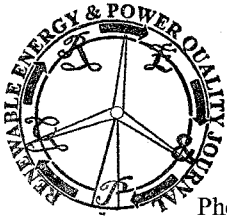


## GEOHERMAL ENERGY HEATING AND HOT WATER FOR A DETACHED HOUSE PROJECT IN OVIEDO (SPAIN)

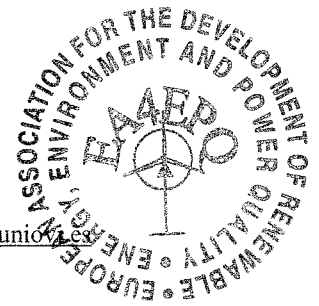


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**Abstract.** Among renewable energies, geothermal energy is gaining importance due to the different applications that are being accomplished within the residential sector. Forecasts suggest a “promising future” for this energy source.

A study carried out by the Department of Energy at University of Oviedo, approached from technical, economic and environmental views related to this source gave as a result the geothermal installation designed for covering the demand of heating and hot water production (DHW) of a detached house located in Asturias described in this paper. Its aim it's to make an optimal use of geothermal energy, combining a geothermal heat pump with a radiant floor heating system in order to keep the building in comfortable conditions and minimizing the effect of the outside temperature.

**KEY WORDS:** Renewable energies, low temperature geothermal energy, DHW, heat pump, energy efficiency.

### 1. Introduction

Within the framework established in 2007 by the EU when establishing the target of obtaining 20% of the energy consumed in the year 2020 from renewable sources, followed by the approval in April 2009 of Directive 2009/28/ EC about promotion of the use of renewable energy sources by recognizing the geothermal energy as one of them, this study considers the design of an installation that uses the geothermal gradient to provide heat and hot water to a detached house located in Oviedo (Asturias).

The requirement HE-4, included in the Technical Building Code (CTE by its acronym in Spanish), establishes for Asturias a minimum solar contribution of the 30%. It also indicates that thermosolar energy can be replaced by other renewable energy sources. The European Directive 2009/28 EC declares geothermal energy as renewable and the Institute for the Diversification and Saving of Energy (IDEA by its acronym in Spanish) in its publication

“Comentarios al RITE 2007” indicates that “*thermal panel systems can be replaced by other renewable source based techniques if the production of CO<sub>2</sub> does not exceed the maximum production permitted by the Administration according to an annual basis*”. For this reason, the installation described will cover the demand of DHW of the building following what is established in the CTE.

According to Table D1 DB HE1 of the CTE, the house is located in the C1 climate zone, with an altitude of 214 m. It has three floors: basement, ground and first floor. The installation is designed for heating the ground and first floors completely while, for the basement, only the living room, bathroom and gym are considered.

The proposed system is radiant floor covering a total surface of 320 m<sup>2</sup>. The house does not have a cooling system and has a thermal insulation of excellent quality, with values of thermal transmittances that surpass the limit values demanded in the DB HE1 document of the CTE. For calculation purposes, it is considered an occupancy of 6 persons in the house, which is the minimum value suggested by the DB HE4 document of the CTE (Section 3.1.1.4) for a house with 4 bedrooms.

The main target in the design of this installation is to provide the user with comfortable environmental conditions by using a heating system characterized for being more energy efficient and less aggressive to the environment than traditional systems.

### 2. Geothermal system

The installation of a heating system applied to housing consists on the heat production elements, the distribution elements, the regulation system and the heat-emitting elements.

The proposed system is based on heat transfer through vertically arranged downhole collectors. A coolant fluid circulates inside the collectors and that acts as a heat