Concept for shallow geothermal opportunity mapping

David Boon¹, Gareth Farr², Laura Williams², Stephen Thorpe¹, Ashley Patton², Rhian Kendall², Alan Holden¹, Johanna Scheidegger¹, Suzanne Self¹, Corinna Abesser³, and Gareth Harcombe⁴

¹British Geological Survey, Environmental Science Centre, Nicker Hill, Keyworth, Nottingham, NG12 5GG, U.K.
²British Geological Survey, Cardiff University Main Building, Park Place, Cardiff, CF10 3AT, U.K.
³British Geological Survey, Maclean Building, Crowmarsh Gifford, Wallingford, Oxfordshire, OX10 8BB, U.K.
⁴Cardiff Council, County Hall, Atlantic Wharf, Cardiff, CF10 4UW, U.K.

Reaching Net Zero CO₂ emissions by 2050 will require rapid and wide-scale deployment of renewable heating technologies in rural and urban areas, including open and closed loop type production wells and borehole heat exchangers, supplying individual, shared, and centralised heat pumps as part of wider district heating and cooling grids. Ground and groundwater conditions are naturally variable and are a key factor in system viability, capital cost and long-term performance. Engineering approaches for heating and cooling of buildings should be optimised for the local thermo-geological conditions to avoid system interference and thermal degradation. Sustainable use of shallow geothermal systems can be achieved by adopting an environmental stewardship approach, integrating geological information within energy master plans, taking full advantage of subsurface data visualisation technology and integrated planning and modelling tools.

We present a method for creating a digital shallow geothermal opportunities map - mostly aimed at moderate- to expert-skill level geoenvironmetal and energy consultants, planners and civil engineers. The output is a digital 1:50 000 scale equivalent thematic map, that provides a synthesis of available technical information by combining data such as 3D superficial geological model data - delimiting aquifer and non-aquifer boundaries, groundwater levels and temperatures, aquifer thickness, flow direction, possibly with inset tables summarising groundwater chemistry and key physical properties of the main geological units such typical thermal conductivity. Built infrastructure that could constrain drilling locations, as well as potential water discharge points and open water heat source and storage opportunities, such as sewers, rivers, canals, docks, and lakes, might also be included in the map. Local development plans and heat demand mapping data could then be integrated with the opportunities map to identify and prioritise districts that would benefit from more detailed viability studies for conversion of fossil fuel heating systems to low carbon heating and cooling technologies.

This project has received funding from the European Union's H2020 research and innovation programme under the GeoERA MUSE project – Managing Urban Shallow Geothermal Energy.