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Berkeley Lab Response RFI - Geothermal Power & Lithium Recovery (23-ERDD-01)

Please see response attached.

Additional submitted attachment is included below.

September 15th, 2023
California Energy Commission Docket Unit, MS-4
715 P Street
Sacramento, California 95814

Re: Lawrence Berkeley National Laboratory Response to RFI Geothermal Power & Lithium Recovery (23-ERDD-01)

To Whom it May Concern:

On August 17th, the California Energy Commission posted an RFI to the CEC website on **Geothermal Power and Lithium Recovery (Docket # 23-ERDD-01)** to gather information on critical challenges and research needs for geothermal power production and lithium recovery from geothermal brine. Berkeley Lab is pleased to present our response below:

Geothermal Power

1. What technical barriers have the largest impact on development of geothermal power plants that use hydrothermal resources in California? How could research and development (R&D) funding be most effectively applied to help increase deployments of new geothermal power plants that use hydrothermal resources in California? What high priority technical barriers have been the most underfunded, and why have they not been adequately addressed by competitive markets?
 - It has been many years since a comprehensive geothermal resource assessment has been conducted for California (for both high temperature systems as well as lower temperature resources that could be utilized for direct use applications). This could also include consideration of the use of depleted oil and gas reservoirs for geothermal energy storage.
 - Improved exploration methods for identifying and characterizing hydrothermal systems - this is especially critical for finding blind hydrothermal systems (i.e., those with no surface thermal features). Improved geophysical methods (such as gravity, magnetics, magnetotellurics, seismic, thermal imaging, lidar), and integration of different data types to formulate comprehensive 3D models are needed to reduce the risk and costs for geothermal exploration. Some of these methods are being applied to the GeoFlight project in the Imperial Valley (<https://www.energy.gov/eere/geothermal/geoflight>) - it would be helpful to expand this approach to explore for geothermal resources in other parts of California.
 - Improved models and techniques are needed to identify zones of subsurface permeability. This would improve well success for both exploration and development drilling. Some of these approaches are being developed in the Ingenious project (<https://gbcge.org/current-projects/ingenious/>) being conducted in the Great Basin region - it would be useful to leverage their work and apply it to California.
 - Improved well stimulation methods could assist in the use of low permeability wells and also facilitate the development of enhanced geothermal systems (EGS), which would expand the potential resource base.
 - New technologies for drilling and completion of geothermal wells could increase the utilization of geothermal resources by greatly reducing the costs associated with geothermal exploration and development.



Lithium Recovery from Geothermal Brine

4. What are the greatest technical barriers to the commercialization of lithium recovery from geothermal brine? What technologies provide the greatest opportunities to facilitate the commercialization of lithium recovery from geothermal brine? What would be the most effective use of R&D funding to advance commercialization of lithium recovery from geothermal brine? What specific technologies or approaches are presenting a particular challenge, and what are some alternatives?
- Managing high salinity fluids is a key technical challenge. Identifying what pretreatment steps are needed prior to direct lithium extraction will be important. This will be especially important when moving from bench-scale to commercial-scale operations. Developing detailed geochemical modeling approaches that will allow numerical simulation of these processes would be helpful.
 - Having robust lithium extraction media that can be repeatedly used to recover lithium from the brine will be critical for commercial-scale operations.

Berkeley Lab appreciates the opportunity to provide these responses which may inform a future grant funding opportunity (up to \$23M in grant funding) addressing the Electric Program Investment Charge (EPIC) 2021-2025 Investment Plan Topic 2 “Advancing Geothermal Energy and Mineral Recovery Technologies.”

The following individual contributed comments: Pat Dobson, *Staff Scientist, Earth and Environmental Sciences Area.*

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