Assessing underground heat exchange and solar heat storage capabilities based on ground thermo-physical properties: the Euganean hills demo site (Italy)

Eloisa Di Sipio, Raffaele Sassi, Stefano Buggiarin, Silvia Ceccato, and Antonio Galgaro
Università di Padova, Department of Geosciences, Italy (eloisa.disipio@gmail.com)

The utilization and development of renewable energy sources (RES) is currently a topic of great interest in energy field. In detail, the coupling of different RES and related technologies, as solar thermal and shallow geothermal, for heating/cooling purpose of residential buildings is a promising sector. The possibility to store the thermal energy produced by solar panels in the underground during the summer season, when the insolation is greater, and to use the heat accumulated during the coldest periods, is strictly related, among others, both to the thermo-physical properties of rocks and to the solar radiation locally available. As the ground is the invariant component of the whole system, a better knowledge of its thermal properties (i.e. thermal conductivity, volumetric heat capacity…) is fundamental to evaluate the amount of heat that can be stored.

This paper presents an innovative methodological approach combining information related to underground thermal energy exchanging and storage capacity with the solar radiation, taking also into account the location of the possible end-users, that is the distribution of the residential buildings in the territory. The Euganean Hills area, located in the Po River Plain (north-east Italy), is selected as demonstration test site. A qualitative map, created using Geographical Information System (GIS) application, has been realized in order to represent the “Ground thermal suitability” of a territory to sensible heat storage, that is the possibility to store solar energy in the underground for a later use.

This thematic map is a really promising tool, suitable for local administrator and professionals, for planning the possible exploitation of solar thermal renewable resources available in the area.