

GEOTHERMAL POWER FROM WELLS IN NON-CONVECTIVE SEDIMENTARY FORMATIONS – AN ENGINEERING ECONOMIC ANALYSIS

by

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Abstract

Many sedimentary formations, including some that contain oil or gas, may be hot enough to serve as commercial geothermal reservoirs. Unlike conventional geothermal reservoirs which generally occur in fractured formations, these reservoirs have intergranular porosity, which allows relatively easy estimation of the hydraulic characteristics of a well from cores and well logs. Using these estimates, the well's power capacity can be estimated for various well production options (such as, pumped or self-flowing) and power generation technology options (such as, binary, flash or hybrid).

The sedimentary formations considered here are not convective systems as is the case for conventional geothermal systems; instead these systems show a conductive temperature gradient. These systems have certain advantages and disadvantages in development compared to conventional, convective geothermal systems. Using the estimated hydraulic characteristics (reservoir flow and storage capacities, and wellbore skin factor), the power capacity of a well in such a system can be estimated from: (a) modeling the well's productivity index as a function of time taking into account the pressure interference between wells; (b) estimation of the flow rate available from the well by downhole pumping and/or self-flowing, taking into account the wellbore heat loss; and (c) estimation of the power capacity for various generation technologies. From the estimation of the power capacity of a well as a function of time, the levelized cost of power over the life of the project can be estimated.

The levelized cost of power is sensitive to reservoir flow capacity (kh) and temperature; it can be very sensitive to drilling depth because drilling cost and temperature increase with depth, while reservoir porosity, reservoir permeability and net sand fraction decrease with depth. For a given reservoir depth, the lower the resource temperature the more sensitive the levelized power cost to reservoir kh.

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