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Feasibility study of geothermal heat extraction from abandoned oil wells using a U-tube heat exchanger
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Highlights

• The possibility of using abandoned oil/gas wells as geothermal resources are investigated.

• A 3D finite volume model of a U-tube heat exchanger is simulated based upon the real field data.

• Simulations are conducted under both steady and unsteady state conditions.

• The effects of different parameters on the performance of the heat exchanger are studied.

Abstract

The purpose of this study is to demonstrate the feasibility of using an abandoned oil well as a geothermal resource. A three-dimensional numerical model of a U-tube heat exchanger is simulated based upon the real field data of an abandoned oil well located in southern Iran. To assess and optimize the performance of the heat exchanger, the influences of mass flow rate, fluid inlet temperature, insulation length, and pipe diameter are analyzed. The simulation results...
indicate that the retrofitted well can be utilized for both electricity generation and direct applications. The great advantage of the proposed heat exchanger is that it can work steadily as a long-term geothermal production system. In a case with 288.16 K inlet temperature and 0.03 m/s inlet velocity, the outlet temperature reaches 324.73 K at the first year of operation and it declines to 324.13 K after 5 years.

Keywords
Geothermal energy; Numerical simulation; U-tube; Heat exchanger; Abandoned oil wells; Heat transfer