Co-funded by the European Community Horizon 2020 Program

Project Title:

GEOthermal Technology for economic Cooling and Heating

GEOTeCH

Grant Agreement No: 656889

Collaborative Project

http://www.geotech-project.eu/

Heat exchanger design review, performance specification and manufacturingdevelopment plans

Executive Summary

Deliverable No.	3.1
Workpackage	3
Task	3.1, 3.8
Lead beneficiary	GEO (Task Leader)
Authors	GH, EMTE, TEC, ARC, GTX, STU, UNILEEDS
Delivery date	30/09/2015
Status	FINAL
File Name:	D3.1_GEOTeCH_finaldraft_v30092015_rev01_ex.docx

Dissemination level		
PU	Public, fully open, e.g. web	
CO	Confidential, restricted under conditions set out in Model Grant Agreement	X
CI	Classified, information as referred to in Commission Decision 2001/844/EC.	

1. PUBLISHABLE EXECUTIVE SUMMARY

The aim of this document is to present how to advance the readiness level of the ground heat exchanger technologies so that their technical performance is further optimized and fully characterized for a range of applications and efficient and accurate design models and procedures are defined. This document is part of the work performed in GEOTeCH European Research Project for the improvement of cost-effective heat exchangers.

This document contains the design analysis and planning of spiral and foundation heat exchangers, identifying the main key performance parameters that need to be quantified for all target applications.

The overall performance of the spiral heat exchangers has been defined in terms of thermal performance (efficiency of heat exchange), pressure loss (energy losses due to pumping power consumption), thermal storage capacity (enhancing thermal performance) and cost. These parameters have been mapped using limits on the dimensions (diameter versus depth) imposed by the drilling method being develop as well in GEOTeCH. These maps define the possible configurations and parameters that will be investigated further during the activities in the project dedicated to the heat exchanger modelling, design optimization, and performance validation.

As the final dimensions of the heat exchanger affect the thermal resistance, storage volume, pressure drop, and production cost this will need to be investigated in more detail using the measurements and modelling at a later stage in the project. Using the results in a sensitivity analysis will yield a thermo-economic optimization of the heat exchanger for different applications.

As a global goal, the overall cost of the GEOTeCH small plug-and-play installations is expected to be 25% lower than conventional ground source heat pump (GSHP) systems due to the improved borehole heat exchanger effectiveness.

The performance of the energy pile depends on the position of the pipes in the pile as well as the relative thermal mass of the pile concrete in relation to the active pipe area. The case of thermally activated diaphragm (screen) walls relies of similar concepts as the energy piles but the configuration is different. Thermal activation of a screen wall is made prior to insertion of the metallic reinforcement in its corresponding trench. Apart from performance, main considerations are structural integrity of the foundation element and coordination of site-works.

The overall performance of foundation heat exchangers has been related to heat transfer rates,. Again, many parameters affect performance and (sustainable) yield. Those parameters need to be investigated further using models later on in the project. To select the cases to be investigated tables presenting the geometric data and technical targets have been developed.

Foundation heat exchanger implementation costs are expected to be 72% lower than an equivalent borehole array so that a complete GSHP system will be 33% more cost effective.