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# BeTemper: thermal characterisation of the Belgian subsoil for shallow geothermal applications

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The current energy transition towards Renewable Energy Sources (RES) is mainly driven in Belgium by intermittent sources such as wind turbines and photovoltaic panels. Other sources are however available, such as biomass and geothermal resources. The latter can take various forms among which Ground Source Heat Pumps (GSHP). This Geothermal RES could be an important supply for the heating/cooling market, which represents 48% of the energy consumption in Belgium. The interest in using the ground as a source or storage device for thermal energy has grown considerably in the last few years and the market is expected to grow significantly by 2020 (Petitclerc, 2013). However, research in the thermal characteristics of the soil and subsoil is lagging behind the industrial technological development. Sizing errors of installations increasing the budget are therefore frequent and promising projects are abandoned.
BeTemper was launched in 2014 for a period of 2 years. It aims to assess the shallow geothermal potential in Belgium through analysis of rock thermal properties from the surface to a depth of 150 m, which covers the standard depth for a vertical loop system currently installed in Belgium (75% of the GSHP market). The project focuses on laboratory thermal properties analyses (thermal conductivity ($\lambda$ in W/m.K) and diffusivity ($m^2/s$)) of about 400 rock samples corresponding to 30 different lithologies. Influences of water content, of porosity, of mineralogical composition and of mineralogical texture on these thermal parameters are studied. Thermal parameters measurements are performed with the high-resolution Thermal Conductivity Scanning method (Popov 1999, 2012) for both saturated and dry conditions. The mineralogical and petrological analyses are conducted thanks to different analytical equipments of the mineralogical and petrological laboratory at the RBINS-GSB. The proportion of the different mineralogical phases of samples are evaluated with the Panalytical X-ray Diffraction equipment, while the EDS (Energy-Dispersive X-ray Spectroscopy) and EBSD (Electron BackScattered Diffraction) modules is applied in order to evaluate the chemical and micro-textural content. Special attention is given to lithologies having a variable $\lambda$ values to assess the influence of porosity and/or minor mineralogical phases on the heat transfer. The sample selection is conducted in order to be representative of the various lithologies composing the Belgian subsoil, taking into account their mineralogical composition, petrological texture along with their degree of alteration. A special emphasis is given to densely populated areas (eg. Sambre & Meuse valleys and large cities of Flanders). with the highest geothermal demands.

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