



geoconvention

Calgary • Canada • May 7-11

2018

Petrophysical Characterization of a Geothermal Reservoir near Hinton, Alberta

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Summary

Geothermal resources are commonly extracted from magmatically heated water near the Earth's surface; however, sedimentary basins can also produce water from high-temperature aquifers that can occur at depths as shallow as 2000m and have temperatures high enough for direct-use heating (80-100 degrees Celsius). In west-central Alberta, the town of Hinton is underlain by Early Cretaceous basin siliciclastics with suitable temperatures and flow parameters. The objective of the study is to develop a 3-D reservoir model that incorporates the large petrophysical database from existing gas wells. The static reservoir model provides constraints on reservoir geometry from stratigraphic analysis and incorporates petrophysical data from boreholes, wire-line, core, DSTs and well logs in order to develop flow parameters. Stratigraphic units of interest in the Cretaceous include the undifferentiated Mannville and Cadomin formations, which occur at depths between 3000 and 5000 m in the study area and have corrected bottom hole temperatures of 100-150 degrees Celsius. They are lithologically and stratigraphically complex incised valley deposits.

Well-log interpretation plays an augmented role in this area, as cores from these intervals are scarce within the study area. Logs are used to determine key lithological characteristics, flow parameters and temperatures of potential reservoir zones. Wire-line data are also critical in developing stratigraphic correlations of the highly discontinuous channels (flow zones) that compose most of the viable reservoir. The formations are situated in the Deep Basin, a regional scale gas pool displacing water from the system. Integration of production data into the petrophysical analysis is vital in order to develop an understanding of the position of subsurface aquifers and whether the water is immobile or producible. Continued analysis will extend the static model to a dynamic one, where additional flow and pressure data will be added to describe variation in flow rates and pressure at the well head as water is produced.

Acknowledgements

As a part of the University of Alberta's Future Energy Systems research initiative, this research was made possible in part thanks to funding from the Canada First Research Excellence Fund.