**Challenges for Evaluating Low Enthalpy Geothermal Resources of Flooded Legacy Coal Mines**

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Groundwater in flooded abandoned mines could be used for geothermal purposes using heat pumps and district heating networks. An open loop involving pumping and re-injection requires considerable groundwater flows in the complex subsurface system including shafts, galleries, and collapsed coal extraction panels. Even if the aquifer thermal energy storage (ATES) can be possibly enhanced by the injection of hot water from waste heat or solar thermal collectors, forecasting long-term efficiency and the possible impacts of geothermal doublets remains an intricate task facing a series of hydrogeological challenges.

During the winter, hot water would be pumped from the deep parts of the mine works, and cold water re-injected in a shallower gallery or in shallow fractured rocks, with a seasonal flow inversion for building cooling during the hot season.

In the numerical model used for prediction, the true geometry of the interconnected network of open galleries and shafts must be conceptualized and described as realistically as possible to ensure the reliability of the developed tool. This last solves coupled groundwater flow and heat transport equations, with temperature-dependent density and viscosity, in a complex 3D heterogeneous domain.

An example of simulation on a synthetic case will be used for illustration and preparation work before further application in a real case study. For this last, a more robust assessment of the thermal storage will be obtained if the parameters of the numerical model can be calibrated on field characterization data.

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