ROMANIA'S FIRST GROUND COUPLED HEAT PUMP USED ONLY FOR RESEARCH PURPOSES

BENDEA Codruta, ROSCA Marcel
University of Oradea
cbendea@uoradea.ro, mrosca@uoradea.ro

Key words: Ground coupled heat pump (GCHP), geothermal energy, renewable energy, borehole

Shallow geothermal resources (up to 400 m depth in some countries) are omnipresent. Everything that's below 15-20 m is called geothermal. The temperature field is function of terrestrial heat flow and soil conductivity. Some countries consider this ground stored heat as geothermal [1],[2].

A ground source heat pump system consists in 3 sub-systems:

- the source of heat;
- the heat pump sub-system;
- the building distribution sub-system.

For GCHP the source of energy is the ground itself. A vertical ground-coupled heat exchanger, known as "borehole heat exchanger" in Europe – a single-U tube consisting of a pair of straight pipes, connected by a 180°-turn at the bottom or a double U, a horizontal or a slinky one is needed in order to extract heat from the ground. The fluid circulating through the heat exchanger is an antifreeze solution, usually ethylene glycol. Its role is to transport heat from the ground to the heat pump (or vice versa). This type of heat extraction is called "in closed circuit".

The first ground coupled heat pump installed in Romania for research purposes only is located at University of Oradea. Since this system is dedicated to studies, there are two ways of collecting the heat from the ground:

- a horizontal heat exchanger, having 4 pipes of 25 mm diameter and 70 m length, laid in a trench, on two levels: two of them are at 1.8 m depth and the other two are at 1.2 m. The pipes are made by a well known company (Gerodur) and the material is high density polypropylene;
- a vertical heat exchanger, double-U type, also of 70 m length, from the same manufacturer, but of 32 mm in diameter.

A very important issue to be taken care of was the thermal interference between the 4 branches of the double U-tube. Therefore, at each 2.5 m, a special piece was incorporated between the pipes, in order to keep them apart.

During the drilling, samples of soil were taken at each 2.5 m and were analyzed by geologists. After completing the borehole and just before introducing the vertical heat exchanger, a complete geophysical test was made. It came out that the ground temperature, at 72 m, is 20 deg.C, which is quite a high temperature. This value is subject of future investigation, since along with the vertical heat exchanger a set of 5 temperature sensors were launched.

These sensors, together with the outside temperature, the inside temperature, antifreeze temperature in the condenser and evaporator of the heat pump, the total power consumption, power consumption of the circulating pumps etc. are connected to a high performance data recorder that records and stores the information, allowing to make charts and plots and to determine the coefficient of performance (COP) of the entire system, and also the seasonal performance factor.