# Deliverable D3.1

# Design of rotating and vibrating machine head and coaxial GSHE of 60mm

## WP3

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| **Grant Agreement number** | 657982 |
| **Project acronym** | Cheap-GSHPs |
| **Project full title** | **Ch**eap and **E**fficient **Ap**plication of reliable **G**round **S**ource **H**eat Exchangers and **P**ump**s** |
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***Dissemination Level***

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| **PU** | Public | |
| **CO** | Confidential, only for members of the consortium (including the Commission Services) | **X** |
| **CI** | Classified, as referred to in Commission Decision 2001/844/EC | |

# Publishable summary

IN WP3 the reduction of costs to install steel based coaxial Ground Source Heat Exchangers (GSHE) based on the piling methodology will be researched and subsequently realized. The state of art today consists out of pushing steel based coaxial GSHE's of an external diameter of 50mm into the ground avoiding the use of drilling rods or using the hammer technique. In such solutions, the steel rods play a double role of coaxial GHSE and drilling rods. One advantage of this solution is the installation time saving due to the avoidance of the rods extraction, which in this case is no longer necessary. In addition, the time and cost of grouting disappears due to the steel GSHE being directly piled into the ground. On the other hand, the cost the steel rods is higher than conventional coaxial GSHE but the yield is also higher due to the high conductivity of the steel and the direct contact with the soil. This results in a lower total length of GSHE's to be installed for an equivalent extraction of energy. The drilling machine is equipped with a sonic head and commercialized under the name ' Vibrasond ' and reaches depths up to 40 meters in soft undergrounds.

One of the objectives of WP3 is the installation of coaxial probes with external diameters larger than 50 mm at depths of 50 m, potentially up to 100 m. Therefore, a first improvement in the installation is the development of a rotating and vibrating machine head. With the combination of vibration, rotation and downward push, it is possible to install probes of larger diameters (60-80 mm) in more types of soils, which was impossible with the old technique. The range of operation for this technique is unconsolidated ground such as sand silt, clay and gravel. In addition, the design of a nozzle in another task in this work package will allow the injection of water at low flow and high pressure during the piling, which is expected to lead to a further improvement in terms of speed, depth and external diameter.

The new machine head has been constructed and tested in the field with promising results in terms of installation speed and realized depths for GSHE's with an external diameters of 76 mm. In addition, simulations have shown that the increased external diameter of the GSHE leads to yield improvements of up to 13%.