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Energy Dome Response to Docket #23-ERDD-08

Additional submitted attachment is included below.

Energy Dome Response to Request for Information

Long Duration Energy Storage Demonstration Solicitation

Docket # 23-ERDD-08

Submission Date: February 16, 2024

LDES System Demonstration – questions aimed more for technology developers, but open to all respondents:

1. According to the California legislation that authorized the LDES program, all demonstration projects must have a system capacity of a minimum of 1 MW for at least 8 hours[1]. Given this requirement and the current state of your non-Li LDES, which of the following system sizes could you deliver in the next 18 months to 2 years? Additionally, which system size would help your technology reach the 200-400 MWh system size in the next 3-6 years?

- System size of 8-10 MWh
- System size of 10-20 MWh
- System size of 20-30 MWh

ED: The Energy Dome CO2 battery is currently ready to deploy at a scale of 20MW and 10 hours of duration (200MWh) with development of a larger base units outlined below. The ready-to-deploy system can be installed in 18 months from NTP. Energy Dome is currently installing a 200MWh system in Sardinia, Italy, is in contracting phase for a 200MWh system in the US with Alliant Energy and is actively seeking projects in California in this size range and larger.

2. What would be the range of the estimated project costs in a direct current (DC) configuration for demonstrating each of the three different system sizes listed in question 1 for your non-Li LDES system as a function of the location of deployment? Additionally, what would be the life expectancy of the demonstrated project? Would it be considered pre-commercial or commercial, and have an expected life of 10-20 years or longer? Please explain.

ED: A 200MWh system has an estimated turnkey cost in a range that is more than competitive than comparative duration Li-Ion. Further, this cost will come down with increased deployment.
The CO2 battery outputs AC current since it uses turbomachinery. No inverter is required.
The life expectancy for a system is 30+ years with no degradation or augmentation required and minimal O&M. This size of project would be considered a commercial system. The engineering is completed, and the supply chain has been established. A twin project to the proposed 200MWh system is already being installed, with another in contracting.

3. For the system sizes listed in question 1, what is the maximum amount of match funding

[1] Assembly Bill (AB) 205 (2022)
https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=202120220AB205

that a technology provider and selected end customer can contribute towards one of the proposed future grants - 20%, 30%, 40%, or higher?
ED: At the moment, Energy Dome can provide a small portion of match funds, along with a grant for the remaining portion.

4. What type of incentives can be leveraged to make a LDES system demonstration more attractive from a financial standpoint? What will be the maximum amount of incentive that a technology provider and selected end user could obtain for the system sizes listed in question 1?
ED: Capacity payments in a form, term and payment level sufficient to incent investment in LDES will encourage the deployment of LDES systems to help increase grid reliability. Furthermore, financially incentivizing services beyond reg up and reg down. Spinning reserve and inertia are benefits that non li-ion batteries, such as Energy Dome's CO2 battery, can provide. Beyond revenue stacking, Energy Dome's system can potentially qualify for up to 50% ITC under the IRA (30% prevailing wage, 10% domestic supply, 10% energy community).

5. Considering that California is aggressively planning to procure energy storage and has already approved over 8 GWs of Li-ion systems, when do you anticipate your non-Li system will be able to compete with Li-ion systems in terms of price and performance for a future commercial solicitation if the price range is $350-$450 per kilowatt-hour (kWh) delivered in a DC configuration? Please explain.
ED: Energy Dome is ready to provide a firm offer below the price range of 350-$450 per kilowatt-hour (kWh) delivered in AC configuration, removing the need for inverters.

6. What demonstration system size would be needed to persuade you to at least partially automate the majority of your LDES system manufacturing capability to deliver a future order in the range of 200-400 MWh in a 12-24-month delivery window?
ED: Energy Dome is prepared to deploy a 200MWh system in the next 18 months and will have one operational by Q4 2024.
a. What is the largest system on a kWh basis you have fielded and have been operating to date?
ED: Energy Dome has a 2.5MW / 4MWh operational demo plant on the island of Sardinia that has been connected to the grid and operational since May 2022.
b. What is the largest system on a kWh basis that you have a firm order to deliver in the next 12-18 months?
ED: Energy Dome will have an operational system of 200,000kWh (200MWh) by Q4 2024.

Demonstration Sites – questions targeting site hosts and adopters, but open to all respondents:
7. How can funded LDES projects better prioritize benefits for under-resourced (low-income and disadvantaged) communities and Tribes? Should benefits to under-resourced communities and Tribes be strict requirements in the solicitation or incentivized through solicitation scoring criteria bonus points? Should match fund requirements be reduced or

potentially eliminated? What are the potential barriers to the funding and development of successful LDES projects in under-resourced and tribal communities? Please explain. Specific examples are welcomed.

ED: The main issue for already funded LDES projects are interconnection times, models reflecting the commercial availability and characteristics (high efficiency, synchronous LDES) of technologies like the CO2 battery, and volume of customers/procurements targeting 8-10 hours outside of Li-Ion. Expediting the interconnection process for sites specifically in low-income and disadvantaged communities would encourage deployment of energy storage projects. Benefits to under-resourced communities and tribes should provide bonus points, rather than be a strict requirement in order to adequately analyze solutions on a technological and financial basis.

Match funds should be increased for projects in under-resourced communities and on tribal land but projects outside these areas should not penalized.

In Energy Dome's experience, under-resourced and tribal communities are ideal areas to deploy projects in order to bring jobs and financial security to the surrounding area. Energy Dome, in partnership with Alliant Energy, is contracting the deployment of a 200MWh CO2 battery in Columbia County with the support of the local tribal nation and college.

8. Should demonstration projects be required to be located in Tier 2 or 3 High Fire-Threat District areas (as defined by the CPUC[2])? Or should these siting locations be incentivized through solicitation scoring criteria bonus points? Please explain.

ED: To appropriately analyze technology, minimal site requirements should be required. Instituting more stringent site requirements will only eliminate technologies from consideration.

9. Do demonstration projects provide more value in certain service territories (i.e. investor owned utilities, publicly-owned utilities, community choice aggregators, rural electric cooperatives, and electric service providers)? If so, why?

ED: Demonstration projects provide the most value where they can eventually be upsized to grid-scale deployments. All of the above off-takers would greatly benefit from the learnings and increased grid-stability with the LDES installation. The value is not dependent on the type of off-taker but rather the mindset and end goal of the off-taker. The greatest value of a demonstration project is gained when upsizing to enhance the grid.

10. Is there any preference for behind-the-meter or front-of-the-meter demonstrations for the system size ranges listed in question 1? If so, why?

ED: No preference for location of the installation

a. For a behind-the-meter installation, does your LDES technology have any advantages to the utility regarding the utility interconnection agreement?

[2] California Public Utilities Commission Fire-Threat Maps and Fire-Safety Rulemaking https://www.cpuc.ca.gov/industries-and-topics/wildfires/fire-threat-maps-and-fire-safety-rulemaking

ED: The CO2 battery uses already existing and well-defined turbomachinery from established suppliers. This means all interconnection info is available. Furthermore, the CO2 battery is already undergoing the interconnection process in a different jurisdiction.

b. If you are considering a front-of-the-meter configuration, have you applied for a CAISO reservation? If so, when would that reservation become effective?

ED: No CAISO reservation has been applied for.

11. Are you considering a project for which the interconnection agreement is already approved?

ED: No.

California Environmental Quality Act (CEQA):

12. What would be the typical footprint range needed to deploy certain LDES systems for the three system size ranges listed in question 1?

ED: Each 20MW / 10h (200MWh) CO2 battery requires 10-12 acres of land.

13. When a GFO is posted, proposals are generally due to the CEC within 8 to 12 weeks, and the CEQA process is generally required for the CEC to award grant funding to a project. The CEC has learned from the initial LDES projects that the LDES systems have a greater footprint than systems exempted from CEQA. Therefore, an environmental impact report or negative declaration is normally required for the potential projects, as are other actions required by CEQA. For the system size ranges listed in question 1, how long would it take to complete the CEQA process (and the National Environmental Policy Act (NEPA) if applicable) for your LDES system, and approximately how much would these processes cost?

ED: In Energy Dome's experience, the CO2 battery to be installed in Sardinia is exempt from a full environmental impact assessment. We estimate a reduced timeframe for completion of the CEQA process.

14. Is it reasonable to require that all GFO applicants complete discretionary permitting and CEQA through their local public agency before submitting a proposal for a project in the sizes defined in question 1? Please explain.

ED: Energy Dome recommends that completion of discretionary permitting NOT be required before submission of a proposal. Completion of permitting should be a requirement for receipt of funding but requiring completion for proposal submission is too strict of a requirement.

15. If the timeline and costs are not feasible, what preliminary CEQA studies or information would you recommend be completed before proposals are submitted to the CEC? Additionally, how long would it take to complete the preliminary CEQA studies or information for your proposed LDES technology for the system size ranges listed in question 1?

ED: All past environmental studies and/or exemptions should be included with proposal submission. We do not expect a prolonged study process considering the simplicity of the CO2 battery. It will depend on the backlog and efficiency of the CEQA.

16. What environmental process would be required if your project were not subject to CEQA? Additionally, how long would it take to complete the environmental process for your proposed LDES technology for the system size ranges listed in question 1?
ED: Without the CEQA, the environmental process includes standard geotechnical analysis and notifying local authorities of the potential hazards due to the presence of CO2. This includes providing a safety and response plan. This is a lean task and does not require substantial time to complete. There are no hazardous materials present in the CO2 battery which greatly minimizes the environmental process.

Greenhouse Gas (GHG) Reductions:
17. As stated in the "Background" section of this RFI, the funds are provided by GGRF, and therefore, CEC is required to track GHG reductions provided by the installed systems.
a. What combination of LDES and renewables is needed to maximize the GHG reductions from a project?
ED: Using PV or wind to charge the CO2 battery during periods of overproduction, while discharging the battery daily to peak shave will maximize GHG reductions.
b. Is there a difference in what your technology can provide in GHG reductions if installed in a behind-the-meter or front-of-the-meter configuration?
ED: No. The CO2 battery can be used effectively either behind or front-of-the-meter for multiple applications such as firming the use of renewable resources to eliminate peaks and valleys in pricing or replacing the use of traditional peaking plants to eliminate the usage of fossil fuels.

Others
18. What lessons have you learned from the LDES projects you have demonstrated, deployed, or operated to date? What major technical, economic, or policy barriers have affected the demonstration, deployment, or operation of LDES systems in the last two to four years? What are some potential solutions to these barriers? How can future funding from this GFO help solve these barriers?
ED: The operational commercial demo plant has provided valuable operational data as well as the implementation of design changes such as the optimal setup for the CO2 drying system. Also, in the process of deploying the full-scale system we have finalized the system design and all associated civil works. The commercial demo plant has undergone multiple third-party analyses.

From Energy Dome's perspective, the major factor affecting the deployment of LDES deployment is the Department of Energy's cost-share grant which Energy Dome was selected for. This funding not only encouraged multiple utilities to consider Energy Dome's technology, but for Alliant Energy to apply and secure 50% cost-share for a 20MW / 10h (200MWh) project. This is currently slated to be the first CO2 battery in the US.

Barriers to deployment include no value to extended energy capacity and prolonged interconnection times. By not having a capacity market in CAISO, LDES is not rewarded adequately for the grid support it inherently provides. Interconnection times threaten to delay the COD of new projects.

19. Are there any additional comments or input you want the CEC to consider as they develop this future GFO?
ED: N/A

Contact Information

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