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Innovative Geothermal Application Development to support in situ workers

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An innovative user-friendly smart phone/tablet-based Application (App) to support users (drillers, owners, designers) on site to complete a preliminary evaluation of the shallow geothermal heat exchangers and heat pump system feasibility was developed in the framework of the EU funded GEO4CIVHIC Project. The App is expected to provide a preliminary evaluation of drilling time and costs, allowing users to design a first version of the geothermal system, including number of probes and recommended drilling method.

The App requires the geolocation, the underground and building structure, the feasibility and the best drilling solution for the site to be analysed. Hence, the reference data defined by the project concerning the fundamental ground parameters (thermal conductivity, lithology etc...), the climatic classes typical of the European territory and the energy profile of a selection of buildings, representative of the European buildings' typology, are stored in a specific database internal to the application itself.

Once the site geolocation is defined, automatically or manually, the user is required to insert geological information. The geological section is developed for non-expert users to allow them a simplified underground geological characterization based on intuitive information related to the form of the landscape (geomorphology) and a rough idea of the rocks/sediments present in the area. Selecting an environment, a sub-environment and a lithology, the App, considering a simplified stratigraphy of about 100 m depth characterized by a homogenous material in saturated conditions, provides an output related to (i) the best method to drill the underground, (ii) the evaluation of time and cost for the drilling method suggested, (iii) the thermal conductivity value linked to the main lithology.

In the Building section, an estimate of the maximum energy requirement for both heating and cooling knowing the latitude and longitude coordinates and the building typology of the test site is

obtained. In the App database, the European cities, based on their geographic coordinates, are grouped in four simplified climatic zone domains according to the Köppen-Geiger climate classification. This allow to obtain the average annual degree days (DD) for heating and cooling necessary to calculate the cooling and heating loads of the building. Then, selecting the reference building typology (residential/non-residential) and the ground characteristics, the App automatically calculate the geothermal field size necessary to meet its energy needs.

The validation in the Mechelen (Belgium) case study of GEO4CIVHIC project shows a good agreement between the App simplified information and the real case condition. Next future more validation will be provided. However, the App outputs are a preliminary, not refined estimate of the geothermal feasibility to realize shallow geothermal systems and cannot be considered as sufficiently detailed to plan these systems. On this regard it is mandatory to acquire more detailed local information, consulting local experts and/or referring to the Decision Support System (DSS) of GEO4CIVHIC Project.

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