Innovative solutions of ground heat exchangers

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Novel ground heat exchangers made of metal and plastic will be tested on site and in the laboratory, coupling with different types of subsoil and different humidity and hydrodynamic conditions of interstitial fluids, focusing on the analysis of heat exchange processes and chemical-physical interactions with aquifers and ground.

The use of a physical model available at the Geosciences Dept. is envisaged; it will allow to perform laboratory tests in real conditions and in a controlled environment, as well as to validate the related numerical models that will be implemented.

Amongst the pilot sites of the EU Horizon 2020 GEO4CIVHIC project will be selected the most suitable ones to carry out on-site experiments and tests, which will follow the coupling tests between the physical and numerical model performed in the laboratory. An evaluation of the heat exchange performance with the subsoil of the geothermal probes being studied will be carried out at these sites, also envisaging the application of non-invasive surface and in-hole geophysical methods, including thermal measurements, electrical potential measurements and Electrical Resistivity Tomography (ERT) investigations. The purpose is evaluating the plume geometries of thermal perturbations induced into the subsoil, as well as validating the results obtained by physical and numerical modeling.

The development of methods of contrasting the phenomena of electrochemical corrosion induced in the subsoil on the heat exchange probes will also be studied.

Collaborations with reference centers and national experts on cement materials, metallurgy, electrochemistry are planned.

A period of abroad experience for further study in the specific field of the PhD topic is planned also, in collaboration with experts from an international body, specifically at one of the project partner (Center For Renewable Energy Sources in Athens Greece, Universitat Politècnica de València Spain, Friedrich-Alexander-Universität in Erlangen-Nürnberg Germany).

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