geoconvention
Calgary • Canada • June 20-22 2022

Hybrid Energy Co-production of the Hydrocarbon and Geothermal Energy by Repurposing Horizontal Wells to the Open-loop System in Horn River Basin, Canada

Wanju Yuan[1], Zhuoheng Chen[1], Bing Kong[1], Gang Zhao[2]
[1]Geological Survey of Canada, Natural Resources Canada
[2]University of Regina

Summary

Canada has pledged to reach Net-Zero emissions by 2050 since the last year (GC, 2022). Achieving this challenging goal requires support and engagement from all parts of society. Canada is already a world leader in the use of renewable natural resources (GC, 2022) including hydro energy, wind, solar, biomass, geothermal and ocean energy, etc. The clean energy transition from hydrocarbon energy to geothermal energy is a practical pathway for the oil and gas sector. This study treats different energy resources as a whole to test the hybrid energy co-production by repurposing horizontal wells to the open-loop geothermal system in Horn River Basin, Canada. Numerical simulations are conducted to analyze the feasibility of hybrid energy production. Our results show that efficient geothermal energy production can be achieved by repurposing the currently horizontal wells to open-loop geothermal systems. This new system can co-produce hybrid natural gas and geothermal energy.

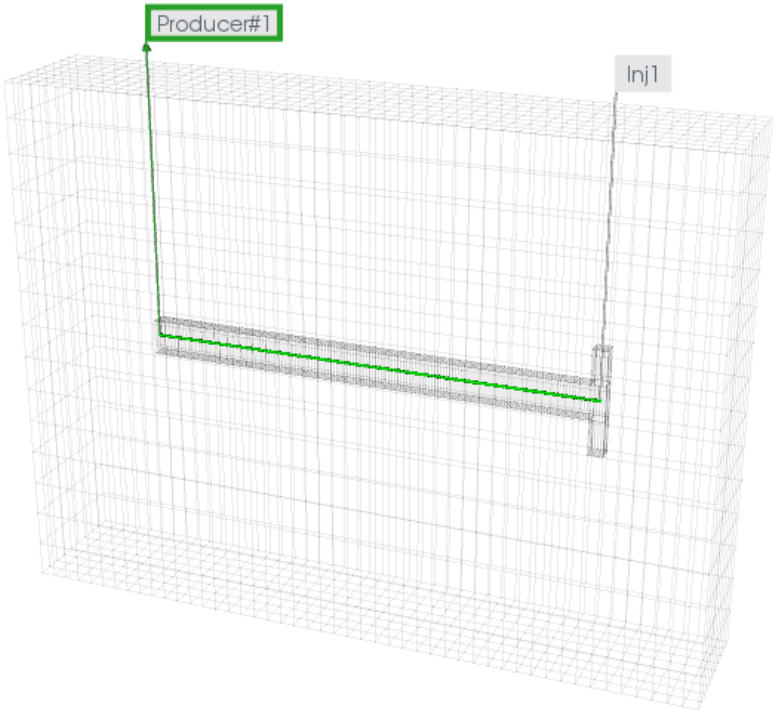

Figure 1. Schematic diagram of repurposing horizontal wellbore to the open-loop geothermal system by adding an additional injection well.

Theory / Method / Workflow

Numerical simulations using the CMG STARS™ module are conducted to analyze the feasibility of hybrid energy production. The Horn River Basin in BC, Canada has been chosen as the target study area because of its significant shale gas reserves (BCOGC, 2014) and geothermal energy potential (Renaud, 2020). Feasibility studies are first conducted to prove the closed-loop geothermal energy production after a period of shale gas production by a horizontal wellbore. Another vertical injection wellbore is supposed to be completed with the connection of the heel of the existing horizontal production wellbore at the bottom hole. The cold water is injected through the wellbore system and heated after being produced out. Because the horizontal part is kept open, the shale gas and heated water were co-produced simultaneously. Multiple scenarios on the various reservoir and operation timing parameters are simulated to analyze the systematic sensitivity.

Results, Observations, Conclusions

Our results show efficient geothermal energy production can be reached by repurposing the currently horizontal wells to open loop geothermal system in Horn River Basin, Canada. The hybrid natural gas and geothermal energy can be co-produced by this new system. Although the injection of cold water in the open-loop system reduces shale gas productivity, proper repurposing timing could help optimize the hydrocarbon and geothermal energy production performance. Considering the credits from the carbon tax, this hybrid energy co-production could be a practical method for the hydrocarbon energy industry.

Novel/Additive Information

A conceptional model of hybrid energy co-production of hydrocarbon and geothermal energy by repurposing the horizontal wellbore to an open-loop system is proposed and aims at studying the feasibility of this hybrid energy production using the current wellbore facilities in the field. De-carbonized hydrocarbon energy could be produced in this way and capital expenditures risk on geothermal energy production is also reduced by sharing the wellbores. It proposed a new hybrid energy production method of geothermal energy on a depleted hydrocarbon reserve.

Acknowledgements

This work is an output of the Geoscience for New Energy Supply (GNES) Program of Natural Resources Canada. Office of Energy Research and Development (OERD) provided funding for this study.

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