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European drillability mapping for shallow geothermal applications

Antonio Galgaro¹, Eloisa Di Sipio¹, Giorgia Dalla Santa¹, Adela Ramos Escudero², Jose Manuel Cuevas³, Burkhard Sanner⁴, Davide Righini⁵, Riccardo Pasquali⁶, Jacques Vercruyse⁷, David Bertermann⁸, Luc Pockele⁹, and Adriana Bernardi¹⁰

¹Università degli Studi di Padova, Department of Geosciences, Padova, Italy

²Universidad Politécnica de Cartagena, Cartagena, Spain

³Instituto de Aplicaciones de las Comunicaciones Avanzadas (ITACA), Universitat Politècnica de València, Valencia, Spain

⁴UBeG Dr. Mands & Sauer GbR, Reinbergstr 2, 35580 Wetzlar, Germany

⁵Hydra srl, Traghetti di Argenta, Ferrara, Italy

⁶SLR Environmental Consulting Ireland Ltd., Windy Arbour, Ireland

⁷GEO-GREEN sprl, Marbais, Belgium

⁸GeoZentrum Nordbayern, Friedrich-Alexander-University, Erlangen, Germany

⁹R.E.D srl, Teolo, Padova, Italy

¹⁰CNR-ISAC, Padova, Italy

The overall goal of the EU funded project GEO4CIVHIC is the development of more efficient and low cost geothermal systems for conditioning retrofitting civil and historical buildings.

The assessment of the most suitable drilling technology for a given geological context could be very useful from both the technical and the economic point of view. In fact, the installation costs are one of the main economical barrier for a wider application of shallow geothermal systems, and they are mainly covered by the drilling time and costs (drilling machine and labour costs).

Generally, the drilling technology suitable on a given site and the related most proper ground heat exchanger are mainly dictated by the local stratigraphy (kind of materials/rocks, state of consolidation) and the local hydrogeological conditions, also affecting the drilling times and costs by requiring the application or not of the casing.

The 'drillability' concept has been defined as the prediction of the most suitable drilling technique related to a given underground for a certain borehole heat exchanger type, by taking into account the estimated drilling and installation time. Therefore, a 'drillability' map has been conceived at European scale in order to support the preliminary design phase of new ground source heat pump systems and to provide a first evaluation of the drilling costs and time for a given location. The map is based on the European geological map released by the European Geological Data Infrastructure (EGDI), freely available in the web, that complies with the INSPIRE (INfrastructure for Spatial InfoRmation in Europe) Directive. It is an ESRI Shape (vector file), Scale 1:1.500.000, Projection ETRS 1989 LCC. The EGDI map is connected to a list that collect all the geological context that can be found all around Europe; the list contains 203 different geological settings. The

association among 'drillability' techniques and geological sequence was conducted by considering the knowledge of the partners that are expert in drilling operations in several European countries.

The classical drilling methods are here distinct into percussing, rotating, and combined percussive-rotation methods. The proposed map compares traditional drilling methods usually applied to install vertical ground heat exchangers as the rotary drilling with tricone or chevron bit and the traditional down-hole hammer (with or without casing) with the new drilling techniques developed within the EU funded project Cheap-GSHPs and GEO4CIVHIC.

So far a first 'drillability' map has been released with the drilling time and costs; further development will report the regulatory constraints related to drilling in specific areas.

The 'drillability' map at European scale is connected to a 'drillability' app still under development that will provide a first assessment of the most suitable drilling technique in a specific geological context both to direct users such as designers, drillers, administrators. Depending on the local geology identified by the users, the app will help to estimate the required drilling time and related costs, providing a preliminary information to start decision making and authorization processes.

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