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Computational simulation of organic Rankine cycle retrofitted to petroleum well

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Abstract

"Geothermal refers to existing heat energy in deep rock and sedimentary basins. Unlike other types of renewable energy resources, geothermal energy provides a stable source of energy as it can be exploited regardless of meteorological conditions. Geothermal energy can be utilized for either heating/cooling purposes or for power generation.

In such systems the heat exchanged with the surrounding rock mass to the heat exchanger. Consequently, the temperature of extracted geofluid from the well decreases with the time in accordance with working parameters. The working parameters are including the flow rate, temperature difference, and the design of the ground heat exchanger. Current work, therefore, aims to develop a reliable heat transfer model to determine the extracted heat from the oil well, see Figure 1. The obtained results from the heat transfer model were used in another model, which simulate the organic Rankine cycle. Assumption made in the current study, such as ground thermal properties, the geothermal gradient and well dimensions, are based on realistic data in the Arabian Gulf. The proposed model was developed for different heat extraction rate and for temperature difference between inlet and outlet of the well. The obtained results can be used to define the optimal working parameters those result in the maximum energy generation during the lifetime of an organic Rankine cycle retrofitted to petroleum well. As shown in Figure 2, the simulations show that the optimal extraction rate 350 W at temperature difference between inlet and outlet of the well equals 16°C and ground heat exchanger diameter equals 95 mm.

This way, for a particular site the proposed models in the current study can be used to specify the optimal working parameters of geothermal system at different working conditions."