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Industrious Labs & The 2035 Initiative at UCSB Comments on CEC Geothermal Workshop

Additional submitted attachment is included below.

Industrious Labs

July 23, 2026

Submitted Electronically

California Energy Commission
Docket Number 26-IEPR-01
715 P Street
Sacramento, CA 95814-5512

Re: Comments on the Geothermal Workshop for the 2026 Integrated Energy Policy Report Update (26-IEPR-01)

Dear Chair Hochschild, Vice Chair Gunda, and Commissioner Gallardo,

On behalf of the undersigned organizations, we appreciate the opportunity to comment on the California Energy Commission's ("CEC") two-day Geothermal Workshop for the 2026 Integrated Energy Policy Report ("IEPR") Update. The workshop underscored the breadth of California's geothermal opportunity, and we write to build on our March 25, 2026 comments urging the CEC to focus on a pathway that was highlighted in the workshop but remains underexplored in the state's planning, specifically the opportunity for the direct use of geothermal energy to decarbonize industrial process heat.

Most industrial process heat in California is still supplied by burning methane gas. Companies with decarbonization targets are implementing measures to reduce or even eliminate their emissions by replacing natural gas with electrified technologies, such as heat pumps, thermal batteries, and electrode boilers. However, even industrial climate leaders may not be considering geothermal as a clean heat solution, given its reputation as a power source and the small number of existing projects. The CEC is uniquely positioned to close this information gap. In the comments below, we offer three recommendations: 1) Map high-potential zones for direct use industrial heat; 2) Analyze the costs and benefits of the two direct use pathways: dedicated geothermal development for industrial heat versus waste heat offtake from a power plant; and 3) Convene developers and manufacturers to catalyze first projects.

I. Resource Mapping: ID High-Potential Zones for Direct Use Geothermal Industrial Heat

Right now, a key barrier to testing and demonstrating industrial applications of geothermal heat is lack of information regarding the opportunity, especially on the part of manufacturers. Most industrial process heat is currently provided by natural gas combustion. Companies with decarbonization targets are implementing measures to reduce or even eliminate their emissions by replacing natural gas with electrified technologies, such as heat pumps, thermal batteries, and electrode boilers. However, even industrial climate leaders may not be considering geothermal as a clean heat solution, given its reputation as a power source and the small number of existing projects. An analysis highlighting how geothermal energy can supply heat, in the form of steam or hot water, at temperatures required for industrial processes would constitute a crucial focal point for California facilities and geothermal developers to explore this opportunity.

We reiterate the recommendation from our March 25 comments that the CEC identify high-potential zones for pilot projects. At a basic level, the analysis could overlay industrial facility locations onto existing geothermal resource maps (for conventional geothermal opportunities) and geothermal temperature gradients (for enhanced geothermal opportunities). As Dimitri Saad of Stanford University noted in his presentation at the Commission's geothermal workshop, approximately 54% of California's industrial process heat demand is required at temperatures below 400°C[i], a range within reach of conventional hydrothermal resources.[ii] These temperatures are also achievable by next-generation geothermal systems, which produced temperatures of 290°C in 2025.[iii] The CEC should account for this fact in screening for industrial facilities best suited for direct use geothermal.

Clusters of industrial facilities in close geographic proximity merit special consideration, since connecting multiple facilities to a geothermal district heat system is likely to be among the most efficient ways to leverage direct heat. Aggregated demand across a cluster also strengthens the co-location case for geothermal developers weighing where to drill. We further recommend the CEC apply a CalEnviroScreen filter, so that the analysis surfaces where direct use development can deliver air quality and public health benefits to disadvantaged communities alongside industrial decarbonization.

The suitability analysis should consider additional dimensions such as fault lines, rock permeability, land rights, and proximity to nearby communities. This would not need to be done from scratch, as geothermal developers and other experts could provide input, data, and feedback on methods.

However, there are likely to be areas where additional data would be useful. The CEC's analysis should identify where additional subsurface data would materially improve site screening. The CEC should also examine Arizona's geothermal resource-characterization program as a model for how states can close those data gaps and improve desktop site assessments through a non-legislative, low-cost pathway.[iv]

Since gathering information about potential sites is costly for geothermal companies, this will ultimately help lower geothermal project risk and reduce overall costs. Crucially, this would also improve the analysis of high-potential zones for direct heat pilot projects. Ultimately, the CEC can help ensure that industrial direct heat potential is considered in geothermal and industrial siting decisions (which we explore further in Section III).

II. Cost Analysis: Dedicated Geothermal Development for Industrial Heat Versus Waste Heat Offtake from a Power Plant

Dimitri Saad of Stanford University in his presentation at the workshop mapped several routes by which geothermal energy can ultimately meet an industrial facility's heat demand.[v] First, hot geothermal water can be converted to electricity, which can then power electrified technologies to produce process heat. Second, electric power can also be used to produce fuel through power-to-gas, which is then combusted to generate heat. Third, hot geothermal water can serve the facility's heat demand without any intermediate conversion at all, which is known as “direct use.” Each additional conversion step introduces losses and equipment costs, which is why direct use, where the resource temperature and the process temperature are compatible, is the most efficient application of the resource.

In turn, direct use geothermal heat applications for industry can work in two ways:

1. An industrial facility can use heat that comes directly from the geothermal loop (via a heat exchanger);
2. Or, the heat can first be used to spin a turbine and create electricity. Then, the remaining “waste heat” is sent for use at an industrial facility.

There are costs and benefits associated with each type of system, but these are not yet well understood. We recommend the CEC conduct a cost comparison of the two direct use pathways over a defined period. This analysis could consider both standalone geothermal development for industrial process heat specifically, as well as arrangements where a facility pays a geothermal power plant to tap directly into a geothermal resource. Either way, prioritizing direct use wherever feasible avoids the double conversion loss of converting geothermal to electricity to then provide heat.

One advantage of using geothermal waste heat for industry is project economics for both developers and industrial users. With an organic Rankine cycle or flash steam turbine, only about 10% of the thermal energy in the steam gets converted to electricity. The rest has to be released as waste heat through costly cooling towers, which are a large expense for a geothermal power plant. Thus, selling this waste heat to an industrial facility instead saves money – even if it is sold at a very low cost to the facility. Whether in the form of waste heat or a direct tap into the resource, industrial heat offtake agreements can provide a valuable additional revenue stream to help make geothermal projects more bankable.

The CEC’s assessment should assess the temperatures achievable from geothermal waste heat streams. Organic Rankine cycle turbines – generally preferred by geothermal power plants – already operate at lower temperatures than flash steam turbines. Depending on the waste heat temperature, an industrial facility may need additional equipment to upgrade the steam to the temperature required by the process.

Finally, the cost analysis should account for the Manufacturing Decarbonization Incentive (“MDI”) Allocation established through the recent Cap-and-Invest Program Amendments as a potential funding source to help close the cost gap on early direct use projects.

III. Convening: Connecting Heat Generators With Heat Offtakers

In addition to providing valuable information and analysis to stakeholders, the CEC can also play an important role in facilitating connections between developers and industrial manufacturers. As we noted above, an important obstacle in the development of direct industrial heat projects is a lack of awareness regarding the market opportunity. The idea first needs to be socialized before uptake can accelerate. Connections also need to be made between private sector stakeholders without prior experience working together.

Alongside or as part of the IEPR process, the CEC should convene geothermal developers and manufacturers to present key findings and highlight the broader opportunity of geothermal for industrial process heat. Discussions could help clarify barriers to deployment on both sides, as well as identify policy solutions where possible. It would provide an opportunity for parties with mutual interest to connect. Arizona conducted a similar exercise when it convened developers to provide input on the state's geothermal policies.

Targeted state action is required to help identify specific best-case opportunities and support project agreements between companies. The IEPR and convening both play crucial functions in enabling these connections. More broadly, the report and convening will encourage geothermal companies to include opportunities for providing industrial process heat (i.e., proximity to existing facilities) in their siting decisions, while helping manufacturers to evaluate geothermal heat opportunities when siting new facilities.

IV. Summary of Recommendations

We urge the CEC to incorporate the following into the 2026 IEPR Update's geothermal assessment:

1. Map high-potential zones for direct use industrial heat: Overlay California's geothermal resource maps against CARB GHGRP industrial facility data, screening for facilities with process heat needs below 400°C, and add industrial clusters and CalEnviroScreen as additional filters. Advance more intensive geological screening to combine EGS potential with proximate industrial load, drawing on Arizona's low-cost, resource-characterization model.
2. Compare the cost of the two direct use heat pathways: Conduct a cost comparison, over a defined period, of direct use geothermal for industrial heat versus waste heat offtake from geothermal power plants, and account for the Manufacturing Decarbonization Incentive allocation as a funding pathway for early projects.
3. Convene developers and offtakers: Convene geothermal developers with potential manufacturers to socialize the opportunity and enable the deliberate matchmaking needed to bring industrial load to the resource.

V. Conclusion

The 2026 IEPR Update will shape infrastructure planning, regulatory action, market signals, and investment across California for years to come. Direct use of geothermal for industrial process heat is a significant and underexamined opportunity to cut emissions and criteria pollution without adding load to a constrained grid, and the CEC is well positioned to conduct the research to unlock its potential. We urge the Commission to adopt the recommendations set forth in these comments, and we thank the Commission and staff for a substantive and informative workshop.

Sincerely,

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[i] D.M. Saad, A.R. Brandt, and I.M.L. Azevedo, *Environmental Research Letters* (21), 2026.
[ii] Jared R. Peacock, Tait E. Earney, Margaret T. Mangan, William D. Schermerhorn, Jonathan M. G. Glen, Mark Walters & Craig Hartline, *Geophysical characterization of the Northwest Geysers geothermal field, California*, J. VOLCANOLOGY & GEOTHERMAL RSCH. (2020); *About The Geysers*, THE GEYSERS.
[iii] Fervo Energy, “Fervo Energy Drills 15,000-FT, 500°F Geothermal Well Pushing The Envelope For EGS Deployment”, June 10, 2025.
[iv] Katy Smith, "Arizona launches $1M geothermal resource study," University of Arizona Office of Research and Partnerships, March 12, 2026.
[v] Dimitri Saad, Stanford University, "The Potential of Enhanced Geothermal Systems in Decarbonizing the Electric Power and Industrial Sectors," Presentation at IEPR Workshop on Geothermal Resources, Docket No. 26-IEPR-01, TN 270856 (June 19, 2026), slides 24–29.