

**Performance and cost analysis of single and double U-tube ground heat exchangers**

Paul Christodoulides\*, Mateusz Zerun, Lazaros Aresti, Soteris Kalogirou, Georgios Florides  
Cyprus University of Technology, Limassol, Cyprus

**ABSTRACT**

Vertical U-tube ground (or borehole) heat exchangers (GHEs) are widely used as shallow geothermal energy systems to achieve sufficient heat exchange capacity under a confined surface area. This is possible because the temperature below a certain depth remains constant over the year. The presence of more than one U-tubes in the GHE in a single borehole may increase the efficiency of the system. It is hence of interest to study the performance of such systems in relation to their manufacturing/installation costs.

The scope of this study is to compare the energy behavior of a single U-tube GHE with a double one. The performances of two such systems, installed under similar ground characteristics, are studied via a Building Management System for a certain time period. The energy dissipated in the ground is obtained by measuring/considering mass, specific heat capacity and temperature difference in the system.

Then, a CFD model based on the convection-diffusion equation and transient time analysis is validated through the installed systems. The numerical model allows for parametric analyses and comparisons of the two systems, leading to a cost analysis.

\* Presenting author, [paul.christodoulides@cut.ac.cy](mailto:paul.christodoulides@cut.ac.cy)