

Mine thermal energy storage in flooded mine workings: Current status and next development steps for a Pilot Site in Bochum, Germany

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Abstract

Mine Thermal Energy Storage (MTES) offers a promising approach for using flooded underground mine workings as large-scale subsurface reservoirs for seasonal heat storage in former or active mining regions. This poster presents the current status and next development steps of an MTES pilot site in the city of Bochum, located in the Ruhr area in western Germany, one of Europe's major former hard coal mining regions.

At the site near Ruhr University Bochum, Fraunhofer IEG is developing and testing an MTES demonstration system in former mine workings at a depth of approximately 120 m. The mine workings are accessed by boreholes to investigate how the mine water occurring in the flooded underground structures can be used as a seasonal underground thermal storage system.

The poster presents the current status and next development steps of the pilot site, including drilling, monitoring infrastructure, field investigations and system integration. Two boreholes have already been completed, a third borehole is currently under construction, and a fourth borehole is planned for 2026. The boreholes are equipped with multichannel downhole sensors and fibre-optic cables to support future operational tests and to characterize the hydrodynamic and thermohydraulic behaviour of the flooded mine workings. Initial investigations include geophysical logging, camera inspection and mine water sampling. Hydrochemical measurements indicate slightly mineralized mine water with a temperature of approximately 12 to 13 °C, an electrical conductivity of about 850 $\mu\text{S}/\text{cm}$, a pH value around 7 and dissolved oxygen concentrations of approximately 5 mg/L. In parallel, thermohydraulic modelling and co-simulation approaches are being developed to evaluate the integration of underground heat storage into the existing heating and cooling network of the Technical Centre.