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Additional submitted attachment is included below.

California Energy Commission
Request for Information: Docket # 23-ERDD-01
Geothermal Power and Lithium Recovery

COMMENTS OF BHE RENEWABLES, LLC

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BHE Renewables, LLC (BHER) appreciates the opportunity to submit comments on the California Energy Commission's (CEC) Request for Information (RFI) to gather information on critical challenges and research needs for geothermal power production and lithium recovery from geothermal brine.

BHER is a wholly-owned subsidiary of Berkshire Hathaway Energy Company and an independent power producer for the wholesale market and customers under power purchase agreements. BHER is a leader in the development and production of energy from geothermal resources with facilities that operate as CalEnergy Operating Corporation in Calipatria, California. Since 1982, the company has owned and operated 10 geothermal power plants with the capacity to produce 345 megawatts in the Imperial Valley and has plans to expand its geothermal capacity in the coming years. BHER also exploring the feasibility of recovering lithium from the geothermal brine at its existing operations.

Pursuant to the RFI Response Guidelines, BHER provides the following responses to the RFI questions.

Geothermal Power

1.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?

Funding for R&D to address the following technical challenges would likely improve the performance, reliability and cost improvements for current and future geothermal power facilities in California's Salton Sea region:

- Develop online chemical and brine flow monitoring for the geothermal power process that can tune plant controls as a whole system (i.e., comprehensive brine management). This could likely be achieved with tuning currently available technology. Additionally, online monitoring systems for different critical equipment and systems, such as steam trap monitoring and battery monitoring systems, could provide real time operational parameters and performance, reduce operation and

maintenance workload, identify issues at an early phase and prevent equipment failure.

- Research and develop methods, designs and equipment that minimize scaling during plant trips, curtailments and abnormal conditions. During such conditions, the scaling rate can increase dramatically, or thermal cycling can cause scale to dislodge from the walls of equipment and restrict brine flow downstream. Both scenarios can result in potential power plant derates and/or planned outages.

- Research and develop transmission line insulator coatings that are extremely hydrophobic, minimize salt formation and can be cleaned or applied while insulators are energized. Every summer, BHE Renewables experiences insulator tracking or flashovers that cause plant trips. The plant trips contribute to upsets, derates, unplanned outages and reduced reliability. The opportunity to perform line maintenance is minimal because the plants keep the lines energized continuously.

- Research and develop a more robust instrumentation that can withstand scaling and corrosive environments, including in the steam process. Examples include (but are not limited to) two-phase flow measurement that tolerates scaling environments and level-measurement that can recognize or differentiate foam from fluid.

- Research to improve solids and silica (filter cake) management through faster settling of particles and/or through a reduction in dissolved silica. Additionally, seek best practices and lessons learned from mining and water processing industries to optimize or seek alternative methods of fluid clarification through solids management.

- Explore the potential of filter cake as a sellable and/or usable product.

- Develop a cooling water side stream filtration system, which can remove the suspended solid from the cooling water and then reduce the main condenser and inter-condenser tube fouling, improve cooling efficiency and generation performance and minimax the maintenance and outage costs.

- Develop improved power backup systems for production wellhead valve control. It is critical to have remote well control during any blackout situation.

- Develop alternative solutions to managing salt precipitation through reliance on dilution water.

Lithium Recovery from Geothermal Brine

4. What are the greatest technical barriers to the commercialization of lithium recovery from geothermal brine?

The greatest technical barriers are mineral management and the variation in brine characteristics.

4a. What technologies provide the greatest opportunities to facilitate the commercialization of lithium recovery from geothermal brine?

Ion exchange and adsorption technologies are the Direct Lithium Extraction (DLE) technologies that provide the greatest opportunities to facilitate lithium recovery from geothermal brine. Additional technologies can be used in the pretreatment and post-treatment steps of lithium recovery.

4b. What would be the most effective use of R&D funding to advance commercialization of lithium recovery from geothermal brine?

The most effective use of R&D funding to advance commercialization is to develop a substitute for Inductive Couple Plasma (ICP) analyzer that can measure brine chemistry within the pipeline and process for continuous monitoring and control.

4c. What specific technologies or approaches are presenting a particular challenge, and what are some alternatives?

Pretreatment methods that use solid precipitation can result in additional waste streams. Membrane or electrochemical approaches may serve as alternatives that would not require solids handling nor generate large waste streams.

5. What brine pretreatment issues have been especially challenging to overcome?

The most challenging brine pretreatment issues are mineral management and the variation in brine characteristics.

6. What technologies or processes can reduce waste products from the lithium recovery process (such as by decreasing mass or by recovering additional co-products in the lithium recovery process)?

Technologies or processes that can reduce waste products from the lithium recovery process are recycling/reusing process wastewater, reusing spent acids, and finding ways to reduce or reuse solid waste.

7. What co-products are the most feasible to recover?

Zinc, manganese, and potash are some co-products that might be recovered from geothermal brine.

7a. What technologies or processes are available to produce them?

Electrochemical and membrane technologies are possible technologies that may be available to produce the co-products.

7b. What TRL are these technologies?

While it depends on the technology, TRLs range between 3-5.