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Comment on geothermal proposal -- downhole heat exchangers in abandoned oil and gas wells

Additional submitted attachment is included below.

Comment on docket 19-ERDD-01 – Geothermal Energy

I am Professor Roland N. Horne, Professor of Energy Resources Engineering at Stanford University (CA 94305), and Director of the Stanford Geothermal Program. I have worked in the field of Geothermal Energy for more than 45 years. I am a member of the National Academy of Engineering.

I read with disappointment that CEC is proposing to emphasize geothermal energy recovery from abandoned oil and gas wells using downhole heat exchangers as one of the two initiatives for research and support. I have specific expertise both in the recovery of geothermal energy using downhole heat exchangers, and in the recovery of heat from abandoned oil and gas wells. I have participated in in-depth studies in both topics, and in fact was a coauthor of a patent application on such a downhole heat exchanger (patent was not awarded) and was a consultant to a company that installed a downhole heat exchanger in a geothermal well in the Imperial Valley in the 1980s. We also made a study at Stanford University in 2009 (funded by Google) on 'single well EGS' which centered on downhole heat exchange.

Although these studies (and field installation) demonstrated that the concept works, the short conclusion is that it does not provide useful amounts of energy. The reason is simple – conduction alone is insufficient to bring sensible quantities of heat to the small area of a wellbore for any time longer than a few hours or days. The conclusion of our 2009 Google study was that a downhole heat exchanger could not provide useful energy for more than a short period of time, unless the well configuration caused fluid to pass far out into the formation (through hydraulically stimulated fractures) and back to a different part of the well.

With regard to geothermal energy recovery from abandoned oil and gas wells, we made two studies. The first, in 2011, investigated the oil wells of the Los Angeles Basin, and concluded that the TOTAL recoverable electricity generation would be about 7 MW. In a later 2017 study, we looked at the direct use of heat recovered from LA Basin oil and gas wells, and its possible collocated utilization – again, it was found to be feasible but of very modest capacity. Both studies considered the produced water, as we already knew this to be of much greater energy content than attempting to use downhole heat exchangers.

In short, the idea of using California public funds to support this topic of research is not a good one. The concept has already been investigated quite extensively (by us and by others) and found to be a resource of extremely modest proportion. There are several much more attractive ideas on the list of candidate research topics that CEC provided in the docket.

References:

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Bennett, Kara P.; Li, Kewen; Horne, Roland N., "Power Generation Potential From Coproduced Fluids in the Los Angeles Basin," Geothermal Resources Council Transactions, 2011.
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