ECONOMIC, GEOLOGICAL AND TECHNICAL POTENTIAL MAPPING TEST IN EUROPE FOR GSHP SYSTEMS

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In order to promote the deployment of low enthalpy geothermal closed-loop systems at European scale, the definition and quantification of the feasibility and potential for different locations is fundamental. In particular, spatial information presented as thematic maps allow the decision process optimization, by identifying the most suitable areas and quantifying their economic and energetic potential. The mapping work described hereafter is related to the European project “Cheap-GSHPs”, which aims to reduce the total cost of ownership, composed out of investment and operating costs, by increasing the safety of shallow geothermal systems during installation and operation and by increasing the awareness of this technology throughout Europe. The work here presented is voted to merge all geological, climatic and energetic data, developing a method to map the techno-economic potential of closed-loop shallow geothermal systems (expressed as €/kW) applied in some test sites representative of main European contexts. Several databases have been created after the collection of geological, climatic, energetic, technological, environmental and economic data at European scale produced within the project. A large amount of numerical simulations were run to standardize 9 representative building types (residential and non- residential) and their energetic requirements in the identified 10 referential climatic locations. Than, were acquired the empirical correlations between geo-distributed and mappable parameters, such as ground surface temperature (GST), ground thermal conductivity (λ), and BHE length suitable to satisfy the required local energy demand. Seven case studies across Europe were considered for the application of the method, in order to test its reliability for different geologies, climates and data availability. GST and weighted λ maps were produced for each of the analyzed case study, considering climate, hydrogeological and stratigraphic information. Regression algorithms were then applied on GST and λ maps in order to obtain BHE length maps to satisfy the energetic requirements, hence creating a €/kW map based on a previously produced costs database. GST, λ and required BHE length maps were compared against real data (usually by using thermal response tests data), where available. In some locations, the cartographic products were also developed with the integration of political constraints, such as the presence of groundwater protection areas. The method seems reliable, not only to create €/kW maps, but also to represent in the European countries semi-quantitative distributed information related to several techno-economic key parameters.

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