

Repurposing Oil and Gas Wells for Geothermal Energy: A Texas Case Study

Kevin McCarthy, Will Pettitt

Baker Hughes

Abstract

Objectives

Publicly available data on hundreds of thousands of boreholes in Texas demonstrate excellent potential for geothermal electricity generation from either current or abandoned oil and gas wells. Near-surface geothermal resources, at depths of 3 km (9,842 ft) or less, are generally less than 150°C (302°F) in Texas. Economically feasible electricity generation is possible with available subsurface temperature conditions within reasonable depths—generally greater than 120°C (248°F) within 4 km (13,123 ft) - given the prolific oil and gas well drilling. Extensive data exists to depths as much as 8 km (26,246 ft), indicating temperatures in excess of 300°C (572°F) in western and south Texas.

Procedures

This study provides a systematic breakdown and analysis of the geothermal potential of oil and gas wells in Texas using publicly available data, evaluating such factors as: 1) conventional potential - wells within reservoirs with existing natural porosity, permeability, and fluid saturation to support geothermal energy production; 2) Enhanced Geothermal System (EGS) potential - wells within reservoirs with adequate temperature ranges but lacking the required porosity/permeability; and, 3) geopressured potential - wells within over-pressured reservoirs capable of carrying natural gas and geothermal heat to the surface without intervention. The study will also evaluate downhole heat exchanger technology and its ability to enhance electricity production and optimization from these various existing oil and gas wells.

Results

The final outcome of this study provides a technical and numerical summary of the potential geothermal resource and electricity generation from existing oil and gas wells in the state of Texas.

Conclusions

Texas produces more oil and natural gas than any other state and to date remains the largest producer of these natural resources, with approximately 4 million barrels per day (MMbbl/d) of oil and more than 20 billion cubic feet per day (Bcf/d) of gas. There is no other state or region worldwide which has been as extensively explored or drilled for oil and natural gas as Texas. Currently, there are ~187,401 active oil wells and 98,709 active gas wells producing oil and natural gas in the state, according to the Railroad Commission of Texas. Additionally, over 7000 of these wells have been abandoned and require significant financial expenses to properly plug and decommission. The assessment supports the imperative need for these wells to be analyzed and assessed for their significant geothermal energy resource potential as an extension of the well life and return on investment of deployed capital, as well as benefiting corporate and societal carbon neutrality goals.