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Characterization of Oligocene Oil Reservoir Sandstones for High Temperature Aquifer Thermal Energy Storage (HT-ATES) in the Upper Rhine Graben (URG), SW Germany

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The storage of low-temperature heat in the near surface underground is already widely used worldwide, whereas only little attempts of storing of higher temperatures have been made so far. However, this can become increasingly important in the heat transition strategy by contributing with this technology to medium and peak load supply. Previous works have demonstrated that a large part of the required thermal energy can be efficiently stored in former oil reservoirs in Tertiary sediments of the URG. The advantage of using depleted oil reservoirs as HT-ATES is that they have a lower overall project risk due to the knowledge of the subsurface from the exploration history and that the geological and geophysical data, which are mostly available, allow a more reliable forecast of efficiency and development costs.

KIT in Karlsruhe has now planned the "Deepstor" HT-ATES research infrastructure for its Northern Campus. The site is adjacent to the former Leopoldshafen oil field and can draw on a large amount of data from boreholes for assessment prior to drilling. The targeted reservoirs is the several meters in thickness consisting of fine-grained calcareous sandstones from the Oligocene Froidfontaine Formation at a depth of approx. 1,300 meters.

The baseline of this study is the interpretation of petrophysical data such as resistivity-, sonic-, gamma and SP-logs to derive hydrogeological and geothermal parameters in 15 deep wells in vicinity of the planned drilling site. An integrated data analysis is performed with simulations to gain a quantitative understanding of the fluid and heat flow of the HT-ATES site and to predict the storage and recuperation capacity. Poro-perm values from core material are used to calibrate the results. The aim is a statistically based assessment of the storage site for planning and cost estimation of the research infrastructure.

This work should provide further insights for the future development of geothermal heat storage and enable the integration of a HT-ATES in the KIT campus.