COST OF ELECTRICITY FROM ENHANCED GEOTHERMAL SYSTEMS

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ABSTRACT

This paper presents the results of an analysis of the cost of electric power from Enhanced Geothermal Systems (EGS), specifically, reservoirs with sub-commercial permeability enhanced by hydraulic stimulation. The parameters in this exercise reflect the conditions encountered at the Desert Peak EGS project in Nevada, but the results should be applicable, at least qualitatively, to any EGS project.

Several types of injection/production well configuration are considered (doublet, triplet, etc.). For each geometry, numerical simulation of energy recovery versus time was conducted for a range of injector-producer spacing, stimulated thickness, and enhancement level (fracture spacing and permeability). From this exercise, the optimized sustainable net power capacity for 30 years as a function of the stimulated volume was estimated for each case. Then the levelized cost of net power was estimated for each case based on capital cost (exploration and drilling cost, stimulation cost and surface facilities cost), operations-and-maintenance cost, cost of money and inflation rate. The uncertainty in the estimated levelized cost was assessed through Monte Carlo sampling of the uncertain variables. Levelized cost was shown to be a function of stimulated volume and well configuration. The lowest possible levelized cost was estimated at 5.43¢/kWh for a repeated pattern and a stimulated volume of 7 billion cubic feet.

A sensitivity analysis was then conducted to assess the impact of changes in the various capital cost components on the levelized power cost. In addition, the impact of changes in certain variables implicit in this exercise on the levelized power cost was also evaluated; the implicit variables considered were the maximum practical pumping rate, reservoir characteristics, and the depth to the reservoir at the site. The impact of any adverse reservoir characteristics was assumed to be manifested in cooling of the produced fluid.

One of the goals of this study was to forecast what the levelized cost of EGS power might be by 2050. For this forecast, the most likely values of the U.S. prime interest rate and the inflation rate were defined based on the economic trend over the last 40 years. The possible values of the other explicit and implicit variables were then estimated for 2050 using certain assumptions about the market forces and the technology improvements to be achieved by then. The results of this study confirm that EGS power is a strategic resource rather than a commercial resource today. With adequate research, development and demonstration over the next decade or two, EGS power should become commercially competitive by 2050.

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