

Title: Thermogeological characterization of the pyroclastic-alluvial aquifer systems of the Piana Campana (southern Italy) for the design of low enthalpy geothermal plants

Tutor: Pantaleone De Vita

Co-tutor: Vincenzo Allocca

Research proposal

Energy supply from renewable sources and energy saving are increasingly critical at a global scale and for our country, as it has been put in evidence by the continuous appeals of the Scientific Community to reduce greenhouse gas emissions and the recent geopolitical crises. In this context, the use of the subsoil as an energy source, already known since the beginning of the last century for high enthalpy geothermal fluids (Lardello), in recent decades has also included the heat exchange with heat pumps applicable in the case of ordinary temperatures (low enthalpy), allowing significant energy savings in the heating and cooling of buildings. The latter possibility has so far had a wide diffusion only in northern Italy. In Lombardy and Piedmont regions, there have been numerous scientific studies aimed at the geothermal characterization of the subsoil which has resulted in a wide diffusion of low enthalpy geothermal plants. This has promoted the enactment of specific regional policies. On the other hand, in Campania region, excluding few exceptions (e.g. the experimental site of San Marcellino, Naples), low enthalpy geothermal energy has so far had a poor development both in terms of studies aimed at characterizing the subsoil for geothermal purposes and the diffusion of plants, representing a potential still largely unexpressed (Svimez Report, 2015).

Starting from the analogies between the heat flow and water flow in the unsaturated and saturated zone, depending on hydrogeological features, this PhD project proposes the thermogeological (Banks, 2007) characterization of the pyroclastic-alluvial aquifer systems of the Campanian Plain. The choice of the study area is motivated by the relatively low depth of water table, which makes it accessible through shallow wells, and by the high urbanization of the area, therefore by the great potential of energy demand.

Research program

The study aims to identify one or more representative sample areas in which to carry out: 1) hydrogeological and hydrogeophysical characterization at a detailed scale, through collection of stratigraphic data and in situ tests; 2) characterization of the thermal regime of the unsaturated and saturated zone by means of measurement campaigns and installation of monitoring stations in existing or new on-purpose boreholes; 3) characterization of the thermal conduction of pyroclastic-alluvial aquifer systems by means of field and laboratory tests; 4) identification of hydrogeological-thermogeological models that can be exported on a distributed scale; 5) reconstruction of low enthalpy geothermal potential maps.

The collaborations will include both bodies responsible for territorial planning and companies, motivated by the results of the research, as well as national and international research groups operating on the topic of low enthalpy geothermal energy. The PhD activity will be supported by funds derived from draft conventions for which the proposer is responsible.