

PhD position on Characterization of thermo-hydro-mechanical properties of longwall goaf for geothermal energy storage in abandoned coal mines

Poste de thèse de doctorat sur la Caractérisation des propriétés thermo-hydro-mécanique des zones foudroyées pour le stockage d'énergie géothermique dans d'anciennes mines de charbon

Université de Mons (UMONS) and Université de Liège (ULiège), Belgium

This PhD project takes place in the field of minewater geothermal systems that aim storing heat in flooded abandoned mines. More specifically, longwall goafs will be investigated as potential geothermal reservoirs through their characterization from mechanical, hydraulic and thermal point of views.

Longwall mining process consists in excavating coal layers under panel configurations. After mining, the panels are no longer supported by the roof supports which induces a progressive collapse of the roof, known as the goaf. Those abandoned collapsed zones have usually a significant macro-porosity, creating underground water reservoir that can serve for geothermal storage systems.

Based on drillings intercepting longwall goaf from abandoned coal mine in the Charleroi mining basin (Wallonia, Belgium), the PhD project will aim at:

- Characterizing the mining network at the scale of an experimental site in a mining concession and in particular in the longwall goaf areas.
- Studying the hydraulic properties of the underground in and near longwall goaf areas, from various pumping tests performed in the drilled wells intercepting the concerned areas.
- Characterizing and modeling of the geomechanical processes in longwall goaf areas to predict their extension and the porosity distribution. Calibration of models based on results from the literature (study on reduced models or real observations) and on the basis of on-site observations.
- Analysis of flows and heat exchanges in the longwall goaf, from pumping and injection of hot or cold water in different areas of the abandoned mines. Numerical simulations of operating scenarios of geothermal storage systems.

We seek a candidate with a background in geological/environmental engineering, hydrogeology, geomechanics or civil engineering. The candidate should have an interest in renewable energy and underground-related applications. For the interaction with the different stakeholders involved in the project, good level in French is necessary (at least level B1 or B2).

The joint thesis will be carried out between Université de Mons (UMONS – Prof. P. Goderniaux and Prof. O. KAUFMANN) and the Université de Liège (ULiège – Prof. B. François), within the framework of the project EFES (Enhanced flexibility in Energy Systems) funded by the WIN4EX Wallon Region.

Both universities offer a dynamic research environment in the field of geological, hydrogeological and geomechanical engineering, respectively in the Geology and Applied Geology Unit (UMONS) and the Urban and Environmental Engineering Unit (ULiège). The PhD student will be co-tutored by the two PhD advisers, in a joint PhD program and will benefit from the extensive training proposed by the doctoral schools of both universities.

The position has a duration of 4 years and the PhD is expected to start on 1st October 2024.

Application deadline (detailed resume + motivation letter + names and e-mail addresses of two referees who may be contacted by those in charge of evaluating applications): 15th August 2024.

Further enquiries on the vacancy and application must be directed to Prof. Pascal Goderniaux (pascal.goderniaux@umons.ac.be) and Prof. Bertrand François (Bertrand.francois@uliege.be).