Possibilities of Using Geothermal Energy in CO_2-EGS Systems in Poland and Norway - the EnerGizerS Project

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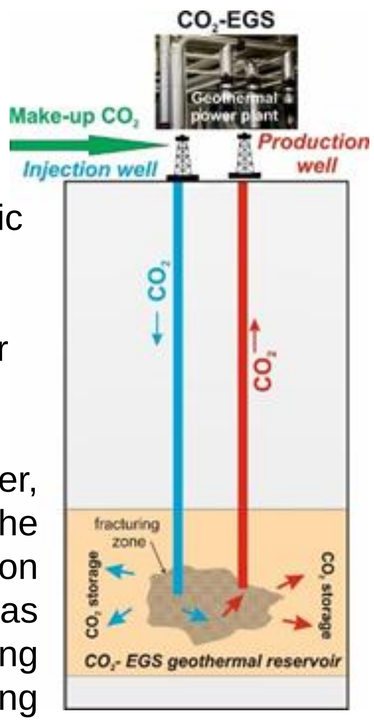
Abstract

The paper presents preliminary results of the work on the operational efficiency of unconventional geothermal systems using carbon dioxide as the working medium, carried out since Oct. 2020, when the **EnerGizerS project (CO_2-Enhanced Geothermal Systems for Climate Neutral Energy Supply)** started. Within the **EnerGizerS project**, an international consortium of scientists is conducting studies aimed at the identification and detailed characterization of geological structures for the localization of CO_2-EGS systems in Poland and Norway, combining the requirements of EGS technology and geological storage of carbon dioxide. The project includes six work packages focused on selecting suitable sites for CO_2-EGS, conducting laboratory tests of drill cores, running an experimental campaign aimed at the evaluation of supercritical carbon dioxide parameters, as well as doing advanced mathematical modeling of the reservoir performance and CO_2-based topside systems for heat and energy production. These activities will be followed by techno-economic and environmental assessments of the considered technology.

CO_2-EGS system scheme

- The energy of hot dry rocks is used in the world by means of **EGS – Enhanced Geothermal System**
- This is done by artificially increasing the hydraulic capacity of a geothermal reservoir, and then introducing a working fluid into it, which is an energy carrier, and bringing it to a power plant or combined heat and power plant
- The most common working fluid in EGS is water, however, due to numerous reasons, including the excellent thermodynamic properties of carbon dioxide and the need to reduce greenhouse gas emissions into the atmosphere, CO_2 as a working fluid instead of water is a very interesting alternative (CO_2-EGS)



Selected locations for potential CO_2-EGS systems in Poland and Norway

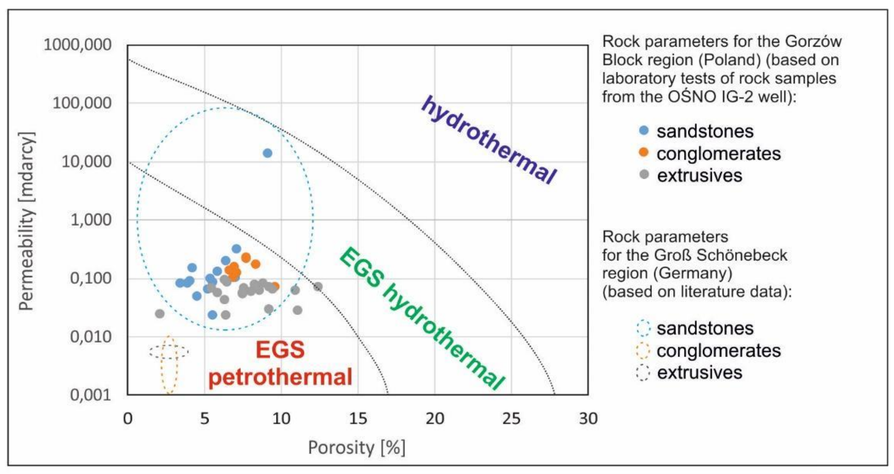
- in **Poland:** the Gorzów Block area and the Mogilno-Łódź Trough (Krośniewice-Kutno area)
- in **Norway:** Åre Formation in the Norwegian Sea, Skagerrak Formation and Ula Formation (North Sea)

Main objective of the EnerGizerS project

- Development of Enhanced Geothermal Systems (EGS) technology using supercritical carbon dioxide as the working fluid;
- Strengthening the cooperation between Polish and Norwegian partners and exchanging experience in the use of geothermal energy;
- Reduction of carbon dioxide emissions into the atmosphere and mitigation of anthropogenic climate change while meeting energy demand.

Laboratory tests

- analysis of rock mineral composition by X-ray diffraction (XRD);
- pore space analysis by mercury injection capillary pressure (MICP) and nuclear magnetic resonance (NMR);
- analysis of thermal properties of rocks - measurements of thermal conductivity using the FOX50 kit;
- analysis of mechanical properties of rocks - studies of elastic and mechanical parameters of rocks.



Porosity and permeability relation of different geothermal reservoir rocks

Conclusion

- This paper primarily presents results of the first two tasks already completed, which enabled identification of appropriate locations for CO_2-EGS potential installations in Poland and Norway as well as detailed laboratory tests on drill cores taken from selected locations.
- The results indicate that the studied rocks have suitable parameters as a geothermal reservoir for CO_2-EGS. Rocks are classified primarily as petrothermal EGS.

Acknowledgements

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References and the full text are given in the World Geothermal Congress 2023 proceedings

The progress of ongoing activities can be followed on the project website
www.energizers.agh.edu.pl

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