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Filer:	Elisia Hoffman
Organization:	Fervo Energy
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November 30, 2023

California Energy Commission
Reliability Analysis Branch
715 P Street
Sacramento, CA 95814

Re: Docket No. 21-ESR-01 Comments of Fervo Energy responding to the Commissioner Workshop on SB 423 Emerging Renewable and Firm Zero Carbon Resources

Dear Vice Chair Gunda, Commissioners and Staff:

Fervo Energy (Fervo) appreciates the opportunity to provide public comment on the Commissioner Workshop on SB 423 Emerging Renewable and Firm Zero Carbon Resources. Fervo acknowledges that this workshop presents the state with an opportunity to enhance reliability as the state moves towards meeting its SB 100 goals. Fervo recognizes the California Energy Commission's (CEC) role in the state's energy planning process in consultation with the California Public Utilities Commission (CPUC) and the California Independent System Operator (CAISO), especially as it concerns the integration of firm, baseload renewable energy sources into the state's electricity grid.

I. About Fervo Energy

Fervo is a developer of utility-scale enhanced geothermal systems (EGS) projects with lease holdings across the west, including California, and is actively developing projects to support the California grid, including the 400-megawatt Cape Station project in Beaver County, Utah. Cape Station will deliver its first phase of carbon-free electricity to the California grid in 2026 to support power purchase agreements (PPAs) with several California Load Service Entities (LSEs) in response to the California Public Utility Commission's procurement order for 1,000 MW of firm, dispatchable geothermal energy no later than 2028.¹

Fervo is at the forefront of utilizing advanced subsurface technologies and drilling techniques for the development of next-generation geothermal energy. Fervo's utility-scale pilot project, Project Red achieved commercial operation this year, and is currently powering Google's data centers in

¹ CPUC, D. 21-06-035 (2021), *available at*, <https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M389/K603/389603637.PDF>

Nevada.² The success of Project Red confirms that EGS is commercially viable and ready to scale.³ EGS opens access to a massive set of new subsurface heat resources and increases the capacity of projects to harness them. Larger projects and more abundant resources mean that EGS is rapidly increasing the geothermal industry’s ability to deliver reliable power across the west.

The geothermal industry is currently undergoing a revolution of innovation. In part due to California’s leadership on reliability and grid decarbonization, next-generation geothermal technologies are available to play a critical role in supporting a reliable and affordable carbon-free grid. Fervo is excited to work with the CEC to integrate these new clean firm technologies and resources into the SB 100 planning process to ensure a smooth and cost-effective pathway to a fully decarbonized grid.

II. Introduction

Fervo commends the CEC’s focus on planning for a zero-emission energy future. SB 423 requires the CEC to identify commercially available firm zero-carbon resources that can bolster grid reliability while mitigating greenhouse gas emissions and pollutants. Fervo’s operating commercial project in Nevada, and 400 MW project being drilled in Utah demonstrate that EGS is currently experiencing rapid innovation and deployment-led cost improvement on its way to delivering zero-carbon, 24/7 power to Californians by 2026. In this comment, Fervo addresses modeling EGS resources and recommends strategies for the CEC to consider in its energy planning. Ensuring the CEC provides accurate data and insights on firm zero-carbon baseload resources are critical inputs for California's reliability outlook.

III. Discussion

A. Fervo strongly supports designating EGS as a “firm, zero-carbon resource” and applauds the recognition of EGS’s performance capabilities and technology readiness level.

In response to the CEC’s presentation on SB 423 Emerging Renewable and Firm Zero-Carbon Resources, Fervo commends the recognition of EGS as a “firm, zero-carbon resource”⁴ and the inclusion of the following in the report:

² Fervo’s commercial pilot became the most productive enhanced geothermal system in history after producing 3.5 MW of power during a 30 day well test earlier this year. On November 28, the project reached commercial operation, selling power to Google data centers in Nevada. Available at <https://blog.google/outreach-initiatives/sustainability/google-fervo-geothermal-energy-partnership/>

³ Norbeck, Jack; Latimer, Tim (2023): Commercial Scale Demonstration of a First of a Kind Enhanced Geothermal System. EarthArXiv, available at, <https://doi.org/10.31223/X52X0B>

⁴ The CEC’s working definition of “firm, zero-carbon resources” are “resources or combination of resources that reliably produce zero-carbon electricity on demand, ensuring a consistent and stable power supply for extended periods and/or are eligible for the Renewable Portfolio Standard (RPS).”

- Acknowledgement of Technological Maturity: Fervo appreciates the CEC’s recognition of EGS as a critical, reliable firm zero-carbon resource. This acknowledgment, in line with the “firm zero-carbon resource” definition and criteria, is significant, especially considering EGS’s Technology Readiness Level (TRL) of 9. This level indicates EGS’s transition from theory and pilot projects to full-scale, commercial deployment, affirming its readiness to contribute significantly to California’s renewable energy landscape. The CEC’s recognition of EGS at this technological readiness level is particularly crucial to adequately plan for California’s renewable energy ambitions. Accurate EGS modeling today will enable the state to diversify and strengthen its renewable energy portfolio, adequately representing EGS as a key player in achieving these goals. Fervo’s recent breakthroughs in EGS, namely Project Red, show the technology’s readiness to scale.
- High-Capacity Factor of EGS and Supporting EGS’s Operational Efficiency: Fervo concurs with the CEC’s assessment that EGS’s capacity factor is consistently above 80%. This high-capacity factor is a robust indicator of EGS’s ability to provide stable and continuous power, reinforcing its role as a reliable energy source for California’s diverse energy needs. The high-capacity factor of EGS, relative to other renewable energy sources, underscores its potential to enhance California’s energy resilience. In a landscape marked by growing energy demands and increasingly variable energy generation, EGS provides the weather independent, 24/7 power needed for a resilient, affordable, and sustainable grid.

B. Fervo recommends modifications to the EGS cost assumptions and emissions profile.

While Fervo supports the inclusion of ESG as a firm zero-carbon resource, there is additional clarification related to the role of ESG that will improve the report. Fervo respectfully urges the CEC to consider modifications in response to misconceptions about geothermal generally, and therefore inclusive of EGS, in the CEC staff presentation. We appreciate the opportunity to offer public comment, and we look forward to collaborating with the CEC on enhancing the final version of the report.

- Modernize EGS Cost Assumptions: The figures cited for both EGS’s Capital Expenditures (CAPEX) and Operating & Maintenance (O&M) significantly overstate the actual costs. Fervo kindly requests that the CEC share additional information with stakeholders on where staff obtained these figures. The National Renewable Energy Laboratory (NREL)’s Annual Technology Baseline (ATB)⁵ assessed NF EGS / Binary geothermal, at a significantly lower cost – approximately between \$17/kW and \$20K/kW in 2023, to between \$7K/kW and \$11K/kW by 2030.⁶ Geothermal drilling costs have

⁵ NREL’s ATB includes detailed cost and performance data (both current and projected) for renewable and conventional technologies over a designated period of time.

⁶ NREL, ATB Data, available at <https://public.tableau.com/app/profile/dana.stright1689/viz/shared/G5359HBD9>

often represented more than half of total project costs, so drilling performance improvement is critical to achieving durable cost reductions. Fervo's recent technological advancements have resulted in an 18-20% reduction of drilling days between wells and are ahead of projections set by the Department of Energy's (DOE) Enhanced Geothermal Shot Initiative.⁷ Learning curves in drilling result in significant improvements to CAPEX requirements. Fervo looks forward to collaborating with the CEC to adequately reflect the trajectory of this rapidly advancing industry. Lastly, Fervo also requests that the CEC include in its cost assumptions a projected range,⁸ how the learning curve reduces costs over time, and the market energy prices for publicly available geothermal contracts (using PPAs as an example). The inclusion of these numbers would provide more accurate cost assumptions that reflect closer actuals to the ones cited in the presentation.

- **Clarify EGS's Emission Profile:** The presentation states that the broad resource category of geothermal is a "low-emission" not "zero-emission" energy source. Fervo requests that the report considers important technological distinctions between different types of geothermal production technology. Binary Cycle power plants, such as those being developed by Fervo, are the most commonly built geothermal power plants today. These generators operate as a completely closed-loop system and have no air emissions.⁹ Rather than combining the emissions profiles of all geothermal technologies together, Fervo recommends that the CEC distinguish between geothermal generation types to provide greater clarity on the zero-emissions profile of Binary Cycle systems.

C. Fervo's responses to CEC's overarching themes and challenges: Interconnection and Permitting, Regulatory and Financial

As a leader in EGS, Fervo offers the following insights that can address these highlighted challenges:

- **Challenges in Interconnection and Permitting:** Efficient interconnection and permitting processes are vital for the successful integration of EGS into California's energy grid. The current interconnection process can be complex and time-consuming, posing significant barriers to timely project implementation. Integration into the CAISO grid is a critical step for long lead time clean firm projects. This step involves navigating various technical, regulatory, and market challenges that can significantly impact the feasibility and timeline of EGS projects. Streamlining this process is crucial for ensuring that EGS can contribute to California's energy needs without unnecessary delays.

⁷ DOE anticipates EGS will become a crucial component of the United States' clean energy portfolio.

⁸ Similar to the range the CEC presented on zinc non-flow under long duration energy storage.

⁹ DOE, Geothermal FAQs, available at <https://www.energy.gov/eere/geothermal/geothermal-faqs>

- Regulatory and Financial Considerations: California's grid planning process is drawing renewed attention to the need for clean firm generation. In addition to a procurement order for 1,000 MW of new geothermal generation by 2028, the CPUC is preparing to develop the Reliable and Clean Power Procurement Program (RCPPP) as part of the ongoing Integrated Resource Planning proceeding to enable regular procurement of long lead time, clean firm resources.¹⁰ These actions reflect the growing need for geothermal energy and a recognition of the urgency in commercializing innovative geothermal technologies. Furthermore, the passage of AB 1373 (E. Garcia, Chapter 367, Statutes of 2023) created a Central Procurement Entity (CPE). The CEC should consider how this new law, together with established and proposed action by the CPUC, alters options for procurement by various entities. The CPE should address specific procurement challenges unique to EGS, including the creation of tailored contracts that capture the distinct characteristics and value of EGS as a firm and reliable renewable resource, thereby streamlining its integration into the state's energy landscape.

IV. Conclusion

EGS is poised to transform California's energy landscape with abundant 24/7 clean energy from resources within the state and across the west. By integrating EGS into the state's renewable energy portfolio, California can achieve a more sustainable, reliable, and cost-effective energy future. Technological advancements in EGS, learning curves, dramatically declining costs, and environmental benefits position EGS as a key player in meeting California's energy goals, particularly in enhancing grid stability, within this decade.

Fervo recommends that the CEC recognize the strategic importance of EGS in energy planning and policy development, especially its technology readiness and its high-capacity factor. Fervo also recommends that the CEC correct assumptions made regarding EGS's cost and emissions profile. Fervo also requests the CEC cite in their report how to address the challenges in interconnection, and regulatory frameworks. These are crucial steps in realizing the full potential of EGS. The collaborative efforts of all stakeholders, including CEC, CAISO, developers, and regulatory bodies, will be essential in advancing EGS as a sustainable and reliable energy source for California.

Fervo is committed to contributing to California's clean energy future through the development and integration of EGS. We look forward to collaborating with the CEC and other stakeholders in this endeavor, ensuring a smooth transition to a decarbonized and resilient energy grid.

¹⁰ CPUC, R.20-05-003, Amended Scoping Memo and Ruling (2023), *available at*, <https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M518/K155/518155091.PDF>

Sincerely,

A handwritten signature in black ink that reads "Sarah Harper". The signature is written in a cursive style with a long, sweeping tail on the letter "p".

Sarah Harper
Policy and Regulatory Affairs Associate
Fervo Energy Company