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# A Feasibility Study of Shallow Engineered Geothermal Systems(SEGS) Using Naturally Burning Underground Coal Seams

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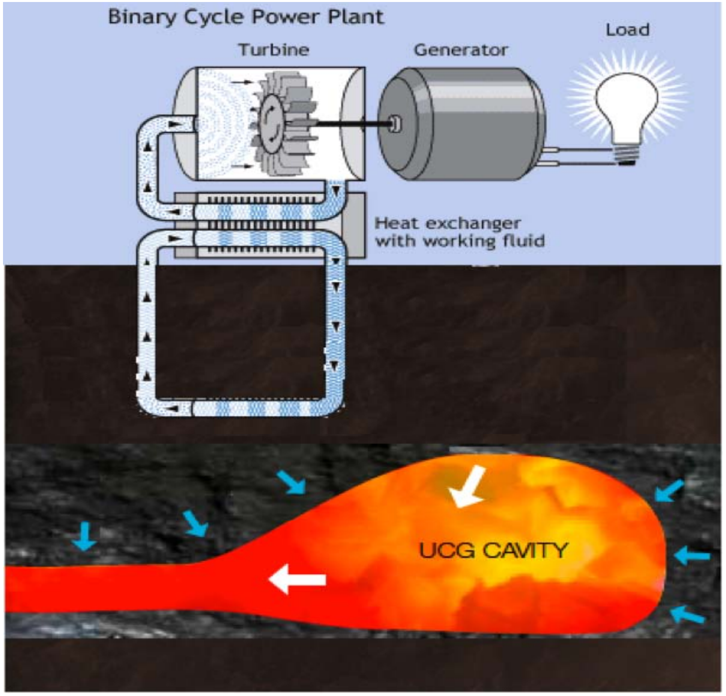
Underground coal fires are found in many countries, including China, India, the United States, Indonesia, Venezuela, Australia, South Africa, Germany, Romania and the Czech Republic. There are over 600 burning underground coal seams in the United States alone. Despite their widespread occurrence, however, we are currently wasting the heat generated by the underground coal fires and simply allowing the $CO_2$ and other toxic gases to emit into the atmosphere. That will soon change. The author will conduct a feasibility study on utilizing the heat from burning coal fires to generate geothermal power, which will add an additional category to the conventional definition of Engineered Geothermal Systems. The burning underground coal seams can burn at a temperature as high as several hundred degrees Celsius and typically occur at a depth of tens of meters, if not hundreds of meters. They are much shallower than the depth that is required to make the conventional EGS utilization possible. The saving of the drilling cost itself may justify the consideration of this unique way to produce geothermal power.

There are three major challenges associated with this new concept. First, it is the understanding of the author that it is difficult to estimate as to how many naturally burning coal seams exist in the world due to the lack of direct detection techniques of underground heat sources. We can only estimate general areas where the surface temperature is elevated by remote sensing techniques or simply observing fissures. For this reason, we team up with a group at Stanford (2010) who has been working on geophysical measurement techniques, including a cesium vapor magnetometer, to assess the volume of a currently burning coal fire. Second, it is challenging to predict the thermal evolution of a underground burning coal fire. The burning front moves as a result of complex parameters, such as geographical and topographical features, as well as the distribution of the buried coal mass. Third, It is difficult to understand the heat transfer that occurs in the subsurface ground structure that include burning coal seams, rock, soil, vegetation, void, water, air and the geothermal pipes.

Only after having overcome these difficulties– resource assessment, predictable thermal evolution and subsurface heat transfer– can we make a valued assessment of the existing naturally burning coal seams, make a sustainable system design for a geothermal power plant, and identify the zone underground where the temperature is high enough to be utilized but not too high to damage the geothermal system structure. These areas of improvement will give added confidence to the economical analysis conducted by Chiasson and his collaborators to investigate the feasibility of developing a binary geothermal power plant that utilizes the heat of burning coal fires. Chiasson and others (2005, 2007) showed that it would be possible to obtain the Levelized Cost of Electricity (LCOE) as low as $0.07/kWh for an optimized binary power plant.



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