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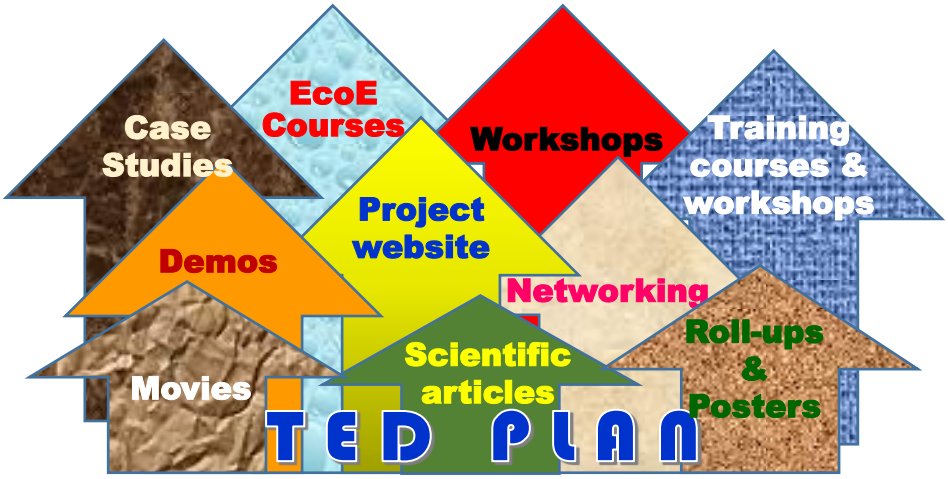
Deliverable D8.12

Last report on Training, Education and Dissemination activities

WP8

Grant Agreement number	792355
Project acronym	GEO4CIVHIC
Project full title	Most Easy, Efficient and Low Cost Geothermal Systems for Retrofitting Civil and Historical Buildings
Due date of deliverable	30/11/2023 (M68)
Lead beneficiary	11 - RGS
Other authors	All the partners



Dissemination Level

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

Document History

Version	Date	Authors	Description
1	26/11/2023	Doinita Cucueteanu (RGS)	Draft document based on all the partners' input sent to the coordinator
2	27 /11/2023	Adriana Bernardi (CNR-ISAC)	Revision of deliverable by the coordinator
3	29/10/2023	Doinita Cucueteanu (RGS)	Final document sent to coordinator
4	30/11/2023	Adriana Bernardi (CNR-ISAC) Coordinator	Final version checked and uploaded in ECAS

Disclaimer

This publication was completed with the support of the European Commission under the *Horizon 2020 research and innovation programme*. The contents of this publication do not necessarily reflect the Commission's own position. The documents reflect only the author's views and the Community is not liable for any use that may be made of the information contained therein.

The content of this document was verified by the project Coordinator but it was not submitted to an internal review because:

(a) its format and content were subject of a preliminary / initial debate in the Consortium with the occasion of the approval of the TED Strategy and the TED Plan already reported to EC in M6,

(b) its content is a synthesis of all partners inputs on all the aspects and activities for training, education and dissemination realized on the reported period of time M37 – M68.

The revision uploaded in EU – EASME in the FINAL one that exactly includes all the corrections, observations and suggestions made by the Coordinator.

Contents

[1] This task was subject of the deliverable D8.9 – Public dissemination level – Uploaded in ECAS in M67 (one month ago).
[2] This task was subject of the deliverable D8.10 – Public dissemination level – Uploaded in ECAS in M67 (one month ago).

[3] This task was subject of the deliverable D8.11 – CONFIDENTIAL dissemination level – Uploaded in ECAS in M67 (one month ago).

Publishable summary

The document **D8.12 - Last report on Training, Education and Dissemination activities** is a **PUBLIC** deliverable in the context of WP8, Task 8.1 – Development of the Training, Education and Dissemination plan, the 72nd and last deliverable during the development of GEO4CIVHIC up to the final day of the project: 30th of November 2023.

The activities described in this document were implemented in the M37 – M68 period of time, meaning after deliver of D8.8 – Third Report on Training, Education and Dissemination – M36.

Abbreviations

GEO4CIVHIC	Most Easy, Efficient and Low Cost Geothermal Systems for Retrofitting Civil and Historical Buildings
TED	Training, Education and Dissemination
GA	Grant Agreement
EU	European Union
EC	European Commission
ECoE	European Centre of Excellence
GSHP	Ground Source Heat Pump
PSC	Project Scientific Committee

Introduction

The document **D8.12 - Last report on Training, Education and Dissemination activities** is a **PUBLIC** deliverable in the context of WP8, Task 8.1 – Development of the Training, Education and Dissemination plan, the 72nd and last deliverable during the development of GEO4CIVHIC up to the final day of the project: 30th of November 2023.

The activities described in this document were implemented in the **M37 – M68 period of time**, meaning after deliver of D8.8 – Third Report on Training, Education and Dissemination – M36.

All the previous reporting documents within WP8, meaning **D8.1 – D8.11 were delivered** at the deadlines provided by the project **Amendment No AMD – 792355-16** and were uploaded in the ECAS portal.

With only one exception: D8.11 – Report on the definition and organization of "European Centres of Excellence for shallow geothermal application in civil and historic buildings, **all the other 11 deliverables in WP8 are PUBLIC** and can be directly accessed in the project website.

Three out of 6 tasks in WP8 were separately reported in M67 (31st of October 2023) by the following PUBLIC / CONFIDENTIAL deliverables:

(i) **Task T8.4** – Networking activities with Architects / Engineers associations and private stakeholders' involvement in the process of dissemination – Deliverable D8.9 – Report on Networking Activities with Architects / Engineers associations and private stakeholders' involvement in the process of dissemination – Task leader PIETRE EDIL - M67 – **PUBLIC**;

(ii) **Task T8.5** – Activities of clustering and collaboration with other EU H2020 projects in shallow geothermal – Deliverable D8.10 – Report on activities of clustering and collaboration with other EU H2020 projects in shallow geothermal – M67 – **PUBLIC**;

(iii) **Task T8.6** – Definition and organization of "European Centres of Excellence for shallow geothermal application in civil and historic buildings – Deliverable D8.11 – Report on the definition and organization of "European Centres of Excellence for shallow geothermal application in civil and historic buildings – Task leader UNIPD – M67 – **CONFIDENTIAL**.

Due to the above premises, and based on a no-redundant approach / reasons, we will present in the next chapters only the **synthesis and conclusions regarding the Task T8.4 / D8.9 and Task T8.5 / D8.10** (PUBLIC documents accessible in the GEO4CIVHIC website) and based on confidentiality reasons, we will present only the **publishable / PUBLIC synthetic information regarding Task T8.6 / D8.11** (CONFIDENTIAL document / deliverable).

The WP8 Gant graph / activity as provided by the Grant Agreement and extended by the GA Amendment **covers the whole period of time of GEO4CIVHIC project from DAY 1 of M1 up to DAY 1795 of M68.**

1 Activities under the task T8.1 – Development of the Training, Education and Dissemination plan

1.1 GANT Graph of T8.1 and current stage at the beginning of this reporting period

The simplified T8.1 Gant graph is the following:

Task /	YEAR #1 M1-M12 (Apr 2018 - March 2019)											
Months / Deliverables	1	2	3	4	5	6	7	8	9	10	11	12
Task 8.1						**3**						**4**

Task /	YEAR #2 M13-M24 (Apr 2019 - March 2020)											
Months / Deliverables	13	14	15	16	17	18	19	20	21	22	23	24
Task 8.1												**5**

Task /	YEAR #3 M25-M36 (Apr 2020 - March 2021)											
Months / Deliverables	25	26	27	28	29	30	31	32	33	34	35	36
Task 8.1												**8**

Task /	YEAR #4, 5 and 6 M37-M68 (Apr 2021 - Nov 2023)											
Months / Deliverables	37	38	39	...	...	...	...	...	...	...	67	68
Task 8.1												**12**

The T8.1 activity was focus on planning, implementing, monitoring and reporting the TED activities. The reporting activity was accomplished previous to this final period of time for the FINAL deliverable, in the following steps:

- **D8.3 (M6) - TED Plan (including TED Strategy)**
- **D8.4 (M12) - First year TED report**
- **D8.5 (M24) - Second year TED report**
- **D8.8 (M36) - Third year TED report**

All these documents were delivered in due time and uploaded in the ECAS portal. As being PUBLIC documents, the respective deliverables are accessible in the PUBLIC area of the project website.

The TED Strategy and TED reports were deeply debated / approved by the consortium partners. They became official guidance and tools for the TED activity in GEO4CIVHIC, preserving initial approach but also improving them in the new conditions of the pandemic period.

The present deliverable D8.12 (M68) – Final TED Report is the final TED reporting step and the TED activities developed within WP8 are presented in the following chapters.

1.2 Impact of the pandemic period and project’s duration extention from 48 to 68 months on the WP8 and T8.1 approach

The pandemic period and the post-pandemic consequences impacted the entire activity of GEO4CIVHIC project and induced a lot of drastic changes in the TRAINING, EDUCATION AND DISSEMINATION actions which, previously were almost never done ONLINE or were made online only in very exceptional circumstances.

As a consequence, starting with the pandemic period and up to the end of the project on the 30th of November 2023, we had to modify step by step our TED approach and to adapt ourselves.

It is very important to affirm that in this period of time, not even for a day / week / month, the **TED activity was not suspended or even slowed down, but on the contrary, it acquired a new dimension, more complex, more difficult and more time-consuming for all the project partners.** This new approach tested our adaptability and creativity.

After 32 months since the previous TED report, we consider that we have coped well with this adaptation process and that we have learned ourselves how to carry out **more effective and more penetrating TED actions in exceptional situations.**

The mentioned situation, circumstances and forced adaptation made us **perform better as a team not only in the direct scientific research but also in the final vector of the scientific research which is the TRAINING, EDUCATION AND DISSEMINATION activity.**

Having said that, in the following chapters / subchapters we will not return to arguments and explanations related to the impact of the pandemic and the period that followed it on each type of TED actions.

2 Activities under the task T8.2 – Training program

2.1 GANT graph of T8.2

Task /	YEAR #1 M1-M12 (Apr 2018 - March 2019)												YEAR #2 M13-M24 (Apr 2019 - March 2020)												YEAR #3 M25-M36 (Apr 2020 - March 2021)												YEAR #4, 5 and 6 M37-M68 (Apr 2021 - Nov 2023)																							
Months / Deliverables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	...	...	...	...	64	65	66	67	68
Task 8.2																																											**6, 7**				

The Training program obviously included as a preliminary phase the creation of a Training Tools Package (TTP) that made the training activity possible and feasible.

2.2 Training Tool Package – TTP

This phase of creation the TTP was not provided in the GA & GA Amendment but represented a continuous preoccupation for all the partners. The debates on a very large, deep and complex TTP started 4 years before the National training courses and workshops period of time (M64-M68), more precise in M12 management meeting in Malta. The concrete decisions were clearly, completely and definitively set little by little within M13-M60 period of time.

The TTP procedure / paradigm on the TTP structure was drawn around a large comprehension on the training activity itself and was implemented rigorously up to the end:

- The TTP is mainly focused on the scientific results obtained in the project but also includes scientific information obtained in previous or current European projects in the shallow geothermal domain. It embraces the whole shallow geothermal area, not necessarily as a summum of GEO4CIVHIC WPs;
- The TTP integrates all the research results in GEO4CIVHIC but not only; previous scientific news on technologies, drilling and GSHP equipment, environment, market, standard etc. must be also integrated;
- In order to ease the access at a specific domain of information, a multi-volumes Training Manual had been created;
- In order to have a coherent approach in each specific volume / domain, the elaboration of each volume had been conducted by a Coordinating author;
- In order to put in temporal correlation, the stage of the research activity in GEO4CIVHIC with the corresponding volume elaboration, each volume had been conducted (from writing to translating step) based on a separate GANT Graph;

- The main steps in the TTP elaboration included the following steps: (i) writing, (ii) scientific verification by PSC, (iii) linguistic verification by GEOSERV (Ireland) and DLH (Malta) and translation;
- The TTP had been elaborated in English language (Master Manual) and, after a rigorous scientifically verification by the Project Scientific Committee partners and linguistically verified by the native English partners, hay had been translated in 6 national languages.

- The translation of the English version was made in 6 languages: French (GEO-GREEN), German (FAU), Greek (CRES), Italian (UNIPD), Romanian (PIETRE and RGS) and Spanish (TECNALIA);
- The TTP were uploaded in the project website both in the PRIVATE area in Word format and in the PUBLIC area, in .ppt format, just before starting the national training courses and workshops and before the ECoE training courses.
- Up to the end the content of the TTP is the following:
  - ❑ One **TRAINING MANUAL** (7 volumes)
  - ❑ Two **USER MANUALS**
  - ❑ Two **BROCHURES**
  - ❑ Two **MOVIES**
- The Seven volumes **TRAINING MANUAL** are the following:
  - ❑ VOLUME 1 – **Energy needs and technical solutions for efficient buildings**
  - ❑ VOLUME 2 **– Geology and mapping**
  - ❑ VOLUME 3 **– Drilling methodology, machines and heat exchangers**
  - ❑ VOLUME 4 **– Geothermal heat pumps technology**
  - ❑ VOLUME 5 **– Sizing GSHP and hybrid technologies**
  - ❑ VOLUME 6 **– Environment and standards**
  - ❑ VOLUME 7 **– Historical and World Heritage Buildings**
- The two **USER MANUALS** are the following:
  - ❑ **DSS - Decision Support Systems for geothermal retrofit**
  - ❑ **Application for support on field for workers in Geothermal domain**

- The two **BROCHURES** are the following:
  - ❑ **GOE4CIVHIC - Technical Brochure**
  - ❑ **GEO4CIVHIC – Historical Buildings Brochure**

- The two **MOVIES** are the following:
  - ❑ Animation movie reflecting the shallow geothermal applications (2,3 minutes) – Installed in the GEO4CIVHIC website in the first 6 months)
  - ❑ Main research results obtained GEO4CIVHIC project (12 minutes) – Installed in the GEO4CIVHIC website in the final month of the project M68).

Translated 7 volumes of the Training manual into 6 national languages of the partners.

The finalization of the TTP was reported in a deliverable:

- **D8.7 (M64) – Production of Training Tools Package (manual, brochures, user manuals) – PUBLIC,** uploaded in due time in the ECAS portal and in the PUBLIC area of the project website.

2.3 National training courses and workshops

The preparation of the national training courses and workshops started in M60 and the plan was reported in a targeted deliverable:

- **D8.6 (M64) - Plan of national courses and workshops - PUBLIC,** uploaded in due time in the ECAS portal and in the PUBLIC area of the project website.

The following **target stakeholders** taken into consideration for all the training events (courses, workshops, demonstrations, site visits etc.) were identified in each organizing country:

- Shallow geothermal specialists: Geologists, Manufacturers for GSHP Equipment, GSHP applications designers, GSHP Researchers
- Constructors, architects, building, structural and H&C engineers, technicians, installers
- Energy and Environment Agencies
- Historical buildings and Monument protection specialists
- Regulatory authorities in energy and H&C
- Local authorities and energy decision makers at local, regional and national level
- Real estate investors and funding institutions
- Lawyers (specialised in environment, construction)
- Ecologists, opinion formers, media
- Building owners representatives, general public interested in energy savings and ecology
- Undergraduate and PhD students (especially in ECoE training system but not only).

The training events planned by the responsible partners tried to put together in a single training event stakeholders with compatible interests and level and knowledge.

The **pre-courses activities** consisted in: **Debates in the consortium / organizational system final approvals / training the trainers** in the previous management meeting M60 – Athens, as they were presented in detail in the D8.6 deliverable – PUBLIC.

In April 2023 in the **M60 – Athens Management Meeting,** the consortium management included in the agenda an internal meeting with the name **"Training the trainers"** with all the actors involved in the training activities: the partners involved in the training events organization AND the partners involved in the elaboration of the TTP – Training Tool Package (Training Manual, User Manuals, Technical Brochures), all of them being directly or indirectly involved in the project training activity. This special meeting includes the final debates and decisions on all the aspects of the training events (content, structure, teams, timing and methodology and the D8.6 deliverable draft structure and content) according to GA provisions.

In the respective meetings were defined the **training teams** for each training event: partners and specialists involved in other countries courses; partnerships, collaboration, split agenda for each course / workshop; possibility to teach from a different country in online courses, the differentiation between the approach of training events for specialists and for non-specialists, the use of the know-how from different EU projects. Each organizer and co-organizer partner were involved in at least one national training course and one national workshop.

Finally, the agenda of each type of event (for specialists or for non-specialists) was envisaged according to the scientific project results as they were presented in the 7 volumes of the Training

Manual, the 2 User Manuals and the 2 Brochures, in WPs results and in the project deliverables and obviously, adapted at the knowledge level of the participants in the event.

Each partner responsible for the training courses under T8.2 planned / implemented minimum 1 training course and 1 workshop / country, meaning for Italy, Spain, Germany, Belgium (French / Dutch language separately), Swiss, Romania, Ireland, Greece.

All the training events have to also focus on civil and historical buildings. The responsible partners had the possibility to decide the most suitable addressed stakeholders, optimum number of participants, the type of presence (in person in a location set by the responsible partner, online or hybrid) and event duration according the concrete situation / level of knowledge of the addressed stakeholders. Part of the training events also include demonstrations, demo site visits, debates with stakeholders' participations, networking activities to maximize events' impact and efficiency.

At the beginning of the training event all the TTP in English, French, German, Greek, Italian, Romanian and Spanish language were accessible in the GEO4CIVHIC project – PUBLIC area, being freely available not only for the trainees but also for any website visitor interested in shallow geothermal. All the TTP pieces were / are downloadable from the GEO4CIVHIC website.

The training activity organized by the network of 4 **European Centres of Excellences for shallow geothermal application in civil and historical buildings** in Spain – UPV, Italy – UNIPD, Germany – FAU and Romania – RGS **is not included in this chapter being part of another task: T8.6.**

The planned training events were largely disseminated through GEO4CIVHIC website, by social media and by the own communication path (included websites) of the organizing partners.

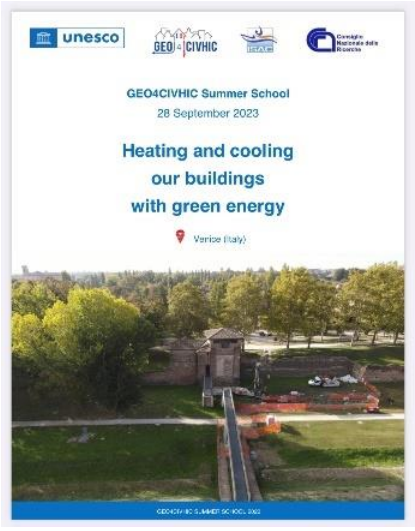
Up to the end of the project on 30th of November all the planned training actions were successfully implemented and reporting as it is presented in the following table:

COUNTRY / RESPONSIBLE PARTNER for training events	TRAINING EVENT TYPE / P – in presence O – online H - hybrid	Nr Participants	Target stakeholders	DATE / LOCATION / DURATION (hours)	MAIN TOPICS and Training tools	TRAINERS / LECTURERS
1. SPAIN / UPV, SOLINTEL, TECNALIA	Course specialists / H	40	Installer, drillers, designers	October 23 / Valencia, Bilbao, Madrid / 2 h	Volumes 1-7 synthesis, DSS demonstration	TECNALIA, UPV, SOLINTEL
	Workshop non specialists / H	28	Public deciders, investors, builders, architects	October 24 / Valencia, Bilbao, Madrid / 2 h	Volumes 1-7 synthesis, DSS law level, business models	TECNALIA, UPV, SOLINTEL
2. GERMANY – FAU	Course specialists / O	20	Deciders, researchers	October 5 / Online / 3 h	Volume 2, 3, 6, 7, GEO4CIVHIC synthesis, News in Germany	FAU, UBeG, Terra- Infrastructure
	Workshop non specialists / O	20	Master and PhD students	July 26 / Online / 3 h	Volume 2, 3, 6, 7, GEO4CIVHIC synthesis, News in Germany	FAU, UBeG, Terra-Infrastructure
3. ROMANIA / RGS, PIETRE	Workshop specialists / H	20	Architects	July 14 / Bucharest / 2 h	Volume 5, 6, 7, GSHP fundamentals	RGS & PIETRE
	Workshop non specialists / H	10	Public deciders	July 17 / Bucharest / 2 h	Volume 1, 2, 3, 4, 5, 6, 7 in synthesis, GSHP fundamentals	RGS & PIETRE
	Course specialists / P	50	Shallow geothermal specialists / Public deciders in local / regional and central authorities	October 30 – November 2 / Oradea / 3 h	Volume 1-7 synthesis, DSS demo, visit in applications in Oradea (Nov 1) and Bihor / Oradea region (Nov 2)	RGS
4. GREECE – CRES	Course for specialists / O	60	investors, engineers, geologists, National Authorities, Local Authorities, cultural heritage society, professors and researchers on engineering and geology, geothermal heat pump installers, energy agencies and others	November 1 / Zoom / 2 h	Volume 2, 3, 5, 6, 7, geological aspects in demo cases	CRES
	Workshop non specialists / O Networking event / O			November 1 / Zoom / 2 h November 1 / Zoom / 2h	Volume 1-7 synthesis, demo cases, DSS demonstration	CRES
5. BELGIUM – GEOGREEN, GALLETTI	Course for specialists / H	12	Geologists	Namur / 2 h	Volume 2-3-4-5-7 + demo cases	GEOGREEN, GALLETTI
	Workshop non specialists / H	12	Decision makers	Namur / 2 h	Volume 2-3-4-5-7 + demo cases	GEOGREEN, GALLETTI
6. IRELAND – GEOSERV	Course for specialists – H	17	Drillers, Installers, Designers, Architects	November 28, afternoon / 3 h	Volumes 1 to 5, Summary of volumes 6 & 7	GEOSERV, UNESCO, Galletti / RED (TBC)
	Workshop non specialists – H	18	Decision makers, local authorities, Gov. departments	November 28 / 3 h	Summary of Volumes 1-7, Focus on volumes 6 & 7	GEOSERV, UNESCO, Galletti / RED (TBC)
7. SWITZERLAND - SUPSI	Course for specialists / Presence	20	Engineers, Drillers, Installers, Designers, Architects	November 23 / Gordola / 2h	Summary of all Volumes, Focus on volumes 5 & 6	SUPSI, (UNIPD material)
	Workshop non specialists / Presence	13	Engineers, Public deciders, investors, builders, architects	November 30 / Mendrisio / 2h	Summary of all Volumes, Focus on volumes 4 & 5	SUPSI, (UNIPD material)
8. ITALY - UNIPD	Course for specialists / P	50 (max)	Geologists, Engineers	Replanned on December 15, 2023 / Padova / 2 h	Volume 1-7, demo cases, DSS demonstration	UNIPD
	Workshop non specialists / H	50	Journalists, politics	November 24 / Lignano (Venice) / 2 h	Volume 1-7 synthesis, GSHP fundamentals and APP	UNIPD
9. UNESCO	Specialists / H	65	Summer school students	Unesco / Venice / 7 h	Volume 1-7 synthesis, focus on historical buildings	UNESCO, CNR, UNIPD, RED, GEO-SERV
18 training events		505	1 out of 18 events was replanned in December 15 for logistic reasons			

As a conclusion, the 17 (+1 in December) training events organized around Europe in the national languages of the trainees had finally trained more than 500 specialists and no-specialists improving their knowledge in shallow geothermal domain, especially applied to civil and historical buildings.

2.4 UNESCO training event

UNESCO training event "GEO4CIVHIC Summer School" was invested as a special one because:



■ The global impact of UNESCO's actions as a valuable scientific partner but also as a vector for GEO4CIVHIC training, education and dissemination activity at regional and international level.

■ UNESCO's summer school was considered to be one of the most important **project demonstrator** on the historical buildings area as examples of sustainable use of environmentally sound renewable energy sources.

Due to these reasons the training event organized by UNESCO had a great importance in the training package of activities in GEO4CIVHIC.

The stakeholder category in the UNESCO course organized under summer school training system was also a special one. The course was intended for secondary school and university students from South-East Europe, as well as to young scientists seeking specialisation in geothermal energy.

The UNESCO course included a diversified set of actions:

- Overview of Green and Ground Energy;
- Demo site posters;
- Dialogue between geologists and engineers on innovative building solutions for residential and historical buildings;
- Implementation results on the demonstration sites from Europe: Italy, Malta, Ireland, Belgium;
- The market of new ideas;
- Roundtable discussion – education and career paths.

The students dove deeper into the successful works done in three historical sites around Europe:

- The Angels' Gate in the UNESCO World Heritage site of Ferrara City of the Renaissance, and its Po Delta (Italy)
- An historical residential house in Greystones (Ireland)
- The Msida Bastion historic garden in La Valetta (Malta)

The UNESCO Regional Bureau for Science and Culture in Europe has supervised, with the support of the management authorities and the GEO4CIVHIC technical partners, the implementation of the real demonstration component adapted to the Angel's Gate in Ferrara, Italy.

2.5 Reporting the training program

The GEO4CIVHIC Strategy set and approved by the consortium at the beginning of the project (M12 - 2019) and the Training activity procedure debated / approved in the Management meeting in Athens April 2023 included a coherent set of provisions regarding the monitoring and unitary reporting template for all the training events.

The reporting template included the following precise aspects:

1. **OBJECTIVES OF THE TRAINING EVENT**

After the implementations of the training events the national event organizers provided events' reports (larger or more concise) and the overall conclusion is that all the partners involved a lot of effort and energy in order to transmit on a large scale the know-how accumulated on the GEO4CIVHIC duration.

At the same time, the partners found creative and optimal TED solutions for transmitted essential information to all the types of stakeholders, in difficult conditions (online, in presence, hybrid), in cooperation with other 1-2-3 partners from their own country or from other partners countries, in the national language or in national language AND in English.

The GEO4CIVHIC TED Strategy elaborated in the first semester of the project included a questionnaire template that has to be collected from the trainees after the training event. The collected questionnaires after the training events organized in M64-M68 from the trainees that agreed to fill them in, of course, as long of this kind of feedback was nor compulsory), allowed to the organizers to extract conclusions for the future improvement of the training events.

The open access allowed to the trainees at the whole TTP in English and in the 6 national languages installed in the GEO4CIVHIC website at the beginning of the training events was also a way to ease the communication with the trainees in their native language.

Up to the end of the implementation of the training events - end of November 2023 (training courses and workshops) **the total number of the participating trainees were 540 in 20 training courses for specialists and no-specialists and in national workshops.**

The organizers received a lot of positive feedback from the trainees that appreciated not only the large domain of the courses' presentations, but also the trainers competence, the received documents (website - TTP links) and the organization aspects as a whole.

All the organizers' reports were uploaded in the PRIVATE area of the GEO4CIVHIC project website.

3 Activities under the task T8.3 – Communication of project's results

3.1 The project website / TED through social media

The project website content, drawing, design was one of the first set / decided / implemented task in the WP8 and was reported in **D8.2 - Production of website (M6) - PUBLIC.**

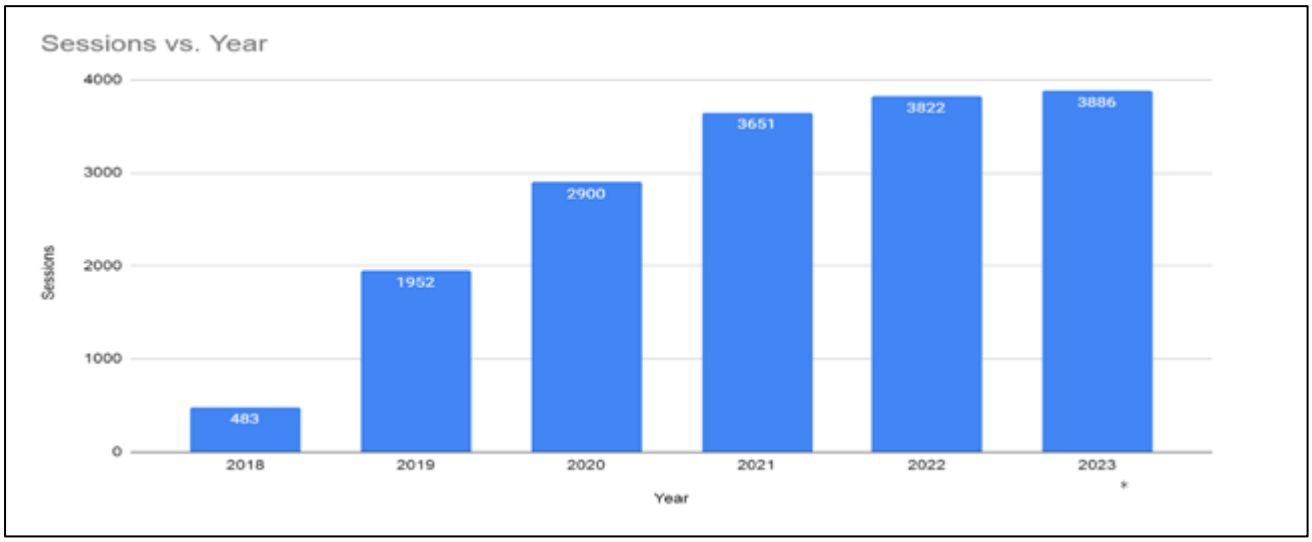
The website was created to cover **all the activities in the project.** The website **structure** was improved on the 5.5 years project duration. The website **content** was continuously updated.

Google Analytics data is split into two periods, **April 1, 2018 - June 30, 2023** and **July 1 - October 31, 2023**, as after July 1 it switched to GA4 and the interface was changed.

In all the 5.5 years of the project, all the partners were monthly informed through a "standard" dashboard on the evolution of the website, including visits, visited pages, duration etc. These monthly dashboards will continue to be send in the next 3 years, meaning up to the 30th of November 2026.

In the 5.5 years of the project, the performance parameters of the website were measured using 2 distinctive software products: **Universal Analytics** for the period April 1, 2018 - June 30, 2023 and respectively **Google Analytics 4 (GA4)** for the period July 1, 2023 - October 31, 2023. This is why the following graph will be also split in 2, each part corresponding to the mentioned period of time / measurement software.

Visit dynamic and audience overview

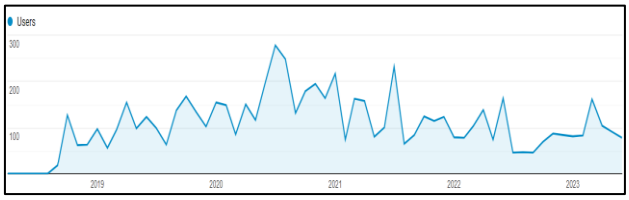


Regarding the visit dynamic and audience overview: the conclusions are the following:

- The number of visitors increased little by little up to over 3500 visitors per year starting 2021;
- The maximum number of visitors was almost 4000 in the last year of the products (between January 1 to November 2023);
- In 2023 the dynamic was also increased after August - the period of time when the TTP were uploaded in the project website.

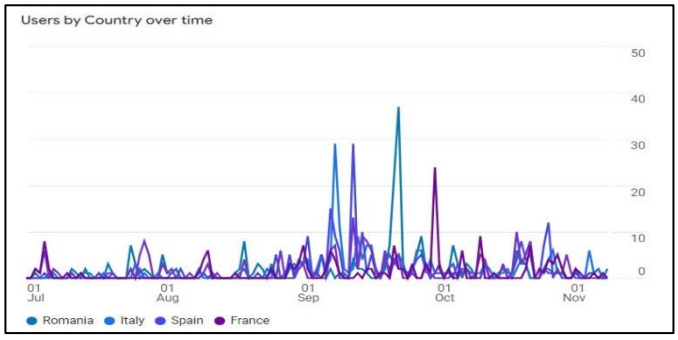
Geographic and demographic details on site visits

April 1, 2018 - June 30, 2023



Country	Acquisition			Behavior		
	Users	New Users	Sessions	Bounce Rate	Pages / Session	Avg. Session Duration
	6,113 % of Total: 55.29% (11,057)	6,268 % of Total: 54.69% (11,460)	8,743 % of Total: 60.58% (14,432)	64.20% Avg for View: 66.85% (-3.97%)	2.39 Avg for View: 2.00 (19.60%)	00:02:20 Avg for View: 00:01:29 (57.98%)
1. Italy	1,101 (17.66%)	1,111 (17.72%)	1,703 (19.48%)	59.42%	2.54	00:02:44
2. Ireland	887 (14.23%)	883 (14.09%)	940 (10.75%)	80.32%	1.79	00:00:35
3. Germany	734 (11.78%)	740 (11.81%)	908 (10.39%)	59.69%	2.25	00:01:04
4. Spain	508 (8.15%)	517 (8.25%)	803 (9.18%)	54.67%	2.38	00:02:45
5. Netherlands	357 (5.73%)	360 (5.74%)	386 (4.41%)	85.75%	1.43	00:00:17
6. Romania	315 (5.05%)	314 (5.01%)	1,148 (13.13%)	45.21%	4.68	00:08:08
7. France	309 (4.96%)	311 (4.96%)	361 (4.13%)	75.07%	1.42	00:00:24
8. Finland	255 (4.09%)	255 (4.07%)	256 (2.93%)	95.31%	1.09	00:00:08
9. Hungary	214 (3.43%)	215 (3.43%)	231 (2.64%)	87.01%	1.26	00:00:27
10. Belgium	205 (3.29%)	206 (3.29%)	235 (2.69%)	68.09%	2.11	00:01:09

July 1, 2023 - October 31, 2023

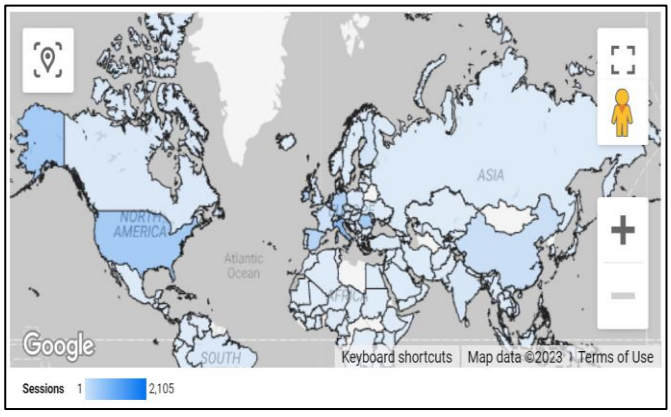


Country	Users	New users	Engaged sessions	Engagement rate	Engaged sessions per user	Average engagement time	Event count All events
	1,558 100% of total	1,538 100% of total	700 100% of total	30.2% Avg 0%	0.45 Avg 0%	0s Avg 0%	8,762 100% of total
1 Spain	163	162	143	43.2%	0.88	0s	1,247
2 France	159	158	8	5.03%	0.05	0s	492
3 Italy	152	144	133	45.24%	0.88	0s	1,192
4 Romania	145	140	183	51.69%	1.26	0s	1,842
5 Greece	121	120	43	24.57%	0.36	0s	618
6 Finland	89	88	1	1.12%	0.01	0s	266
7 Netherlands	84	84	1	1.19%	0.01	0s	254
8 Germany	80	79	36	33.96%	0.45	0s	408
9 Austria	51	51	16	25.81%	0.31	0s	201
10 United Kingdom	50	49	15	25.86%	0.30	0s	217

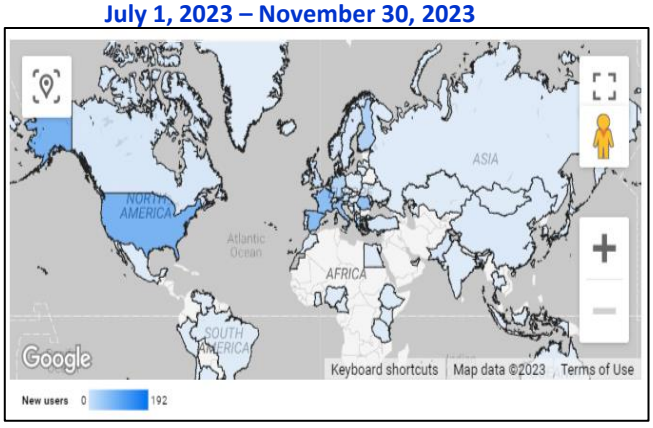
Regarding the geographic and demographic details on site visits the main conclusions are the following:

- The majority of visitors came from the countries of the consortium partners.
- Many visitors also came from other European or non-European countries which shows a broad interest / impact of the scientific news in the field of surface geothermal energy (as can be seen in the following picture).

April 1, 2018 - June 30, 2023



July 1, 2023 – November 30, 2023

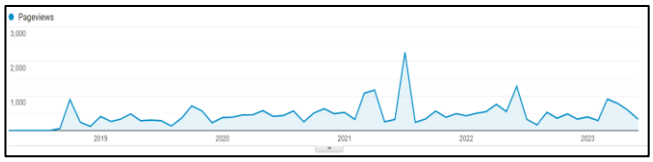


Most visited pages in the website

The most visited pages in the website were the general, initial ones, meaning the pages presenting the objectives of the project, the componence of the consortium, the work packages structure etc.,

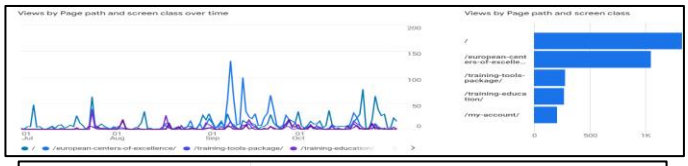
in the last 6 month the most visited website pages were **"European Centre of Excellence", "Training Tools Package"** and **"Training – Education"** meaning the ones presenting the research results and the training events, as it is shown in the following pictures.

April 1, 2018 - June 30, 2023



Page	Pageviews	Unique Pageviews	Avg. Time on Page	Entrances
	28,805 % of Total: 100.00% (28,805)	21,547 % of Total: 100.00% (21,547)	00:01:29 Avg for View: 00:01:29 (0.00%)	14,432 % of Total: 100.00% (14,432)
1. /	15,293 (53.09%)	11,540 (53.56%)	00:01:13	11,290 (78.23%)
2. /consortium/	1,064 (3.69%)	903 (4.19%)	00:01:58	268 (1.86%)
3. /events/	1,064 (3.69%)	586 (2.72%)	00:01:17	114 (0.79%)
4. /public-publications/	1,042 (3.62%)	722 (3.35%)	00:01:57	172 (1.19%)
5. /about/	986 (3.42%)	823 (3.82%)	00:01:56	236 (1.64%)
6. /wp-deliverables/	726 (2.52%)	554 (2.57%)	00:03:47	138 (0.96%)
7. /my-account/	713 (2.48%)	321 (1.49%)	00:00:30	143 (0.99%)
8. /training-education/	435 (1.51%)	381 (1.77%)	00:00:19	82 (0.57%)
9. /private-publications/	426 (1.48%)	306 (1.42%)	00:02:23	81 (0.56%)
10. /blog/	373 (1.29%)	296 (1.37%)	00:01:19	52 (0.36%)

July 1, 2018 - October 31, 2023



Page path and screen class	Views	Users	Views per user	Average engagement time
	4,737 100% of total	1,520 100% of total	3.12 Avg 0%	0s Avg 0%
1 /	1,332	833	1.60	0s
2 /european-centers-of-excellence/	1,048	508	2.06	0s
3 /training-tools-package/	278	121	2.30	0s
4 /training-education/	272	105	2.59	0s
5 /my-account/	206	52	3.96	0s
6 /events/	168	109	1.54	0s
7 /about/	126	82	1.54	0s
8 /2023/08/29/geo4civhic-summer-school-2023/	123	78	1.58	0s
9 /training-tools-package-ro/	122	84	1.45	0s
10 /private-publications/	121	33	3.67	0s

TED through social media

All the updates planned and / or implemented in the project website in 5.5 years were simultaneously inserted in a specific / coherent format in all the social media accounts of the GEO4CIVHIC. The long list includes the GEO4CIVHIC Final Conference in Malta :

- **Facebook** https://www.facebook.com/geo4civhic/posts/pfbid0USDwE7Z2tQkXbeeDYstr74zWdA9PCWtTshZzkrFhpRM5F6Hb7mDcKQy9tdQgSgyRl
- **LinkedIn** https://www.linkedin.com/feed/update/urn:li:share:7127966064612622336/
- **X** https://twitter.com/GEO4CIVHIC/status/1722200937916493864
- **Instgram** https://www.instagram.com/p/CzYcVsnMtJi/

Global impact through UNESCO network / links

The global UNESCO visibility, it's contacts, interfaces and link's networks were largely exploited in order to promote GEO4CIVHIC project, not only UNESCO's contribution itself. In this way, a multitude of UNESCO's news published both in GEO4CIVHIC and UNESCO website and in the respective social medea accounts doubled the impact of the project actions giving them a global impact.

Scientific publications

Along the 68 months of the project, the scientific activity presented in national and international publications and events in the form of scientific articles, communications, posters, roll-ups etc. were largely reflected in the GEO4CIVHIC website news and their complete content was also included in the website.

The **PUBLIC publications** area includes all the Manuals (in English and translated in 6 other languages), the initial and final technical brochures, the leaflets, announcements etc. in PDF format at https://geo4civhic.eu/public-publications/.

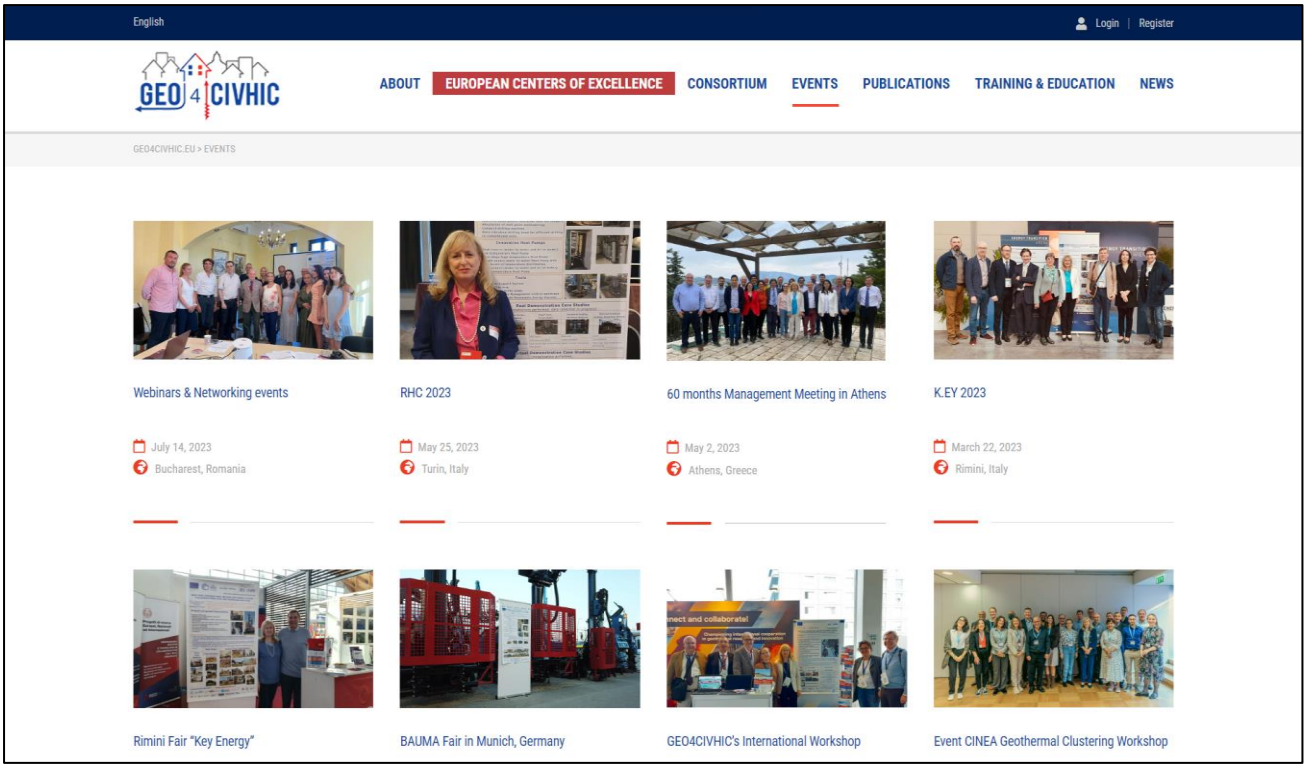
The **PRIVATE publications** area includes 314 documents and 3 videos regarding the demo sites. (https://geo4civhic.eu/private-publications/; this number of documents includes the TTP in Word accessible only for the partners).

In the WP Deliverables area are included all the 72 Deliverables and the Periodic Reports - https://geo4civhic.eu/wp-deliverables/

The **Congress & Conference Articles** area includes 31 documents present at https://geo4civhic.eu/congresses-and-conferences-articles/ and in **ANNEX 1** of this deliverable. On the end of the project there are some publications procedures in progress. They will be finalized up to the FINAL GEO4CIVHIC REPORT in 2024 and will be also inserted in the website at that time.

The scientific articles published in journals are inserted in the **Journal's area** at https://geo4civhic.eu/journals-articles/ and in **ANNEX 2** of this deliverable. This list will be also continuously updated in the next month / years.

All the articles were written by the scientific researchers working in GEO4CIVHIC project, were debated between the partners before publication and were approved by the Scientific Project Committee and by the project coordinator.



The 59 **Technical and scientific international events** in which GEO4CIVHIC project was present are largely described and can be found at https://geo4civhic.eu/events/

3.2 Internal comunication through the project website

The internal communication reflected by the project website consists in the following documents uploaded in the website:

- Agenda of all the management meetings
- Presentations made by the WP / task leaders in all the management meetings
- Minutes of meetings for all the management meetings
- Pictures from formal / unformal meetings within the management assemblies
- Communication list of contacts (continuously updated)

3.3 The Final Conference

On the 14-15th of November the Final Conference of GEO4CIVHIC project took place in Malta - La Valletta and was organized by DLH.

The two days conference was dense and all the documents (agenda / public and private presentations / pictures) were uploaded in the project website.

The consortium participants and the guests received printed materials about the GEO4CIVHIC project and memory sticks with the project's logo and having inside the whole package of training tools in English, French, German, Greek, Italian, Romanian and Spanish languages.

4 Activities under the task T8.4 – Networking with Architects / Engineers associations and private stakeholders' involvement in the process of dissemination

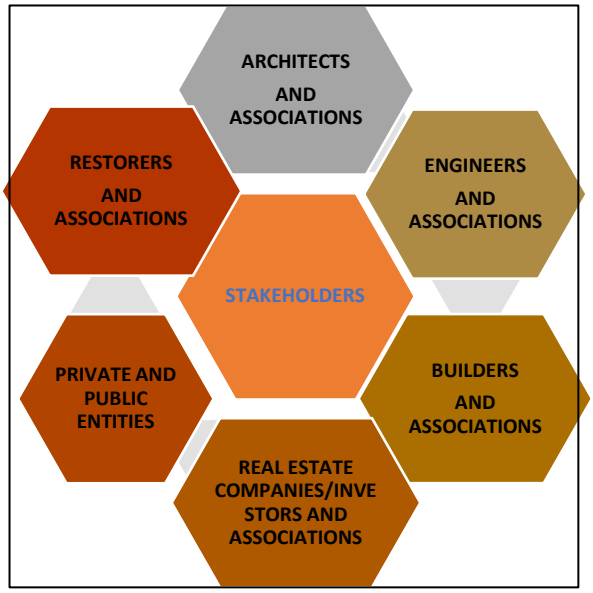
4.1 The task T8.4 provided deliverable on M67 (31st of October 2023)

The deliverable **D8.9 - Report on Networking Activities with Architects / Engineers Associations and private stakeholders' involvement in the process of dissemination (PUBLIC)** reported on the 31st of October 2023 by the task coordinator PIETRE EDIL, offered an in-depth review of the various networking activities with **architects, engineers, builders, real estate companies, investors, restorers and associations of these categories**, undertaken in the context of Task 8.4.

It outlines a broad spectrum of **national and international initiatives** vital for creating network for the **future exploitation activities and engaging stakeholders**. The core audience for these activities spans European and international networks in the construction, shallow geothermal and retrofitting market.

The T8.4 activity was developed on the collaborative spirit of all the consortium partners that have shaped an expansive networking strategy, ensuring it is robust, relevant, and tailored across various Work Packages and tasks. Rigorously respecting the standards of confidentiality and GDPR, the GEO4CIVHIC project has successfully created a **complex stakeholder database**, useful for the future Exploitation Plan of the Consortium.

The main types of actions developed under T8.4 include 2 categories:



1. **Networking events:**
   - ❑ Meetings with European and International Networks of Architects, Engineers, Constructors, Real estate investors, Restorers or other interested stakeholders by inviting them on the webinars and other events organized by each partner
   - ❑ Training courses focused on the identified stakeholders
   - ❑ Workshops focused on the identified stakeholders
   - ❑ Seminars focused on the identified stakeholders
   - ❑ Conferences, congresses with relevant theme and focused on the identified stakeholders
   - ❑ Fairs and exhibitions in the field of geothermal, shallow geothermal and retrofit market
   - ❑ Meetings with stakeholders from the identified categories with the occasions of presenting relevant and publishing papers, that meet the 3 criteria from the definition of networking activities
2. **Social media actions focused on the targeted audience**
   - ❑ Campaigns Newsletters and E-mail with project information

The deliverable D8.9 presented / described a very large number of networking actions / initiatives (158 in total) implemented by the partners, in tabular format, that allowed to crown this action with a stakeholder data base.

In the final part of the deliverables are presented also in tabular format a large number (66 in total) of European and national level stakeholders associations for each type of the following categories: architects, constructors, engineers, real estate and investors, policy makers and public authorities, private stakeholders, platforms for networking, historical monuments associations.

4.2 Main conclusions on networking activity

The most important **conclusions** regarding the **GEO4CIVHIC Networking Activities** can be summarized as follows:

1. An overwhelming majority of **networking activities** have been incorporated into the **individual networking plans** of **all 19 project partners,** that have played a role in shaping the consortium's networking planning, aligning with their specific engagements across various WPs and tasks, during all project stages
2. Notably, there's a continuously increase of in the networking activities during the project's duration following the **Dissemination Plan** (Task 8.1). **All the networking activities previewed were realised.**
    - 158 networking initiatives
    - Along with these networking activities, the partners also implemented **several networking actions in online** campaigns for networking
    - A stakeholders data base was created as fundamental for future Exploitation Plan
3. A meticulous approach has been adopted in considering all discerned and potential **stakeholders**. The strategy focused on tailoring and conveying the most relevant information, knowledge, and data to each stakeholder, ensuring its pertinence and impact. The **main stakeholders' categorie**s identified for the task 8.4 were**: architects, engineers, builders, real estate companies, investors, and restorers and associations of these categories.**
4. **All the 19 partners of GEO4CIVHIC** project prioritized a smooth and continuous flow of information and resources, by leveraging **networking activities**, they sought to foster collaborations, encourage mutual knowledge sharing, and tap into diverse expertise.
5. This collective partners' approach was not just about amplifying communication, but was geared towards significantly **optimizing the results** of the project. By bridging gaps and uniting varied skill sets, the partners aimed to harness the full potential of each entity involved, ensuring that the project not only **met its goals** but exceeded expectations in touching the market needs.

In conclusion, the collaboration and **networking with architects, engineers, builders, real estate companies, restorers and associations of these categories** have been the driving force between **the successful implementation** of our networking activities and the future projection of the Exploitation Plan.

The synergy between the **19 partners** and the presented **stakeholders** has resulted in a sustainable development that caters to the **market demands and focuses on commercialization**. This successful integration of the importance of **effective networking and collaboration** should be presented separately for each partner in order to have an overview of the **networking activities and their results**.

5 Activities under the task T8.5 – Clustering and collaboration with other EU H2020 projects on shallow geothermal

5.1 The task T8.5 provided deliverable on M67 (31st of October 2023)

The deliverable **D8.10 - Report on Clustering and collaboration with other EU H2020 projects on shallow geothermal (PUBLIC)** reported on the 31st of October 2023 by the task coordinator CNR-ISAC, and present at the web site address https://geo4civhic.eu/wp-content/uploads/2023/11/GEO4CIVHIC_T8.5_CNR-ISAC_D8.10_final.pdf offered an in-depth review of the various clustering and collaboration with other EU project undertaken in the context of Task 8.5.

The joint dissemination activities with other European projects during the development of the GEO4CIVHIC project are described as demonstrating extensive activity in the European context. The useful meetings with other European projects are described in details in the deliverable based on in-depth description of this extensive activity carried out in the European context at meetings with other European projects where there was an exchange of information and discussion of cooperation possibilities.

All the clustering and collaboration activities implemented in the 5.5 years of the GEO4CIVHIC project are also presented in the project's website - PUBLIC area. In the deliverable D8.10 these actions are presented in two distinct categories:

- Activities organized by INEA / CINEA
- Other activities of clustering with EU projects

5.2 Clustering and collaboration actions and conclusions

On the duration of the project, the following three events were organized by INEA / CINEA with the specific objective of the clustering and collabotration with the EU H2020 projects:

- INEA H2020 workshop, Brussels (Belgium), October 8th, 2019
- 2nd Clustering organised by INEA: H2020 projects on Geothermal projects in occasion of WGC 2020- Reykjavik, April 2020/ 25th October 2021
- 3rd Clustering meeting organised by CINEA: H2020 projects on Geothermal projects - Berlin 17 October 2022

In the second category of clustering / collaboration events described in D8.10 contains the following:

- ECTP Conference 2018 - Brussels on 13-14 November
- International Sustainable Energy Conference 2018 – October 3rd - 5th, 2018, Graz (Austria)
- European Geothermal Congress – June 19th , 2019, The Hague (Nedherland)

- REHVA 13th World Congress CLIMA, Bucharest (Romania), 26th - 29th May, 2019
- EVENT "SHALLOW GEOTHERMAL ENERGY DAYS" – Brussels 24th – 25th September, 2019
- BRENET Conference in Aarau (Switzerland) – 3rd - 4th September 2020
- EVENT EGEC, March 31st , 2022
- EVENT "GEOSCIENCES FOR A SUSTAINABLE FUTURE" - 19th - 21st September 2022, Torino (Italy)
- EVENT EGEC, EUROPEAN GEOTHERMAL CONGRESS, 17th – 21st October 2022, Berlin (Germany)
- EVENT RHC, May 25th, 2023 – Torino (Italy)
- World Geothermal Congress 2023, Beijing, China, 15th – 17th September, 2023

As general conclusions regarding the activity developed by GEO4CIVHIC in clustering collaboration actions with other European projects in the field of renewable energies and especially geothermal energy was a continuous preoccupation despite the long pandemic period.

In fact, the consortium tried to transform this difficulty into an opportunity because even if it constituted a break to specific type of activities, the project partners continue to communicate and to collaborate in each occasion when they meet colleagues from different projects. GEO4cIVHIC partners took advantage of these meetings discussing / informing / exchanging / sharing their useful research results and putting the basis for future collaborations.

Numerous interesting discussions took place during conferences, workshops and, in particular, during the clustering events organised by CINEA/INEA. These events gave to the participants the opportunity to learn about the development of innovation in the renewable energy sector within the framework of other Research and Innovations projects funded by the European Commission.

These opportunities helped to understand what is missing to push research and in particular the low-enthalpy geothermal sector to develop further and, in particular, how to achieve specific goals.

In conclusion, the various joint activities carried out allowed the institutions/SMEs and industries involved to learn about existing innovations, experiences and expertise and to receive information on the different efforts and results achieved during the development of the European projects.

Finally, at the end of the project, beyond the satisfaction for the research results themselves and the achieved objectives, the communicating with colleagues is a related objective that brings professional satisfaction and hope for the future. Because, in this future, the involved specialists will be able to combine the results and knowledge achieved for the further development of technologies by trying to overcome existing barriers to greater awareness, particularly in shallow geothermal energy.

6 Activities under the task T8.6 – Definition and organization of "European centres of excellence for shallow geothermal application in civil and historical buildings"

6.1 The task T8.6 provided deliverable on M67 (31st of October 2023)

The deliverable **D8.11 - Report on Definition and organization of "European centres of excellence for shallow geothermal application in civil and historical buildings" (CONFIDENTIAL)** reported on the 31st of October 2023 by the task coordinator UNIPD, offered an in-depth review of the activity undertaken in the context of Task 8.6.

EUROPEAN CENTERS OF EXCELLENCE FOR SHALLOW GEOTHERMAL APPLICATION IN CIVIL AND HISTORICAL BUILDINGS

This activity that must have an important impact on the future of the shallow geothermal domain and mostly on its application in civil and historical buildings started almost at the beginning of GEO4CIVHIC project and has as main vectors the four partners designated to host the centres of excellence, each located in a specific region:

- ECoE for Southern Europe located at the University of Padua (UniPD) - Italy
- ECoE for Central Europe located at Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU) - Germany,
- ECoE for Western European located at the Universitat Politècnica de València (UPV) - Spain
- ECoE for Eastern European CoE is hosted bylocated at the Romanian Geoexchange Society (RGS) - Romania.

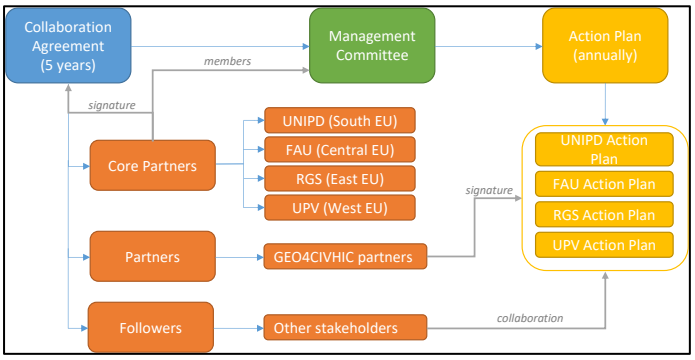
The ECoE organization represent a group of people leading the organization and different structures, in a specific focus area, towards pre-determined goals. The aim of ECoE is the improvement of the expertise in a certain area, by exploiting the most of its resources to help business improvement. ECoE provide a focal point for knowledge management, by capturing new abilities and practices from inside and outside of the business.
Therefore, the goal of the ECOE is to find the best practices and their dissemination to the other departments.

ECoE are built around a team of people, who can either be hired from outside the company or are already employees. The team members can continue to hold other positions in the business and therefore work in the role part-time or be full-time employed. In this sense, ECoE can be both an on-going part of the business or a temporary setup. As an example, a business might choose to set up ECoE in the event of a new technology adaptation.

The tendency for ECoE is to be built around a specific focus area, which is relevant for the company and of particular importance for the business. The typical focus areas include:

- ***Technology:*** the adaptation of a new technology system or simply the study of a new technology to improve the business.
- ***A business concept:*** the introduction of a business concept.

- ***Skill:*** improvement and utilization of a new skill such as certain management practices.
- ***Other broad area of study:*** for example, workplace equality.



The framework for establishing the ECoE network is divided into three focal steps:

- Define strategy and vision
- Secure funding
- Make the centres operational

The first step was accomplished on the GEO4CIVHIC project duration. The first action in the step of inter-operability of the four ECoE was the ECoE international course organized on 25th - 26th of September.

6.2 The ECoE first event: the international course organized by the ECoE network

Course organization procedure

After many debates in the semestrial management meetings and in the four ECoE online meeting, a final frame procedure was elaborated. This detailed procedure allowed the RCoE network to organize the event in a very rigourous and coherent way from the announcement of the course and the enrollement of the trainees up to the final communicate and diploma's distribution to the graduees.

The course was set as a hybrid training event in English language and was destinated only for GSHP specialists / doctoral students. The enrollment was based on the evaluation of a questionnaire completed by the paticipants.

In three of the ECoE (Italy, Spain and Romania) the course was hybrid. Because FAU's students (many of them from abroad Germany) were in the inter-semester break until mid October, the organizers adopted an online training course format."

Duration / Timeline / Trainers / Participants

The course duration was 2 days / 4 modules (half of days) and coverd a complex agenda that followed the training tools package already finalized by the partners and uploaded in the GEO4CIVHIC website.

Each MODULE was coordinated by an ECoE partner as follows:

MODULE I: Buildings' Energy Loads - September 25th 2023

ECoE Eastern Europe - Romanian GeoExchange Society – RGS
ECoE South Europe - Consiglio Nazionale delle Ricerche – CNR
Università degli Studi di Padova – UNIPD

MODULE II: Geology – September 25th 2023

ECoE Central Europe - Friedrich-Alexander-Universitat Erlangen Nurimberg (FAU)
Unweilt Baugrund Geothermie Geotechnik (UBeG)
GeoServ – Geothermal Energy Specialists

ECoE South Europe - Università degli Studi di Padova – UNIPD
RED s.r.l. – Renewable Energy Development

MODULE III: Heat Pumps Technology and Drilling Techniques – September 26th 2023

ECoE South Europe - RED s.r.l. – Renewable Energy Development
Consiglio Nazionale delle Ricerche (CNR)
HiRef s.p.a.

ECoE Central Europe -Terra Infrastructure

MODULE IV: Sizing Ground Source Heat Pumps (GSHP) – September 26th 2023

ECoE South Europe - Universidad Politècnica de València (UPV)
TECNALIA Research and Innovation

The participants were from 18 countries meaning from Germany, Greece, Ireland, Italy, Lithuania, Macedonia, Mexico, New Zeeland, Norway, Peru, Portugal, Romania, Slovenia, Spain, Switzerland, Turkey, Ukraine and United Kingdom.

Up to the end 56 graduated trainees obtained the diploma.

- **MODULE I: Buildings' Energy Loads**

	Lesson / Subject	Timing	Responsible / Trainer
PART I	**nZEB**	45 minutes	**RGS – Horia Ban - President**
			Adriana BERNARDI – CNR Italy **Horia BAN** – RGS / TERMOLINE **Alexandra BAN** – RGS / TERMOLINE **Iulia PRODAN** – RGS / Expert Project SRL
PART II	**Thermal loads**	25 minutes	**RGS – Horia Ban - President**
			Horia BAN – RGS / TERMOLINE
PART III	**Application of geothermal to historical buildings**	75 minutes	**Adriana Bernardi / Michele De Carli**
			Adriana BERNARDI – CNR Italy
			Michele DE CARLI – UNIPD Italy

- **MODULE II: Geology**

	Lesson / Subject	Timing	Responsible / Trainer
PART I	**Geology**	60 minutes	**FAU** – David Bertemann **/** **UBeg –** Burkhard Sanner
PART II	**Geothermal mapping**	60 minutes	**UNIPD –** Antonio Galgaro
			RED srl – Luck Pockelè **Silvia CONTINI** – RED **Giulia MEZZASALMA**– RED
PART III	**Environmental impacts and regulation**	60 minutes	**GeoServ –** Riccardo Pasquali
	1.		

- **MODULE III: Heat Pumps technology and drilling techniques**

	Lesson / Subject	Timing	Responsible / Trainer
PART I	**Innovative methods of geothermal drilling**	75 minutes	**RED** – Luck Pockelé
			TERRA Infrastructure – Arno J. Romanowski
PART II	**Geothermal heat pumps**	75 minutes	**CNR –** Sergio Bobbo
			HIREF – Carlo Bissaro

- **MODULE IV: Sizing Ground Source Heat Pumps (GSHP)**

	Lesson / Subject	Timing	Responsible / Trainer
PART I	**Thermal response tests**	**75 minutes**	**UPV** – Miguel A. Mateo UPV - Borja Badenes
	-		**Miguel A. MATEO** – UPV **Borja Badenes** – UPV
PART II	**Decision support system for geothermal installation sizing**	**60 minutes**	**TECNALIA –** Amaia Castelruiz
			Amaia Castelruiz – TECNALIA

Dissemination of the event

The ECoE course dissemination was conducted in different ways, starting with the use of GEO4CIVHIC website, of LinkedIN and other social media, the different university websites, on H&C platforms, and in all the partner websites and contact lists.

Conclusions on ECoE achieved objectives and positive aspects

Overall, the general impression of the course is very successful, as testified by the number of participants, both online and in presence. Despite a few minor technical difficulties of connection, unavoidable in the context of the wide distribution in Europe of the 4 city cores in Valencia - Spain, Padova - Italy, Oradea - Romania, Erlangen - Germany, as well as of the trainees' locations (some of them from outside Europe), the course took place without any major difficulty and the reception of the presentations was impeccable.

6.3 Future of after the project end

New training and dissemination initiatives are being organized by the Centers of Excellence, aimed at both technical staff of the geothermal supply chain, public administrators and undergraduates and doctoral students from the various universities involved in the GEO4CIVHIC project. These activities will be carried out for at least three years from the end of the project as the four partners responsible for ECoE presented in the Final Conference in Malta:

GEO 4 CIVHIC

❖NEXT THREE-YEAR PRELIMINARY ROADMAP

Year	Month	Actions	Addressed stackholders	Cooperating organizations
2024	February - March	Action organized independently by each ECoE according the local technical / scientifical interests (at national or regional scale)		GEO4CIVHIC partners, Universities, SMEs, local / central authorities.
	May - June	ECoE workshop "Historical buildings"		
	October - November	ECoE course (replication of the training course held in 2023)	High level Studentes (MS'C, PhD and PostDoc)	GEO4CIVHIC partners
2025	February - March	Action organized independently by each ECoE according the local technical / scientifical interests (National or Regional scale)		
	May - June	ECoE workshop "Energy from the Ground"		
	May-July	"Geothermal Urban Energy Communities" Conference		
	October - November	ECoE course (replication of the training course held in 2023)	High level Studentes (MS'C, PhD and PostDoc)	GEO4CIVHIC partners
2026	February - March	Action organized independently by each ECoE according the local technical / scientifical interests (at national or regional scale)		
	May - June	ECoE workshop "Geothermal city planning"		
	October - November	ECoE course (replication of the training course held in 2023)	High level Students (MS'C, PhD and PostDoc)	GEO4CIVHIC partners

Co-funded by the European Union

Conclusions on TED activity

At the end of the long GEO4CIVHIC project the very brief approach on TED compressed on few words is the following:

- TED activity includes many diverse tasks.
- The implementation of TED plans implies a lot of hard work.
- In implementing TED you often encounter unexpected and very challenging difficulties.
- The greatest reward in TED activities implementation represents the coronation of the scientific research process.

ANNEX 1

CONGRESSES AND CONFERENCES ARTICLES

Final Conference - Malta - 15 November 2023

Presentations

1 Geothermal Market_BURKHARD S
2 GEO4CIVHIC project_BERNARDI A
3 Geothermal mapping_GALGARO Et al
4 Heat Exchangers_POCKELE_Et al
5 Heat Pumps_POLETTO Et al
6 Msida Bastion real case study_MICALLEF D
7 Battel real case study_VERCRUYSSE Et al
8 Angel_s gate real case study_BAMPA Et al
9 Historical private house real case study_PASQUALI R
10 Sizing GSHP_DE CARLI Et al
11 App_DSS_MEZZASALMA Et al
12 Environmental impact_PASQUALI Et al
13 Exploitation_TORRES Et al
14 Dissemination_URGHUEGUIA Et al

World Geothermal Congress - 15-17 September, 2023

Ground Source Heat Pump Systems Applied To Historical Buildings To Improve Their Energy Efficiency

Adriana Bernardi, Gianluca Cadelano, Alessandro Bortolin, Adele Manzella, Francesca Bampa, Luc Pockelé, Giulia Mezzasalma, Silvia Contini, Riccardo Pasquali, Michele De Carli, Laura Carnieletto, Antonio Galgaro, Giorgia Dalla Santa, Eloisa Di Sipio, Giuseppe Emmi, Fabio Poletto, Andrea Tarabotti, Burkhard Sanner, Luciano Mule Stagno, Daniel Micallef, Sarah Noye, Dery Torres, Hugo Grasset, Leonardo Rossi, Loredana Fodor, Doinita Cucueteanu, Robert Gavriliuc

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European Geothermal Congress - 17-21 October, 2022

Shallow Geothermal Energy for existing buildings – overview and status of project GEO4CIVHIC

Shallow Geothermal Energy for existing buildings – overview and status of project GEO4CIVHIC

Adriana Bernardi, Michele de Carli, Luc Pockelé, Fabio Poletto, Antonio Galgaro, Eloisa Di Sipio, Amaia Castelruiz , Javier Urchueguía, Borja Badenes, Riccardo Pasquali, David Bertermann, Luciano Mule'Stagno, Dimitrios Mendrinos, Jacques Vercruysse, Laura Fedele, Davide Menegazzo, Laura Carnieletto, Silvia Contini, Giulia Mezzasalma, Gianluca Cadelano, Alessandro Bortolin, Burkhard Sanner

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EGC 2022 - GEO4CIVHIC paper Poster

Click here to view the paper

Geosciences for a sustainable future - 19-21 September, 2022
Recommendations for the planning and management of ground source heat pump systems in an urban environment, considering the effects of reciprocal thermal interference
Belliardi M., Soma L., Perego R., Pera S., Di Sipio E., Zarrella A., Carnieletto L., Galgaro A., Badenes B., Pasquali R., Bertermann D. & Sanner B
Click here to view the paper

Proceedings World Geothermal Congress 2020+1 - April - October, 2021
A First European Collection of Thermal Response Tests
Antonio Galgaro, Giorgia Dalla Santa, Jacques Vercruysse, Dimitrios Mendrinos, Fabio Moia and Angelo Zarrella
Click here to view the paper

Innovative Coaxial Heat Exchangers for Shallow Geothermal
Luc POCKELE', Giulia MEZZASALMA, Davide RIGHINI, Jacques VERCRUYSSE, Francesco CICOLIN, Gianluca CADELANO, Antonio GALGARO, Giorgia DALLA SANTA, Michele DE CARLI, Giuseppe EMMI, Dimitris MENDRINOS, Riccardo PASQUALI, Adriana BERNARDI
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Geotherm Offenburg Congress & Exhibition - 24 June, 2021
GEO4CIVHIC Geotherm 2021 Presentations
CONGRESS PROGRAM
GEO4CIVHIC Geotherm 2021 GALLETTI
GEO4CIVHIC Geotherm 2021 GEOGREEN
GEO4CIVHIC Geotherm 2021 GEOSERV
GEO4CIVHIC Geotherm 2021 ISAC
GEO4CIVHIC Geotherm 2021 RED
GEO4CIVHIC Geotherm 2021 TECNALIA
GEO4CIVHIC Geotherm 2021 UNIPD
GEO4CIVHIC Geotherm 2021 UPV

ARTIFICIAL INTELLIGENCE IN ARCHITECTURE, ENGINEERING AND CONSTRUCTION - 25 March, 2021
Harvest the power of the building digital twin with artificial intelligence
Sarah Noye, José Antonio Chica
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WEC CENTRAL & EASTERN EUROPE ENERGY FORUM – FOREN 2020 - 7-10 September, 2020
Trends in the European Research in the domain of Heating and Cooling Systems with Geothermal Heat Pumps – research projects financed by the European Commission (CHEAP-GSHPs and GEO4CIVHIC)
Robert GAVRILIUC, Doina CUCUETEANU, Tiberiu CATALINA
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18th International Refrigeration and Air Conditioning Conference at Purdue - July 13-16, 2020
Thermodynamic Analysis for the Selection of low GWP Refrigerants in Ground Source Heat Pumps
Davide MENEGAZZO, Sergio BOBBO, Laura FEDELE, Michele DE CARLI, , Laura CARNIELETTO,

Giuseppe EMMI, Fabio POLETTO, Andrea TARABOTTI, Dimitris MENDRINOS, Giulia MEZZASALMA and Adriana BERNARDI
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European Geological Union - 3-8 May, 2020

Assessing grouting mix thermo-physical properties for shallow geothermal systems
Enrico Garbin, Ludovico Mascarin, Eloisa Di Sipio, Gilberto Artioli, Javier Urchueguía, Dimitris Mendrinos, David Bertermann, Jacques Vercruysse, Riccardo Pasquali, Adriana Bernardi, and Antonio Galgaro
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Click here to view the presentation

European drillability mapping for shallow geothermal applications
Antonio Galgaro, Eloisa Di Sipio, Giorgia Dalla Santa, Adela Ramos Escudero, Jose Manuel Cuevas, Burkhard Sanner, Davide Righini, Riccardo Pasquali, Jacques Vercruysse, David Bertermann, Luc Pockele, and Adriana Bernardi
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50th Congress for Heating, Ventilation and Air Conditioning - 4-6 December, 2019

Feasibility considerations regarding the implementation of a GSHP system for an industrial facility.
Prof. Robert Gavriliuc, Ph.D.
Romanian GEOEXCHANGE Society
Click here to view the paper

Conference on Sustainable Development of Energy, Water and Environment Systems, Dubrovnik - 1-5 October, 2019

Impact of Climate Conditions and Energy Prices on Museums
Refurbishments in Different European Countries Based on Geothermal Energy, Electrical Power or Natural Gas Systems
G. Cadelano, F. Cicolin , G. Emmi , M. De Carli , G. Mezzasalma, G. Dalla Santa ,A. Bernardi
Click here to view the paper

Shallow Geothermal Energy Days - 24-25 September, 2019

Shallow geothermal maps in Cheap-GSHPs and GEO4CIVHIC European Projects
Dr. Eloisa Di Sipio
Click here to view the paper

The European Geothermal Congress - 11-14 June, 2019

Innovative drilling methods, heat pumps and tools to address shallow geothermal in the built environment: H2020 project – GEO4CIVHIC
Adriana Bernardi, Luc Pockelé, Burkhard Sanner, Francesco Cicolin, Sergio Bobbo, Michele De Carli, Antonio Galgaro, Javier Urchueguía, Giulia Mezzasalma, Riccardo Pasquali, Fabio Poletto, Amaia Castelruiz Aguirre, Dirk Ulrich, Davide Poletto, Robert Gavriliuc, Dimitrios Mendrinos, Davide Righini, Jacques Vercruysse, Leonardo Rossi, Michele Vavallo, Luciano Mule'Stagno, Marco Belliardi, David Bertermann
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Economic, geological and technical potential mapping test for GSHP systems in Europe

Rodolfo Perego, Sebastian Pera, Antonio Galgaro, Giorgia Dalla Santa, Matteo Cultrera, Michele De Carli, Giuseppe Emmi, David Bertermann, Johannes Müller, Dimitrios Mendrinos, Jacques Vercruysse, Riccardo Pasquali, Adriana Bernardi
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REHVA 13th World Congress CLIMA - 26-29 May, 2019

Sensitivity analysis using simulations for a ground source heat pump – implementation on a solar passive house
Gheorghe Ilisei, Tiberiu Catalina and Robert Gavriliuc
Click here to view the paper

The H2020 project GEO4CIVHIC (Most Easy, Efficient and Low Cost Geothermal Systems for Retrofitting Civil and Historical Buildings)
Michele De Carli, Antonino Galgaro, , Gianluca Cadelano, Francesco Cicolin, Sergio Bobbo, Javier Urchueguía, Giulia Mezzasalma,Riccardo Pasquali, Fabio Poletto, Amaia Castelruiz Aguirre, Amo J. Romanowsky, Davide Poletto, David Bertermann, Robert Gavriliuc, Dimitrios Mendrinos, Davide Righini, Burkhard Sanner, Jacques Vercruysse, Leonardo Rossi, Michele Vavallo, Luciano Mulè Stagno, Marco Belliardi, Adriana Bernardi
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Archetype definition for analysing retrofit solutions in urban areas in Europe
M. De Carli, L. Carnieletto, A. Di Bella, S. Graci, G. Emmi, A. Zarrella, N. Baseggio, M. Belliardi, L. Rossi, L. Mulè Stagno, B. Badenes, J. Urchueguía, B. Sanner, G. Cadelano, A. Bernardi
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Implementation of a geothermal heat pump system in a solar passive house
Gheorghe Ilisei, Tiberiu Catalina, Marian Alexandru, and Robert Gavriliuc
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ANNEX 2

ANNEX 2 - JOURNAL'S ARTICLES

ENERGIES - April 2023
Energetic Analysis of Low Global Warming Potential Refrigerants as Substitutes for R410A and R134a in Ground-Source Heat Pumps
AUTHORS: Fedele, L., Bobbo, S., Menegazzo, D., De Carli, M., Carnieletto, L., Poletto, F., Tarabotti, A., Mendrinos, D., Mezzasalma, G., Bernardi, A.
Journal: Energies 2023, 16(9), 3757; https://doi.org/10.3390/en16093757
Published: 27 April 2023

Application of a method for the sustainable planning and management of ground source heat pump systems in an urban environment, considering the effects of reciprocal thermal interference
AUTHORS: Marco Belliardi, Linda Soma, Rodolfo Perego, Sebastian Pera, Eloisa Di Sipio, Angelo Zarrella, Laura Carnieletto, Antonio Galgaro, Borja Badenes, Riccardo Pasquali, David Bertermann, Burkhard Sanner.
Version 1: 12 May 2022
Version 2: 25 Nov 2022 (Revision)

"Construction and Building Materials" Journal, Elsevier - 2022
Selection of backfill grout for shallow geothermal systems: Materials investigation and thermophysical analysis
AUTHORS: Ludovico Mascarin, Enrico Garbin, Eloisa Di Sipio, Giorgia Dalla Santa, David Bertermann, Gilberto Artioli, Adriana Bernardi, Antonio Galgaro

TECNALIA, UNIPD – September 2021
A review of advanced ground source heat pump control: Artificialintelligence for autonomous and adaptive control
AUTHORS: Sarah Noyea, Rubén Mulero Martineza, Laura Carnielettob, Michele De Carlib,Amaia Castelruiz Aguirrea
a TECNALIA, Basque Research and Technology Alliance (BRTA), Mikeletegi Pasealekua 2, Donostia-San Sebastián, 20009, Spain
b Dept. of Industrial Engineering, University of Padova, via Venezia 1, Padova, 35131, Italy

ENERGIES – April 2021
Evaluation of the Effect of Anti-Corrosion Coatings on the Thermal Resistance of Ground Heat Exchangers for Shallow Geothermal Applications
AUTHORS: Cadelano, G.; Bortolin, A.; Ferrarini, G.; Bison, P.; Dalla Santa, G.; Di Sipio, E.; Bernardi, A.; Galgaro, A.
FULL REFERENCE: Cadelano, G.; Bortolin, A.; Ferrarini, G.; Bison, P.; Dalla Santa, G.; Di Sipio, E.; Bernardi, A.; Galgaro, A. Evaluation of the Effect of Anti-Corrosion Coatings on the Thermal Resistance of Ground Heat Exchangers for Shallow Geothermal Applications. Energies 2021, 14, 2586. https://doi.org/10.3390/en14092586

"Geothermics" Journal, Elsevier - 2020
An updated ground thermal properties database for GSHP applications – published

AUTHORS: Giorgia Dalla Santa, Antonio Galgaroa, Raffaele Sassi, Matteo Cultrera, Paolo Scotton, Johannes Mueller, David Bertermann, Dimitrios Mendrinos, Riccardo Pasquali, Rodolfo Peregoa, Sebastian Pera, Eloisa Di Sipio, Giorgio Cassiani, Michele De Carli, Adriana Bernardi
ENERGIES – September 2020 Energetic and Exergetic Analysis of Low Global Warming Potential Refrigerants as Substitutes for R410A in Ground Source Heat Pumps AUTHORS: Sergio Bobbo, Laura Fedele, Marco Curcio, Anna Bet, Michele De Carli, Giuseppe Emmi, Fabio Poletto, Andrea Tarabotti, Dimitris Mendrinos, Giulia Mezzasalma and Adriana Bernardi
ENERGIES – August 2019 Improving the Energy Efficiency, Limiting Costs and Reducing CO2 Emissions of a Museum Using Geothermal Energy and Energy Management Policies AUTHORS: Gianluca Cadelano, Francesco Cicolin , Giuseppe Emmi , Giulia Mezzasalma , Davide Poletto , Antonio Galgaro and Adriana Bernardi
REHVA Journal – August 2019 The H2020 project GEO4CIVHIC – Most Easy, Efficient and Low Cost Geothermal Systems for Retrofitting Civil and Historical Buildings AUTHORS: Michele De Carli, Adriana Bernardi