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Geothermal heat storage in the Upper Rhine Graben –the DeepStor project at KIT Campus North

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The subsurface condition of the Upper Rhine Graben are favorable for developing novel geothermal utilization concepts. In particular, they allow for an optimization of the energetic use for variable heat production and storage scenarios. The fact that former hydrocarbon reservoirs are involved, perfectly describes the transition to the future use of renewable CO2-neutral energies.

The concept is tailored to the Campus North of the Karlsruhe Institute of Technology (KIT) that is located in the central-eastern Upper Rhine Graben. It includes multi-level utilization with heat recovery from the deep Mesozoic reservoirs (GeoHeat project) and seasonal heat storage in the Tertiary Sandstones above (DeepStor project). In the long term, the concept should cover a significant part of the basic heat load at the KIT Campus North in a climate-neutral way. The underground of the campus is characterized by the largest known heat anomaly in Germany, with temperatures of ≥ 100 °C at a depth of 2 km. In connection with the existing area-wide local heating network, the campus offers good conditions for the extraction, seasonal storage and distribution of heat from deep geothermal energy. The step-by-step development of deep geothermal energy at the KIT Campus North within the framework of the DeepStor storage project will include first the deep underground to Tertiary Basin. The high temperature storage of renewable heat involves the same Tertiary strata from which hydrocarbons have been extracted until the 1990s (Stricker et al, this issue) and will be supplied in a first step with heat from cogeneration as well as current renewable waste heat from scientific infrastructure projects such as “bioliq”.

The expected reduction of flow rates by seasonal storage in the later GeoHeat project should serve in particular to reduce induced seismicity, which is still one of the greatest obstacles for the industrial, deep geothermal development in the Rhine Graben.
DeepStor consists of three stages:
1) The establishment of a scientific demonstrator for high-temperature heat storage in the deep underground with the aim of validating the technical feasibility.
2) Coupling of the prototype to above-ground plants (e.g. CHP, bioliq) with feed into the local heat grid.
3) Integration into the regular operation of the KIT Campus Nord heat supply system.

For the interaction with public DeepStor will implement an inter- and transdisciplinary co-design. This represents a paradigm shift in the definition of the development concept and the operation of geothermal power plants. This innovative approach makes it possible to integrate civil society already in the concept development phase. In this way, constructive impulses from society can be made fruitful at an early stage in order to identify the challenges of deep geothermal energy and thus also of the local “heat transition” and to develop solution options.

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