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Post-event Summary Report

The European Geothermal PhD Days (EGPD) is an annual conference organised by PhD students for PhD students, giving them a platform to share their research on geothermal energy. Now in its 14th instalment, EGPD was held in the UK for the first time and hosted in the City of Glasgow from the 4th to 6th of April 2023. This year the event has been organised by a team of PhD students from the University of Glasgow, University of Strathclyde, and University of Edinburgh.

This three-day event gives PhD researchers an opportunity to showcase their work and network with other PhD students in the geothermal community. The first two days focussed on talks and poster presentations hosted at the University of Strathclyde (Day 1) and University of Glasgow (Day 2). The third day, held at the BGS GeoEnergy Observatory (UKGEOS) in Glasgow, consisted of a site tour and communication workshop.

The aim of the European Geothermal PhD Days 2023:

- Provide an environment for PhD students to share their research and network with their peers.

The objectives to achieve this aim were the following:

- Provide informal networking events for PhD students.
- Give students time to present their work in lightning presentations.
- Use poster sessions to create dialogue between distinct research areas.

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View from the afternoon poster session in the Learning and Teaching building at the University of Strathclyde

Day 1: University of Strathclyde

INVITED SPEAKERS (DAY 1)

DR. NEIL BURNSIDE

University of Strathclyde
*Shallow Geothermal:
Past, Present and future*

PRASANNA AMUR VARADARAJAN

Celsius Energy
*Closed-loop with inclined
wells: Modelling the be-
haviour of the Celsius
Energy system*

LUCY COTTON

Geoscience Ltd. & WING
*Geological overview of
the geothermal resource
in Cornwall, featuring the
Eden Geothermal Project*

In focus: Shallow and deep geo- thermal, socio-environmental factors, fluids, and fractures

Day 1 was opened by Dr. Neil Burnside (Chancellor's Fellow in Geoenergy, University of Strathclyde) at the Learning and Teaching Building, University of Strathclyde, with a discussion on Shallow Geothermal: Past, Present, and Future. By drawing from the insights of several PhD students under supervision, as well as his own experience, Dr. Burnside helped to set the scene for the remainder of the morning session, focussing on the topic of Shallow Geothermal. This session also included a presentation from Prasanna Amur Varadarajan, which introduced

the audience to the Celsius Energy system of inclined closed-loop wells.

Student presentations on shallow geothermal focussed to a large extent on mine-water geothermal energy with talks from David Walls and Alexandra Sweeney discussing the technical potential for deploying the technology in the UK. Talks from Tom Hambley, Anglia Ruskin University, and Katherine Deeming, University of Strathclyde, added a valuable perspective on the importance of place-based relationships and the unintended consequences of projects on

local communities.

The afternoon session shifted the focus to Deep Geothermal, with a keynote from Lucy Cotton of Eden Geothermal, Geo-Science Ltd. and Women in Geothermal (an initiative aimed at encouraging girls to join STEM fields, particularly geology and geothermal). This highly technical presentation focused on the geological setting of the Eden project in Cornwall and discussed the importance of community engagement when carrying out a geothermal project, particularly when undertaking an enhanced geothermal system and the associated risks of induced seismicity.

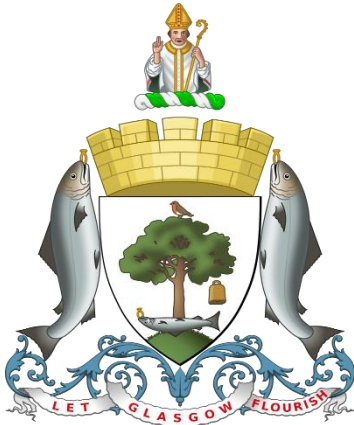
Presentations from the PhD students included discussions on the potential role of hydrocarbon exploration datasets in the prospecting of geothermal resources, based on the work of Abel Marko (ELTE Eotvos Lorand University Budapest). The importance of data and subsurface characterisation was also discussed in a presentation by Scott Hess (University of Calgary) on a novel real-time drilling monitoring system for deep geothermal wells. Detailed case studies on subsurface characterisation were also described, as students Mike Schiltz (University of Strathclyde) and Aislinn Williams (University of Glasgow) summarised their observations from the Strathmore and Clackmannan synclines, respectively.

Best presentation (Day 1):

Ali Sweeney

Best poster (Day 1):

Scott Hess



City of Glasgow council remain committed to a low-carbon energy future for the city

The evening of day 1 invited delegates to attend a civic reception at the Glasgow City Chambers, hosted by the Glasgow City Council in collaboration with the Glasgow Convention Bureau. A formal welcome to the City of Glasgow was delivered by Bailie Rashid Hussain, representing the Lord Provost, which underlined Glasgow's commitments to achieving net-zero by 2030 and the willingness to remain open to avenues of research into the solutions to meeting these goals.

In response to Bailie Hussain, William Nibbs (EGPD 2023 organiser) took the opportunity to thank delegates for attending the EGPD event as well as thank the City of Glasgow Council for hosting the civic reception event in the City Chambers. He also joined Bailie Hussain in highlighting the ambitious net-zero targets set by the city of Glasgow and promoted geothermal energy as a valuable technology in meeting these goals. Finally, he expressed the importance of events like the EGPD in enabling a

Civic welcome from the City of Glasgow Council at the Glasgow City Chambers



Civic welcome to the City of Glasgow

dialogue and knowledge-sharing platform between often distinct areas of Geothermal research.

The civic reception was an important reminder of the role that local government can play in supporting the energy transition. The engagement from the local council to support an initiative such as the EGPD was encouraging, and Baillie Hussain showed a genuine enthusiasm to learn more about the

strengths of geothermal energy, in particular the role of ground-source heat pumps in future low-carbon heating scenarios.

With Scotland's ambitious 2045 net-zero target it is the hope of the organisers that event such as the EGPD will build a recognition of geothermal as a player in the transition and help to integrate the technology into plans for the City's future.



Group photo in the Advanced Research Centre at the University of Glasgow

Day 2: University of Glasgow

A day of geothermal district heating, enhanced geothermal systems and exploration

Day 2 was held at the Mazumdar-Shaw Advanced Research Centre, University of Glasgow, and was opened by Prof. Gioia Falcone (Rankine Chair of Energy Engineering and Associate Director of the Centre for Sustainable Solutions at University of Glasgow). The focus of the day's opening plenary was "Medium and Deep Geothermal: conventional and unconventional solutions and their sustainability." This offered stimulating insights into the meaning of "sustainability", the meaning of "heat-in-place" and presented a selection of ongoing research at University of Glasgow, including a brief overview of deep borehole heat exchanger modelling as part

of the INTEGRATE and Net-Zero GEORDIE projects.

The remainder of the morning session delved into the role of geothermal in district heating and cooling (DHC) grids, featuring keynotes from the session sponsor COST Action Geothermal-DHC. Dr. Aleksandrs Zajacs (Technical University of Riga) introduced the delegates to the topics of 4th/5th generation DHC grids and discussed heat source prioritisation as determined by grid heat supply temperatures and size of the annual heat demand. This highlighted geothermal as the most suitable candidate technology for many relatively low temperature (<100°C), high demand

scenarios.

Building upon the points made by Dr. Zajacs, Dr. Apostolos Michopoulos (University of Cyprus) focussed on the potential of distributed energy systems with seasonal thermal energy storage, such as shallow borehole arrays, thereby enabling synergies between production and distribution.

“

We are delighted to co-host this unique opportunity for peer-to-peer networking and for fostering geothermal innovation. To witness the collegiality with which our students have come together to plan this event over the past few months has been truly inspiring.”

PROF. GIOIA FALCONE,
University of Glasgow

INVITED SPEAKERS (DAY 2)

PROF. GIOIA FALCONE

University of Glasgow
Medium and deep geothermal: Conventional and unconventional solutions and their sustainability

DR. APOSTOLOS MICHPOULOS

University of Cyprus
Decarbonisation of district heating as an opportunity for implementation of geothermal energy

DR. ALEKSANDRS ZAJACS

Technical University of Riga
The role of district heating and cooling networks in future energy systems

Presentations from PhD students in the morning session were primarily focussed on subsurface characterisation with relevance to geothermal-enabled DHC, such as underground thermal energy storage. It could be inferred that there is a potential disconnect between ongoing geothermal research and modelling of surface infrastructure, leaving the topic of co-simulation open as an area for future work. Embedding geological modelling within whole systems energy demand modelling also

continues to require further exploration.

The afternoon focused on research regarding enhanced geothermal systems, exploration, and modelling. In this diverse session, topics ranged from innovative electrical geophysical exploration techniques by Loris Piolat (University of Lorraine) to studies on the impact of working fluids on geothermal power production from the likes of Maciej Szymanek (AGH University) and Tristan Merbecks (Politecnico di Milano and ETH Zurich). The session,

also delivered engaging geophysical case studies including several from the Mexican context, such as the coastal amagmatic case of La Jolla beach, presented by Daniel Carbajal Martinez (University of Bern).

The poster session displayed innovative concepts such as heat recovery from high heat producing underground nuclear waste disposal facilities using closed-loop advanced geothermal systems, modelled by Hannah Doran (University of Glasgow).

Best presentation (Day 2):

David Johnstone

Best poster (Day 2):

Emmy Penhoët



The Conference Ceilidh

After a long day of technical presentations and discussions, PhD students were invited to sample traditional Scottish culture by attending a conference ceilidh at the Strathclyde Student Union. This event worked really well

at breaking the ice between the students and allowed more informal networking.

Complete with live band, the ceilidh was well-received by participants and the feedback to the organising committee highlighted

the effectiveness of the evening in bringing PhD students closer together – making them feel more comfortable to engage conversations regarding their research. Similar events could be arranged at future EGPD editions.

PhD students
break the ice
with live traditional Scottish
dancing

Conference participants trying Scottish ceilidh dancing at the University of Strathclyde Student Union





The British Geological Survey giving students a tour of the UKGEOS facilities

The third and final day of the PhD Days featured a half-day field trip and workshop at the UK GeoEnergy Observatory (UKGEOS) in Dalmarnock, Glasgow. The site was established as a first-of-its kind laboratory to experiment with mine-water as a potential heat source and storage medium. Researchers are invited to make use of the 12 available boreholes (a combination of injection/extraction and monitoring boreholes drilled to depths between 45-90m) to experiment with the existing flooded coal workings beneath Glasgow – this will act as a test bed for understanding the thermo-chemical-hydro-mechanical properties of specific mine configurations. Such mine workings are typical of urban areas in the UK with a legacy of coal mining – providing

insights into subsurface behaviour and offering a basis for initial predictions of system performance.

Representatives of the British Geological Survey (BGS) – led by Dr. Alison Monaghan and Vanessa Starcher – delivered informative site tours, describing the technologies and extensive measuring capabilities at the observatory.

The range of operating conditions available to the researcher offers diversity in the experimental set-up and in combination with the downhole and surface measuring technology will enable vast quantities of data to be generated. It is hoped that the majority of these data will be made openly available – improving the application of data driven techniques in

Day 3: UK GeoEnergy Observatory

Exploring the future of mine-water thermal energy in the east-end of Glasgow

researching the risks, impacts and processes of mine-water thermal energy systems in the UK.

A second UKGEOS site in Cheshire, England, will also act as a testing ground available to researchers, including PhD students.

Given the number of presentations dedicated to mine-water in the Day 1 Shallow Geothermal session, the EGPD organising committee hope that the introduction to the site

will lead to collaborations in the future, with PhD students returning to Glasgow to make use of facilities. More information about the UKGEOS sites in Glasgow and Cheshire can be found on the BGS website at:

<https://www.ukgeos.ac.uk>



Maja Turnšek leading a workshop
on the challenges of communicating
geothermal energy research



Communication skills in geothermal energy

Participants focused on being the ambassador,
translating the complexity, and claiming their
voice, in workshop led by Maja Turnšek

Running in parallel to the UKGEOS field trip was a workshop titled: “The Challenges of Communicating Geothermal Energy”. The unseen nature of subsurface storage, the complexity of geoscience and the comparisons to the oil and gas industry, all of these make it challenging to effectively convey the strengths and weaknesses of geothermal energy. The EGPD 2023 organisers therefore saw it pertinent that PhD students develop an understanding of the

key principles for communicating their research. Through a series of questions and provocations from Dr. Maja Turnšek, students were led to address three relevant problems faced when communicating Geothermal Energy: Claiming your voice, translating the complexity, and being the ambassador.

CLAIMING YOUR VOICE

Aim: Create a PR report for the EGPD event which gives a voice to the PhD students in Geothermal.

Outcome. Group 1 used the target audience (e.g., local citizens of Glasgow) and the publication type (e.g., local newspaper) as the starting point for building their PR statement. From these foundations the team crafted a story of the PhD geothermal students as heroes in a race against time drama situation to redress the mistakes of the past. The story followed the lines of heroes replacing the villainous polluting fossil fuel systems which have been put in place by generations past.

“ The results gave realisations you cannot really teach via a lecture format. I was amazed by the energy, creativity and especially the interconnection of the students. You could just see that some made friends and co-authoring partners for life. Which, when you boil it down, is really the essence of EGDP

DR. MAJA TURNŠEK,
University of Maribor

While the concept of students as heroes may be inspiring, care must be taken when selecting the villain in the story. This is particularly important to avoid the victimisation or isolation of any group in society. This group may play a role in facilitating sustainable changes if brought into the conversation rather than identified as at fault for the installation of polluting systems.

TRANSLATING THE COMPLEXITY

Aim: Translate the material of a complex research topic into material for the public.

Outcome. Using the case study of a district heating (DH) network supplied by deep geothermal energy, Group 2 experimented with approaches to explaining the research in a simple, easy to understand tweet and LinkedIn post. Reminded of the key principle to deploy visual aids, the group opted to include a side-by-side comparison of an urban centre before and after the intervention of DH. This was hoped to draw an

emotive response from the audience (general social media users) which would then grab the attention and invite the viewer to learn more about the images.

Visual aids are an important principle of communication but are only effective if they clearly refer to the research topic. The concept of a renovated cityscape may entice the social media user but may be insufficient to rapidly explain the role of deep geothermal in the scenario. By focusing on secondary effects of the research only, the audience might remain unsure of the research involved thereby rendering the strength of the message significantly diminished. In the future, Group 2 could look to incorporate short animations into the visual aids thus presenting a fuller picture of the DH design.



Participants working collaboratively on the questions and provocations posed during the workshop

BEING THE AMBASSADOR

Aim: Promote the subject of geothermal energy among students at your host university.

Outcome. Group 3 started by stating motivations behind students' engagement with a subject – these included future job prospects and becoming active in real-world solutions to

environmental problems. The team then sought methods for addressing these motivations while simultaneously meeting the ambassador goals (e.g., educate on geothermal and attract students to researching geothermal energy). The solutions made use of trending social media (e.g., TikTok) to provide short, fun clips on geother-

geothermal-related subjects. Once engaged, it was hoped that students would progress to self-directed conceptual decarbonisation projects followed by participation in informal geothermal lectures and ultimately to joining a university geothermal society, or hub, led by ambassadors. The hub would interact with international geothermal bodies in an approach similar to Engineers Without Borders.

The fundamental challenge of 'Being the Ambassador' is the sustainability of the envisaged 'hub': how resilient is the hub to ambassadors leaving the university? What is the long-term purpose of the hub, and what activities must take place to ensure its long-term survival? These are difficult questions to answer but the solution may lie in a collaboration between top-down support and a bottom-up passion to inspire – effective two-way communication is therefore essential.

Each team in the workshop presented their ideas to the rest of the cohort, bringing a diverse range of communication solutions





The European Geothermal PhD Days continues to be an important event for PhD students across Europe, offering the opportunity to increase the visibility of their research in a formal environment. With this year's EGPD being the first to be held in the UK it is hoped therefore that students in the UK will become increasingly collaborative with universities across Europe, helping the UK geothermal sector to benefit from a sharing of ideas and practises.

As hosts for EGPD 2023, the organising committee have defined some key takeaways from the experience of hosting, organising, and participating in the EGPD:

- Effective communication is key to conveying the strength and weaknesses of geothermal energy. Further emphasis should be placed on workshops aimed at developing the necessary skills across all areas of the geothermal sector. The key principles of communication are

explored in more depth, in relation to the EGPD, in a blog post available on the Geothermal-DHC COST Action website.

- The event was a platform for diverse subject matter which gave participants insights into areas of research previously unfamiliar to them. The opportunity to learn from other geothermal research provoked PhD students into thinking how similar methodologies or technologies could be applied in their own area of research helping to promote holistic thinking.
- Informal settings allowed for great ice-breaking events, making participants feel more comfortable to question and probe each other's work. Facing often light-hearted, though engaged, questioning from their peers prompted students to consider alternative perspectives of their work previously unconsidered. This sort of questioning from people of different expertise and background will serve as a good learning experience for future academic conferences.

The EGPD 2023 Organising Team has formally passed hosting responsibilities to a PhD team at TU Delft which will be the venue for the next edition of the EGPD in April 2024.



**The EGPD 2023
Organising Team**