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**Geothermal Resources Council (GRC) Comments on SB 100 Report  
Draft Results**

*Additional submitted attachment is included below.*



September 15, 2020

**RE: Written Comments to SB 100 Draft Results Workshop  
SB 100 Joint Agency Report: Charting a path to a 100% Clean Energy Future**

Thank you for presenting the modeling work at the SB100 Draft Results Workshop. We welcome this review of California's SB100 goals and support California's development of 100% clean and renewable energy over the next 25 years. We appreciate all the hard efforts gone into these analyses; however, we need to change the approach that California is taking to develop a sustainable power mix and need strong leadership to achieve that change.

The Geothermal Resources Council (GRC) is the world's largest non-profit professional and trade association for the geothermal industry and community, serving the USA and with an international footprint. We champion the Earth's clean and renewable power source that's always available 24/7 beneath our feet. We were founded in 1972 and are registered in California.

The rolling blackouts that have occurred this summer took many Californians by surprise, forcing millions to fend without power during the already challenging conditions of a heatwave and a global pandemic. They are clearly caused by California running the power grid too close to the margin without robust power supplies able to cover times of system stress. This must change.

In response to broadscale de-energizations, Governor Gavin Newsom, [in a letter](#) dated August 17th, requested that the California Energy Commission (CEC), the California Public Utilities Commission (CPUC), and the California Independent System Operator (CAISO) immediately review "its resource adequacy requirements, existing procurement plans and demand response programs to ensure they provide the needed foundation for reliable power."

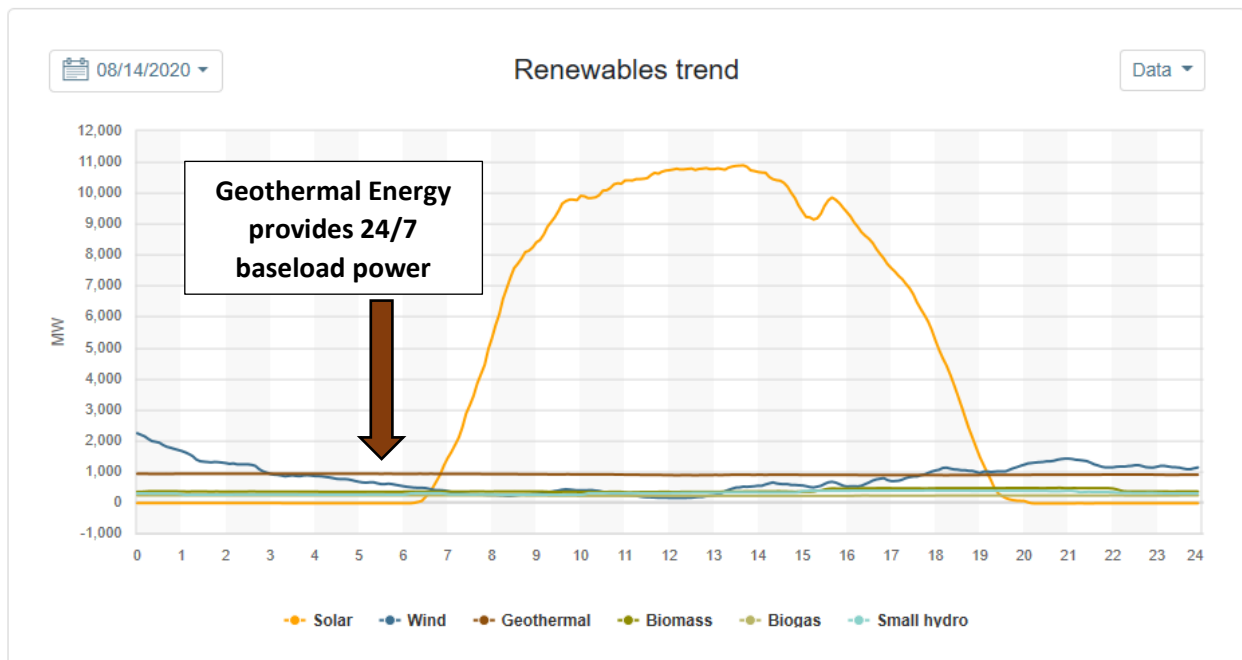
Governor Newsom urged the energy regulators to "do more to ensure reliable service and to safeguard California's energy future." This is a clear call to action, and the geothermal industry stands ready to do our part to immediately contribute to the stronger, more resilient foundation for reliable power that California desperately needs.

The modeling that the CEC and CPUC is performing does not provide a solution to these problems. Modeling is a method of informing thought experiments based on the assumptions, inputs and methodologies that are used in the analyses. It is clear the modeling results as presented have very high uncertainty and are not grounded in reality. California cannot rely on the promise of greater than 50 gigawatts (GW) of storage capacity to be built over the next 25 years based on technologies that are unproven, undeveloped and unable to store energy for greater than a few hours.

To be clear, we are not against energy storage, but it must be balanced as part of a practical portfolio of energy sources. Storage will play a significant role in grid reliability given time to develop reliable systems and availability of technologies and minerals. However, “keeping the lights on” in California in 10 years’ time needs action now based on practical realities of the power system today and customer demand estimated over the next decade. We know that electrification will come as the popularity of electrical transport increases and natural gas usage in homes decreases. Seasonal and daily demand times will change. It’s clear that we need renewable and clean firm but also flexible power to sustain the grid. Power that doesn’t depend on weather, or time of day, or the ability to store that energy for more than a few hours. Power that can also be dispatched down and back up in a controlled, predictable way in response to system operator requirements.

We need to make certain we do not overlook an expanded build out of sustainable high-capacity firm but flexible geothermal power when California has substantial resources that can be developed immediately. Surely the practical realities that occurred this summer highlight that a re-evaluation of California’s long-term approach needs to be made urgently. The geothermal industry has been advocating this for decades without any progress, resulting in over reliance on intermittent resources today that cannot be sustained in the future without also building out renewable and clean baseload.

While the CEC, CPUC and CAISO acknowledged in [their response](#) to Governor Newsom’s letter that a full investigation into the root cause of the blackouts would take time, a few things have already become clear. First, California’s commitment to clean energy in no way contributed to the rotating outages. And second, when power demand was needed the most, geothermal power was delivered unabated, as seen in the CAISO supply chart below.



Renewable Energy Supply Chart for August 14, 2020, provided by [California Independent System Operator \(CAISO\)](#).

During the peak demand times that caused the rolling blackouts, all of California's geothermal power plants continued to produce 24/7 baseload clean energy, without interruption, regardless of their location in the state. To deliver power during these peak times we need resources in the mix that can remain fully available 100% of the time. The geothermal industry is proud of our ability to deliver just that. Unfortunately, geothermal energy makes up only 5% of the state's energy portfolio. It is clear by looking at the energy data provided by CAISO that additional geothermal energy would have mitigated the energy shortfall that caused the blackouts.

Geothermal energy is undergoing a transformation. Modern geothermal power plants are dispatchable, making geothermal energy not only available 24/7 to a power grid that needs it but also flexible to ramping down or up to help cover changing operational requirements over the day. Geothermal resource exploration and development is also moving away from focusing on specific geological areas of interest to developing geothermal anywhere, with the goal of developing power across the country. The high value proposition of geothermal power includes: low project land use, high jobs per megawatt (MW), ancillary grid services, and mineral recovery, among other things. The geothermal industry has successfully executed eight Power Purchase Agreements (PPAs) so far in 2020 despite the economic situation caused by the coronavirus pandemic. Clearly the increased interest shown in geothermal power goes against the assessment presented at the SB100 workshop.

California has ample geothermal resources. According to a [study by the U.S. Geological Survey \(USGS\)](#) there is greater than 3,800 MW of identified resources in California that could be developed now given the opportunity. There are 10s of gigawatts more resources that could be added to this number after further exploration and characterization using today's technologies and 100s of gigawatts if advanced technologies are realized that are currently being developed with the support of the U.S. Department of Energy (DoE). This is a huge potential that the State of California cannot overlook.

Price reductions through scale of build out will make capital and operational costs of geothermal development more economic. A 2016 study by the Center for Energy Efficiency and Renewable Technologies (CEERT), in collaboration with National Renewable Energy Laboratory (NREL) modeling, quantified the value of additional geothermal energy in helping California comply with the Renewable Portfolio Standard (RPS).<sup>1</sup> The study concluded that development of an additional 1,250 MW of geothermal resources at the Salton Sea alone is cost effective as part of a diverse renewable portfolio.

We humbly submit the following specific recommendations on the SB100 modeling work presented at the workshop:

- 1) Geothermal generation is correctly identified within the category of "Zero Carbon Firm Resources", but is modeled based on geothermal cost forecasts and other constraints which we don't necessarily agree with. As discussed further next, we recommend

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<sup>1</sup> Caldwell, J., and L. Anthony, The Value of Salton Sea Geothermal Development in California's Carbon Constrained Future, CEERT, March 2016

clarifying that geothermal should not necessarily be evaluated separately from the less constrained category of “generic” zero carbon firm resources, and adding more LCOE points to the generic resource modeling, such as \$65/MWh. This allows the geothermal sector to anticipate the levels of market demand which may occur in response to cost reductions. The correct language in the study will also help prevent perceptions that geothermal can’t compete with some hypothetical “generic” resource with the same attributes.

- 2) The study modeling inputs should switch to using the latest 2020 Annual Technology Baseline (ATB) published by NREL. This has a significantly reduced baseline for geothermal operational and capital costs that will in turn have a significant increase on the selected quantity of geothermal energy resulting from the models – modelers in the workshop Q&A commented on the price sensitivity and acknowledged that just a relatively small reduction in price will affect the selected energy result.
- 3) Cost decreases for geothermal over the next 25 years should be matched to those in the ATB that show more aggressive and realistic declines. New technology development and benefits of scale will bring down prices. The industry is already seeing contract prices decreasing towards 60 \$/MW.h. Lower prices for geothermal power in the near future are realistic, as predicted by the latest edition of the ATB.
- 4) CEC should account for differences in tax incentives when assessing resources and treat geothermal the same as wind and solar.
- 5) Remove the arbitrary upper limit of 2,500 MW maximum geothermal power in the modeling as the available resources that can be built out now are considerably higher – as noted by the USGS report described above (in the range of 10s of gigawatts in the 25 years modelled here). Modelers in the workshop Q&A admitted to this threshold limit for which there is no apparent or clearly defined reason. There is also a cap on Out of State geothermal at 320 MW, which should also be removed or significantly increased. Imported geothermal energy is currently at 280 MW and has increased by over 230% in the period 2017 to 2019.
- 6) Related to our first point above, the “Zero Carbon Firm Resources” study scenario shows that at \$60/MWh, approximately 15 GW of Generic Baseload and Generic Dispatchable power should be built out in the state by 2045. While these results are encouraging, they imply that geothermal is not a potential source of “Zero Carbon Firm Resource” at these lower prices and has other constraints. This is caused by the high price sensitivity, combined with inaccurate prices used for geothermal energy, and the arbitrary upper limits described above. Geothermal power is simply not automatically selected by the models but clearly fills this role. Geothermal power should be identified as dispatchable in this context as modern plants that should be constructed will have this feature. Additionally, the “No Combustion Scenario” describes a 4x increase in generation of geothermal energy in the state, highlighting that the high-capacity-factor baseload feature

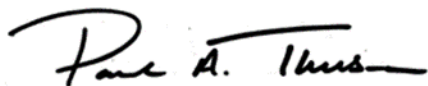
of geothermal power yields significant pay back per megawatt of installed power capacity, if it's allowed to replace the combustion sources.

The current power crisis in California has been years in the making, with procurement decisions made during the past decade laying the groundwork for the capacity shortfall experienced this summer. We need strong leadership and direction on procurement to ensure this problem does not continue to repeat. The 2018 IRP process in California called for [1700 MW of new geothermal generation](#) in the state by 2030 to meet the state's climate and reliability goals; however, no concrete action has been taken to realize this objective. As a result, although there are promising signs of new developments in the industry, it has been nearly [a decade since a new geothermal plant came online in the state](#). Realizing the IRP's guidance of adding 1700 MW of reliable, clean power from geothermal could have made a world of difference during the rolling blackouts this summer.

We recommend that an industry-led task force be established by the state agencies to examine a practical path to developing a minimum 1700 MW of geothermal power in the State of California over the next 10 years. That task force should convene before the end of 2020 and aim to provide a report for the end of 2021 with a meaningful timeline of goals, mechanisms, and metrics for build out.

We urge strong leadership on procurement, transmission, and market design to lead a renaissance in development of California's abundant 24/7 geothermal resources. A 100% clean energy future, with an affordable, resilient system is entirely possible in California. The world is watching California for how it designs its future power mix in this great energy revolution. Let's not waste this opportunity to show the world how a robust power system can be developed by continuing to overlook new build out of one power source that can really help achieve sustainable clean and renewable energy goals. That's the Earth's power source right below our feet.

Sincerely,



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