

ENVIRONMENTAL IMPACT OF ENERGY EFFICIENCY IMPROVEMENT OF LISTED HISTORICAL BUILDINGS THROUGH SHALLOW GEOTHERMAL SYSTEMS

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Abstract. Historical buildings are a considerable part of the European building stock and they account significantly in energy consumption of European Union member states. These buildings, despite subjected to architectural protection, should be adequate from an energy point of view to allow their reuse or continuity of use according to current quality standards. The application of European regulations on energy consumption containment and efficiency improvement takes into account measures on the building envelope, as well as the updating of the existing technological systems, which may include the use of solutions compatible with the exploitation of renewable energy sources. With regard to historical building, the functional adaptation and the need to ensure thermos-hygrometric conditions suitable for the conservation of heritage objects and people comfort, require a planning effort to balance correctly the importance of conservative aspects and the choice of new systems and technological solutions. In fact, from a purely technical point of view, historic buildings represent a not favourable scenario, due to the different constraints they are subject to and which inevitably limit the use of energy solutions that are more efficient but also more impacting architecturally. The most widespread intervention strategies that have proven effectiveness for common buildings can hardly ever be applied on historical buildings. A solution to these problems can be found by acting on the primary energy source, and in this sense the compliance with conservative needs can be achieved by using geothermal energy. Compared to other solutions, this technology significantly limits the architectural impact, since most of the system is located underground and the use of heat pumps avoids any type of combustion on site without negative effects on the integrity of the system. Despite the ever-increasing demand for renewable energy applications, including geothermal energy, there are no specific national and European standards to fully implement these energy sources in the historic building stock. In order to investigate the application of such technologies in historical buildings from a very practical standpoint, and to encourage discussions that should start a legislative process, the outcome of a research study on the environmental impacts of geothermal technologies applied on a historic building is presented. Specifically, the presented case is taken among a series of real case studies carried out within Horizon 2020 project Cheap-GSHPs, and it consists of an environmental impact assessment on a refurbished historic building where innovative geothermal systems have been installed (Belfield House at University College of Dublin). In this framework, not only the impacts due to the construction and operation phases have been considered, but also the mitigation measures to make the intervention compatible with the historic features of the building. **Keywords:** *geothermal, impacts, historic buildings*