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Resources for the October 28, 2021 Lithium Valley Commission Meeting to Inform Discussion of Environmental Impacts

This document provides a list of identified resources compiled to inform the discussion at the October 28, 2021, Lithium Valley Commission Meeting and Environmental Impacts Workshop. These resources address a range of topics and have been compiled to assist the Lithium Valley Commission's discussion of the key statutory requirements for the Lithium Valley Commission report related to the topic of environmental impacts, including a discussion of:

- Safe environmental methods and standards for lithium extraction from geothermal brines and how this compares to other methods for deriving lithium.
- Potential environmental impacts to the state resulting from extraction, processing, and production of lithium and lithium-dependent products from geothermal brines.

Robust environmental impact assessments of proposed projects to conduct mineral recovery from geothermal brines at existing geothermal power plants and proposed projects for new geothermal power plants with integrated mineral recovery components will be completed consistent with the requirements of the California Environmental Quality Act (CEQA), National Environmental Policy Act (NEPA), and other state and local environmental review and local planning requirements. These assessments are outside the scope of the legislative mandate for the Lithium Valley Commission report, but these environmental review processes may help inform aspects of the report. Reports and documents developed for compliance with CEQA, NEPA and other planning and permitting requirements may be useful resources that provide understanding of the range of impacts. However, the efforts of the Lithium Valley Commission will more generally identify and assess those topics as described in Assembly Bill 1657 (E. Garcia, Chapter 271, Statutes of 2020), which identifies the requirements for the Lithium Valley Commission report to the legislature. This analysis, although more narrow than full CEQA or NEPA reports, must still recognize the complex relationship of lithium production within the existing regional conditions and further distinguish the impacts and benefits associated specifically with lithium production from those associated with the siting and operation of geothermal power plants where colocated lithium facilities operate.

For purposes of the Lithium Valley Commission activities and report, the analysis must also consider impacts related to production of lithium from other extraction methods as compared to those from technologies that recover lithium from geothermal brines.

Regional Considerations

Any discussion of environmental impacts must first recognize the current regional conditions and efforts to restore the Salton Sea area. Air quality and ecological threats at the Salton Sea are being addressed by the California Natural Resources Agency, California Department of Fish and Wildlife, and California Department of Water Resources through implementation of the Salton Sea Management Program (SSMP). Phase 1 of the SSMP is a 10-year plan to construct projects that create critical environmental habitat and reduce dust from the exposed lakebed,

while evaluating the feasibility of water importation for restoration of the Salton Sea. See [Salton Sea Project](https://saltonsea.ca.gov/) (<https://saltonsea.ca.gov/>).

Impact Considerations of Co-located Recovery of Lithium from Geothermal Brines at Geothermal Energy Power Plants

Geothermal power is a clean source of energy that has the unique characteristic of providing baseload power not subject to intermittency or variability related to weather and climate conditions, and, as such, plays a critical role in the state's progress to providing 100 percent zero-carbon energy by 2045 and economy-wide carbon neutrality by 2050. Energy sector planning models project the need for additional geothermal development in the state's known geothermal resource areas including the Salton Sea region. For purposes of the Lithium Valley Commission report, it is important to understand and distinguish potential impacts associated with the geothermal power plant from those associated with the lithium recovery components.

There are three current lithium recovery projects in planning or development phases in the Salton Sea region. The unique design of each project should be considered in an analysis of environmental impacts; however, only one of the three projects has reached a stage where environmental studies discussing impacts have been completed. As the other projects noted below are still in planning stages the environmental impacts are more generally discussed in planning documents, as noted. The following provides a brief summary of each of the three projects with references for documents describing impacts and considerations.

Energy Source Minerals

EnergySource Minerals is planning to build a lithium extraction facility at its Featherstone power plant, with operations potentially beginning in 2024 (EnergySource 2021). EnergySource Minerals has reported successful completion of pilot testing of its patented Integrated Lithium Adsorption Desorption (ILiAD) technology, which combines lithium selective sorbent with continuous bed processing. Environmental analysis documents for this project include the [Final Environmental Impact Report for the Energy Source Mineral ATLiS Project](https://www.icpds.com/assets/hearings/02.-WSA,FIER,-MMRP,-CUP20-0008,-PM02485-Energy-Source-Mineral-ATLiS-PC-Pkg.pdf), available online (<https://www.icpds.com/assets/hearings/02.-WSA,FIER,-MMRP,-CUP20-0008,-PM02485-Energy-Source-Mineral-ATLiS-PC-Pkg.pdf>).

Berkshire Hathaway Energy Renewables (BHE Renewables)/BHER Minerals, LLC

BHER Minerals, LLC, (a subsidiary of Berkshire Hathaway Energy) began the Salton Sea Geothermal Lithium Recovery Demonstration Project in 2020 with financial support from California Energy Commission through the Electric Program Investment Charge. The demonstration facility will be sited at an existing geothermal power plant, with the project managed by BHER Minerals (wholly owned subsidiary of Berkshire Hathaway Energy). Current environmental analyses have been limited to initial project activities such as design, engineering, permitting, technoeconomic analysis, coordination, and technology transfer planning. These tasks are limited to intellectual, academic, or

analytical activities and will help to define the remaining project tasks which will require further analysis.¹

Controlled Thermal Resources

Hell's Kitchen Geothermal, LLC, a subsidiary of Controlled Thermal Resources (CTR) is in the planning phase for the Hell's Kitchen project, described as a hybrid geothermal power-lithium extraction operation. The current plan is for a 49.9-megawatt power plant and 20,000 metric ton/year lithium hydroxide production with operations potentially beginning in 2024. The current phase of this project includes design and planning activities; and, therefore, no project specific environmental analysis documents are available at this time.² ThinkGeoEnergy, an information services provider for the global geothermal energy sector, published a 2020 interview with Rod Colwell, CEO of CTR; the article discusses the plans for the Hell's Kitchen facility, including CTR's description of impact and cost effectiveness considerations. The article is available online at "[Environmentally friendly direct lithium extraction from geothermal – Interview with Rod Colwell, CEO of Controlled Thermal Resources](https://www.thinkgeoenergy.com/environmentally-friendly-direct-lithium-extraction-from-geothermal-interview-with-rod-colwell-ceo-of-controlled-thermal-resources/)" (<https://www.thinkgeoenergy.com/environmentally-friendly-direct-lithium-extraction-from-geothermal-interview-with-rod-colwell-ceo-of-controlled-thermal-resources/>).

Impacts from Lithium Production – Comparison of Traditional Extraction and Geothermal Brine Recovery Methods

Multiple resources cited in resource lists prepared for prior Lithium Valley Commission workshops include summaries of the current methods employed globally to source lithium and include information on the impacts associated with each method. The prior resource lists are included in the [Lithium Valley Commission docket](#) (<https://efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=20-%20LITHIUM-01>).

Among the resources previously identified is a study from the National Renewable Energy Laboratory (NREL), [Techno-Economic Analysis of Lithium Extraction Technologies](#) (<https://www.nrel.gov/docs/fy21osti/79178.pdf>). This report is part of an effort to assess geothermal brines as a source of commercial lithium supply for the United States.

In addition, the following articles provide an overview of methods that produce lithium from geothermal brine compared to other lithium extraction methods, as well as impacts associated with these methods.

1 [NEPA Determination. Project Title: Electrolytic Production of Battery-Grade LiOH H2O from Geothermal Brine.](#) Recipient: BHER Minerals, LLC. <https://www.energy.gov/sites/default/files/2021-07/CX-023971.pdf>. Imperial County, September 3, 2021.

2 [Hell's Kitchen Geothermal Lithium Extraction Pilot](#), SCH 2020080039, Notice of Exemption, Hell's Kitchen Geothermal LLC. August 2020. <https://ceqanet.opr.ca.gov/2020080039/2>.

- In August 2019, Alex Grant, co-founder of Lilac Solutions (a direct lithium extraction company), wrote "[EXPLAINER: Overview of Direct Lithium Extraction \(DLE\) from Geothermal Brines](https://finfeed.com/features/explainer-overview-direct-lithium-extraction-dle-geothermal-brines/)," (https://finfeed.com/features/explainer-overview-direct-lithium-extraction-dle-geothermal-brines/) published in the Finfeed newsletter. The article describes current technologies and summarizes four environmental considerations of recovering lithium from geothermal brines in different geographic regions and using different technologies.
- In November 2020, the BBC.com published "[The new 'gold rush' for green lithium](https://www.bbc.com/future/article/20201124-how-geothermal-lithium-could-revolutionise-green-energy)" (https://www.bbc.com/future/article/20201124-how-geothermal-lithium-could-revolutionise-green-energy) in its Future Planet section. The article compares certain environmental impacts associated with different lithium extraction methods including estimated CO2 emissions, use of water, and use of land per metric ton of lithium recovered.