



Sustainable Energy Authority of Ireland

National Energy Research, Development & Demonstration Funding Programme

FINAL REPORT – H2 2021

SECTION 1: PROJECT DETAILS

Table 1.1 – Summary of Project Details

Project Title	Characterisation of Shallow Geothermal Properties (ShallowTHERM)
Lead Applicant (Organisation)	Terra GeoServ Ltd (T/A GeoServ Solutions)
Lead Applicant (Name)	Riccardo Pasquali
Report Prepared By	Riccardo Pasquali
Total Project Duration (months)	12 (11 month extension)

	Name	Organisation
Partner Applicant(s)		
Collaborator(s)	James Byrne	GAI
External Consultant(s)	Dr. Mark Muller	Geophysicist

Project Summary/Abstract (max 500 words)	
<p>ShallowTHERM is testing a methodology, previously applied in Italy, to estimate the underground heat-exchange potential for shallow geothermal installations, in particular, vertical closed loop collectors. The methodology focuses on the use of the DCCA/E/GSI Tellus airborne electromagnetic dataset linked with GIS-based geological maps and thermal properties. The project has developed and is optimising a method of mapping litho-electrical units (Santilano et al., 2015, 2016) to integrate the characteristics of these units with the existing Irish Ground Thermal Properties (IGTP) database and selective additional laboratory measurement carried out as part of the project to map thermal conductivity. This methodological approach and the derived data, will allow thermal conductivity to be more accurately determined over significantly wider areas of bedrock coverage in Ireland (as opposed to the currently available single point measurements in the IGTP database). The available thermal conductivity data will allow for direct input into the ground source vertical closed loop collector suitability maps recently published by GSI and improve the understanding and potential for deployment of GSHP systems.</p>	

Keywords (min 3 and max 10)	Geothermal, shallow geothermal, ground source potential mapping
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SECTION 2: EXCELLENCE & INNOVATION

(max 2 pages)

2.1 Overall Project Update

The project progress for the second half of 2021 is summarised in a final technical report submitted to SAEI and GSI as part of the final technical reporting period. The final technical aspects and implementation of the last parts of the project workflow are discussed in detail in the final technical report.

This document focusses on listing the main achievements for the H2 2021 reporting period. These include:

- Completion of the final digital datasets for the thermal conductivity and closed loop collector energy extraction rate maps developed at the end of H1 2021.
- Write of a scientific research methodology and findings as part of the dissemination activities including technical research paper to the Processes open journal.
- Dissemination of project results through the project website and national geothermal workshops on geothermal energy.

2.2 Innovation / Novelty – Beyond State-of-the-Art

Please note this section has been left the same as the H1 2021 report as the innovations and final outcomes of the project have not changed during this reporting period.

- **Innovation 1: Use of Tellus EM data to define LE units:**

A workflow for integrating lithological and geophysical properties has been defined for the Irish context and tested on key areas where high resolution EM data and geological properties are available allowing the grouping of these properties into district LE Units.

Low flight areas and high resolution EM data could consist of more than 50% of the currently completed [Tellus survey area](#) to which the project workflow could be applied where coupled with existing thermal conductivity and historical thermal conductivity dataset and with the need for limited thermal conductivity verification measurements.

- **Innovation 2: Regional scale thermal conductivity maps**

Regional Scale thermal conductivity maps have been developed maps for three areas covering 620 km², 562 km² and 535 km² respectively and represent the first verified regional 2D mapping dataset of thermal conductivity that integrated geological and thermal properties. This is a significant advancement beyond the current state-of-the-art (point specific bedrock thermal conductivity data) allowing average thermal conductivity data to be determined based lithological and resistivity properties.

- **Innovation 3: Regional scale closed loop energy exchange potential maps**

Thermal conductivity of the subsurface is the single most important parameter in determining the potential for energy exchanger (extraction and re-injection) in the case of conduction dominated closed loop geothermal systems. Modelling of potential energy extraction rates from closed loop collector has been implemented as part of the project based on the regionally mapped properties. The modelling has taken into consideration the use of a

GSHPs in the context of a building energy rating of B3 (in line with Part L of the building regulations) and the requirement for performance set out in prEN17522:2020 and NSAI Standard Recommendation S.R. 50-4:2021 Building services - Part 4: *Heat pump systems in dwellings* to determine maps with peak energy extraction rates achievable at regional scale for the case study areas of the project. These maps are a first in kind product and have significant potential for replication based on the completed project workflow..

SECTION 3: RELEVANCE & IMPACT

(max 3 pages)

3.1 Communication, Dissemination and Exploitation

The dissemination activities undertaken as part of the ShallowTHERM project during the H2 2021, reporting period have focussed on the following:

- Publication of all project results to the project website (www.irishgrouttherm.com) and the project results.
- Outcomes of the project disseminated to other Irish geothermal research projects such as DIG (De-risking Ireland's Geothermal energy potential) where thermal conductivity data will be used to determine the final crustal models;
- Dissemination of project results and data access as part of the Geological Survey Ireland Geothermal Energy Workshop held on the 19th of October 2021;
- Submission to the Special issue of Energies (ISSN 2227-9717) *Special Issue "Advances in Integrated Geothermal Energy Systems"*. The paper was submitted in November 2021 and has now undergone 5 No. revisions. The final paper is still not officially accepted at the time of writing this final report (28/02/2022) with additional style, content and figure revisions requested;
- The submitted abstract to the European Geothermal Congress 2022 Scientific Committee has been accepted and a final paper submission for the congress is being completed (deadline April 26, 2022).

Annual Dissemination Summary Tables

If applicable, please list details of any scientific publications in Table 3.1 on the next page. Please mention papers published in peer-reviewed journals or papers disseminated at conferences (e.g., on the conference website, etc.).

Please list details of all dissemination activities in Table 3.2 on the next page (e.g., publications, conferences, workshops, websites/applications, press releases, flyers, articles in press, videos, presentations, exhibitions, thesis, interviews etc.).

3.2 Intellectual Property Management & Exploitation

If applicable, please provide details of any patents or IP generated as a result of this research award, or underway.

This section is not applicable to the project. Data generated as part of the project is being made publicly available

Table 3.1 – List of Scientific Publications

Title	Main Author	Journal Title	Number, Date or Frequency	Publisher	Year of Publication	Is/will open access be provided? If you marked “will”, please provide an estimate of the date	Peer-reviewed (Y/N)?
Mapping Thermal Properties using Resistivity, Lithology and Thermal Conductivity Measurements	Pasquali, R. Muller, N. Harlin, K.	<i>Special Issue "Advances in Integrated Geothermal Energy Systems"</i>		Processes (ISSN 2227-9717)	2022		Y
Mapping Thermal Properties using Airborne Survey Data to assess potential for closed loop energy exchange	Pasquali, R. Muller, N. Harlin, K.	<i>Proceedings of the European Geothermal Congress 2022</i>		European Geothermal Energy Council	2022		Y

Table 3.2 – List of Dissemination Activities

Type of Activity	Main Leader	Title	Date/Period	Location	Type of Audience*	Size of Audience
<i>Presentation of the Project</i>	<i>R. Pasquali</i>	Characterisation of Shallow Geothermal Properties - ShallowTherm	<i>19/10/2021</i>	<i>Online</i>	<i>Industry, Policy makers, Research</i>	100

<i>Project Website update and development</i>	<i>GEOSERV</i>	www.irishgroundtherm.com <i>project website update</i>	<i>June 2021</i>	<i>N/A</i>	<i>Industry, Policy makers, Research</i>	<i>120</i>
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**Scientific Community (Higher education, Research), Industry, Civil Society, Policy makers, Medias, Other ('multiple choices' is possible).*