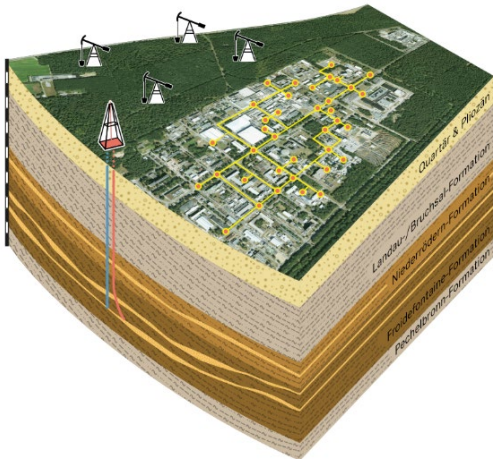


## DEEPSTOR – RESEARCH INFRASTRUCTURE FOR GEOTHERMAL HEAT STORAGE

### PROJECT INFORMATION, NEXT STEPS AND CONTACT DETAILS



With the **DeepStor** research project, KIT is doing pioneering work in geoenery research at Campus North: as part of the MTET program of the Research Field Energy, high-temperature heat storage (HT-ATES) in the deep underground is being investigated. Heat storage is a key factor in the energy transition. If surplus heat energy from the summer can be efficiently stored in the form of hot water in the pores of deep rock, it could be available as climate-friendly heat in winter. Depleted oil formations, among other things, are suitable for such “geothermal batteries”. There are several former oil formations in the Karlsruhe region and the wider Upper Rhine Graben, which means there is great storage potential in the region.

**Exploration drilling ‘DeepStor-1’** into the potential storage formations on the edge of the former Leopoldshafen oil field will explore the subsoil directly at KIT. A borehole approximately 1,400 m deep will be drilled in the south-western part of Campus North. Over a distance of ~700 m, rock samples will be extracted intact as drill cores for further examination in the laboratory – a first in this area. Subsequent logging and testing will yield a wealth of data from the subsurface, which will also be used to improve the parameterization of simulation models. This will enable **fundamental questions about the suitability of the subsurface** for seasonal heat storage to be answered. The data collected will also form the basis for the further development of the DeepStor project.



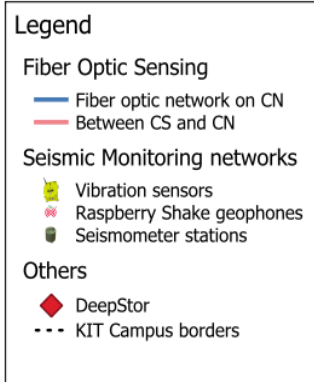
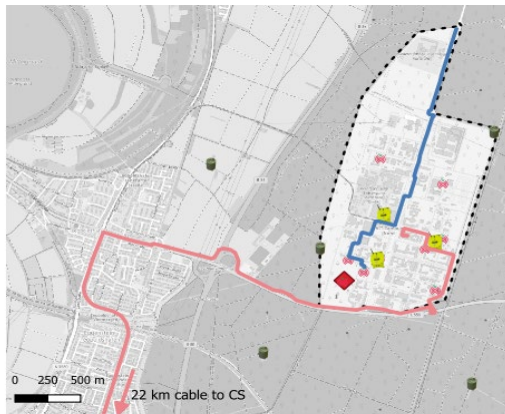
### SEISMIC MONITORING AND THE TRAFFIC LIGHT SYSTEM

Seismic monitoring is a high priority in the DeepStor project. The concept ensures that unusual vibrations are immediately detected, evaluated and communicated – exceeding the minimum legal requirements. Monitoring on and around Campus North is based on several types of sensors:

1. **Conventional seismometers and vibration measuring devices** – a network of five permanently installed, highly sensitive stations around the exploratory borehole. It continuously and precisely records ground vibrations in order to detect and characterize potential seismic events. The network is supplemented by three vibration meters, which are installed to accurately record vibrations in buildings.
2. **Plug-and-Play-Seismometer** („Raspberry Shakes“) – Installed in various buildings across Campus North. Institutes are invited to participate by hosting a Raspberry Shake device.
3. **Fiber-optic cables** – These are installed along the borehole and within the ground. Distributed Acoustic Sensing (DAS) technology is employed to convert standard fiber-optic cables into dense arrays of seismic sensors. These sensors are capable of detecting ground motion with high spatial and temporal resolution.

This monitoring network is directly connected to a **traffic-light response system**, which establishes precise vibration thresholds that initiate pre-defined safety and response actions during drilling and research operations. In light of the sensitivity of the surrounding research infrastructure, conservatively **low vibration thresholds** have been established for DeepStor. The system has been designed to comply with the relevant DIN 4150-3 standard for highly sensitive structures, which sets a vibration velocity limit of 3 mm/s. **An independent third-party** assessment has provided the technical and normative support for the

system. When ground vibration velocities exceed 0.02 mm/s, alarms are automatically triggered and the cause is investigated. In the event of vibrations reaching 0.3 mm/s, it is standard protocol to implement a temporary suspension of all operations as a precautionary measure.



Seismic sensors in the DeepStor measurement network on Campus North (left) and Raspberry Shake (above)

## NEXT STEPS: PREPARATION OF THE EXPLORATORY DRILLING

The drilling permit has now been granted. The commencement of the **DeepStor-1** borehole is planned for the **Q2/Q3 2026**. Currently, construction work is being carried out on the periphery. Preparatory work at the drill site is scheduled to begin in the coming months. **Conductor pipes** — large-diameter steel casings — will be installed at depths of approximately 36 to 40 meters to ensure the protection of groundwater resources. The process utilizes the proven **impact piling** method, where a hydraulic hammer drives the pipes into the subsurface in incremental steps. During this construction work, audible impact sounds and minor ground vibrations may occur in the immediate vicinity. However, these effects decrease rapidly with increasing distance. Structural damage to nearby buildings is not expected. All applicable DIN standards and precautionary vibration limits will, of course, be fully observed.



## COMMUNICATION AND COORDINATION

The DeepStor team utilizes various communication channels to disseminate information regarding upcoming construction work and drilling activities. These channels include the company website, newsletters, and circular emails. The team is already in direct contact with units in the surrounding buildings and operators of sensitive experiments. Should you have any questions or require assistance, please do not hesitate to contact us.

Please contact the DeepStor team if you,

- would like to be added to the newsletter mailing list, or
- have sensitive experiments that should be accompanied by individual seismometer monitoring.

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