comments for docket #20-EPIC-01, EPIC 4 Investment Plan' was successfully submitted to Docket Number **20-EPIC-01** https://efiling.energy.ca.gov/GetDocument.aspx?tn=239117&DocumentContentId=72565.

[5] Wiser, Ryan H, Bolinger, Mark, Gorman, Will, Rand, Joseph, Jeong, Seongeun, Seel, Joachim, Warner, Cody, and Paulos, Ben. Hybrid Power Plants: Status of Installed and Proposed Projects. United States: N. p., 2020. Web. doi:10.2172/1644289 https://www.osti.gov/biblio/1644289

Response to Question 3: ***Do you have suggestions on changes to certain initiatives?***

As described in the prior responses, RCAM requests that advanced and innovative forms of Pumped HydroElectric Storage be explicitly added to Initiative 5 Long Duration Energy Storage as a technology as one of the storage technologies warranting further development and demonstration.

M-PHES has potential to provide ALL of the long duration energy storage needed by California to reach its 100% clean energy goals by 2045 while providing economic benefits and good jobs resulting from localized manufacturing and abundant regionally-available construction materials.

Thank you for your consideration of these comments.

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