1. **Technical experience in the Geothermal TCP area**
   a. **Understanding of the sector in the UK and internationally**

The interpretation below highlights the main challenges and opportunities in geothermal energy in the UK and internationally. It draws on the collective expertise of BGS, but particularly on that of the two main BGS contributors to the IEA geothermal TCP – [REDACTED] (applying for role as alternate candidate) and [REDACTED] (current lead of the IEA mine water energy task).

Geothermal energy can be used for low carbon heating and power generation. It is a proven source of energy which is secure and contributes to decarbonisation of heat and energy around the world. **Decarbonisation of heating** remains a key challenge in the UK,[1] and it is where deployment of geothermal technology could make a considerable impact in the UK.

Opportunities for developing the technology exist across the UK, mainly for domestic or commercial heating or cooling applications[2], but in a few places also for electricity generation.[3] BGS and collaborators have estimated the geothermal heat resource to be one hundred to two hundred times the UK's domestic heat demand.[4] Mine water energy resources alone could be large enough to provide all heating requirements for coalfield areas of the UK[5]. Further opportunities arise from the ability to use abandoned mines (and the subsurface more generally) for storage of thermal energy (heat or cold), up to 16 TWh[6] or around 5% of annual UK domestic heat demand.

In addition to **emissions savings**, geothermal energy also provides opportunities for **local and national job creation**. Many of the UK's largest urban centres lie above deep sedimentary aquifers or areas of former coal mining activity, there is potential to "give a second life to coal mines" and to create employment in these areas as part of the Governments levelling up agenda, as well as nationally, through geothermal schemes as well as through building a UK supply chain.[7] [8]

However, there are a number of **challenges** associated with these projects which have delayed uptake of geothermal technologies in the UK compared to other renewable technologies. Through its research and extensive stakeholder engagement, BGS has identified several common themes in relation to barriers to deployment of geothermal technologies in the UK.[9]

A main challenge for deep geothermal and mine water energy projects is the **geological risk** of not achieving the required temperatures or water flows. This risk is highest at the start of a project but reduces once a first well has been drilled and more knowledge of the geothermal reservoir becomes available.[10] High drilling costs and the risk of failing to locate a viable and sustainable resource present a major barrier to the development of geothermal heat, power and mine energy projects.[11] Furthermore, low technology deployment in the UK has meant that the geological and financial risks are not well understood, especially for mine water and deep geothermal projects. In addition, there is very little publicly available data of the actual drilling and project development costs. The **lack of such**

[1] Energy Systems Catapult (accessed 25/08/2022)
[2] [REDACTED] (2014) [REDACTED], 22; [REDACTED] (2010), WGC 2010, Bali.; [REDACTED] et al. (2021). QJEGH, 54; [REDACTED] et al.(2019), STOTEN, 697. [REDACTED] et al. (2017). QJEGH, 50.
[3] [REDACTED] et al. (2017). Geotherm Energy 5
[4] [REDACTED] (2014) [REDACTED] J,; [REDACTED] et al., (2018) J Pow Energy 232.
[5] Coal Authority
[6] [REDACTED] et al. 2020 (ΔT of 5ºC scenario)
[7] [REDACTED] (2021) BBC Future Planet
[8] Mine Energy Taskforce (2021) Mine Energy White Paper
[9] Environmental Audit Committee (2022) : BGS evidence to geothermal inquiry
[10] Dumas et al., (2019) EGC 2029, Den Haag; Arup (2021): Deep geothermal Energy
[11] [REDACTED] & [REDACTED] (2022) POSTbrief 46.

data has contributed to the reluctance of private investors and public bodies to support this technology. There are also few to no deep wells to provide in-situ understanding of the geothermal reservoirs. In the absence of such data (i.e. measured temperatures and flows from target depths), it will remain difficult to derive estimates of the actual resource.

Another barrier in the UK, is the lack of national scale tools that highlight geothermal opportunities. BGS, through its long research, starting in the 1970s[12] has compiled a comprehensive collection of data and knowledge on deep and shallow geothermal resources in the UK, including estimates of reserves. However, it remains a challenge to translate the data into useful information for policy makers and planners, e.g. through tools that match geothermal heat supply with areas of demand and existing infrastructures. A current commission from BEIS will address aspects of this challenges but there remains an urgent need for comprehensive tools for use by potential developers and planners, including government departments and public sector landowners.

As [REDACTED] et al [13] have highlighted, geothermal energy is **not recognised by law as a natural resource** in the UK, and there is currently no regime or regulatory mechanism for managing the geothermal resource. This creates uncertainty for investors, but also makes it difficult to assign and enforce licencing conditions on use of the resource (e.g. temperature limits). This has potential implications for ensuring sustainability of the resource as levels of use / deployment of geothermal systems increase. Stakeholder consultations undertaken by [REDACTED] and colleagues[8, 10] have highlighted that aspects of the current **regulatory system** for geothermal energy are regarded as a barrier to technology deployment. Regulatory and policy challenges related to geothermal energy exist in many countries across the globe and international knowledge exchange is important to share lessons and learning. Such global exchange could be enabled through the IEA Geothermal TCP and its member countries (see proposed topic in 1b).

Furthermore**, market barriers** such as a lack of technology awareness, high upfront costs of installation (with long payback periods of 5–8 years for domestic GSHPs and 4–20 years for deep and mine water geothermal installations)[14], capital constraints for consumers, and uncertainty about a technology's performance contribute to slowing down the widespread adoption of shallow, deep and mine water geothermal technologies in the UK.

Gaps in geothermal energy research have been reviewed recently by [REDACTED] [REDACTED] and others, for example as part of a commission by the Natural Environment Research Council to review the Geothermal energy research landscape [15]. In the NERC report, we highlight that the UK geothermal landscape is less evolved than in other countries, despite significant potential resources of varying depth, geology and location. The review further highlights that the technical concept for shallow ground source heat, mine water and deep geothermal from granites has been demonstrated in the UK, while deep aquifer geothermal and underground thermal storage are less developed. However, there remain several research challenges in finding, accessing and utilising geothermal resources cost-effectively and in sustainably operating and managing the resource within environmental limits. Seasonal thermal storage demonstration in geothermal reservoirs is a key objective of the EU PUSH-IT project which begins later 2022. BGS is part of the European 19 partner project aiming to develop generic solutions and practices that are relevant across Europe and the UK.

[12] [REDACTED] & [REDACTED] 1986; [REDACTED] et al., 1992; [REDACTED] 2010, 2014; [REDACTED] & [REDACTED] 2017; [REDACTED] et al. 2021

[13] [REDACTED] et al., (2018) Who owns (geothermal) heat; [REDACTED] et al. (2020) Unlocking the potential for geothermal energy

[14] [REDACTED] (2017). GREBE project; [REDACTED] et al. (2020) WGC 2020+1, Reykjavik

[15] [REDACTED] [REDACTED] et al.,(2019) Landscape review for NERC geothermal infrastructure study, IR/21/022

Innovation in drilling is urgently needed to reduce costs and access more areas for geothermal developments. This together with development of geology-agnostic advanced geothermal technologies (AGS) have been a focus of innovation in the US and Canada for a number of years (see PIVOT conference)[16]. Other innovations to improve the business case for geothermal projects include co-production of lithium or new models for delivering – as described in [REDACTED] & [REDACTED][11] Many of the challenges identified in the UK apply globally including sustainable business models, mitigation of predevelopment risks, environmental impacts regulation and policies to encourage wider uptake. BGS, through existing roles with the IEA, European Energy Research Alliance, and various research projects, engages with a range of stakeholders within the UK and internationally to seek solutions to these challenges, support innovation and better understand opportunities.

In 2014, UK Government recognised the future role of the subsurface in Net Zero and announced £31 million funding to build field infrastructure facilities for research and innovation in geothermal, energy storage and related technologies. BGS is delivering and operating these UK Geoenergy Observatories (https://www.ukgeos.ac.uk/). Each observatory delivers a different body of knowledge relating to different geothermal systems including ground source heat pump systems and thermal energy storage (UKGEOS Cheshire), mine water energy (UKGEOS Glasgow) and integrated urban geothermal systems (Cardiff). Delivery and running of these infrastructures have provided BGS with a broad understanding of the technical challenges and opportunities related to the different technologies, as well as with detailed insight of research needs and knowledge gaps.

In mine water energy, pilot and commercial schemes operating for tens of years, and a mine water heat team at the Coal Authority with whom BGS work closely, focus the challenges to de-risk and reduce costs. Stakeholder engagement undertaken by BGS for UKGEOS Glasgow confirmed research needs across geoscience, energy engineering and environmental monitoring to further de-risk exploration and improve borehole success rates[17], improve understanding of the sustainability of the heating/cooling/storage resource[18] (e.g. connectivity and interference of adjacent schemes), operational environmental impacts [19] and maintenance[20] and improve efficiency of heat transfer processes. Innovations in drilling techniques, heat/flow modelling methodologies, and non-invasive sensing and monitoring are likely to be important for cost-reduction[21], key to reducing payback periods and improving the business case. National scale mapping tools combining geoscientific factors and heat demand are also high priority[8]. Sharing of successes and failures, awareness raising, and summaries of regulation, policy and data availability were identified needs from the 2022 IEA mine water energy symposium, chaired by [REDACTED]

[16] PIVOT conference 2020, 2021, 2022 - https://www.texasgeo.org/pivot-conference
[17] [REDACTED] et al. 2021 QJEGH
[18] BGS for Coal Authority, commissioned report CR/22/033
[19] [REDACTED] et al. 2022 E Sci Sys Soc
[20] Walls et al. 2021 Energies
[21] NERC et al. 2019 workshop report

b. Developing research tasks and leading working groups

Dr [REDACTED] is Head of BGS geothermal energy research at the BGS and leads a wide project portfolio covering a range of topics from shallow to deep technologies and their application in different geological settings. As part of her role, Dr [REDACTED] has developed research strategies, including the setting up and building of new research tasks within BGS. In addition to a good technical knowledge of geothermal energy, her specific expertise is in Geothermal policy and regulation. She works closely with stakeholders from government, regulation, industry and academia, nationally and internationally, to inform the development and regulation of geothermal energy. Dr [REDACTED] is involved in international projects (including the REDACTED project), developing policy and regulatory advice to support for geothermal developments and operations as well as delivering the underpinning, scientific evidence base. Through her various stakeholder interactions and research engagements and, recently, through her role as REDACTED, Dr [REDACTED] has developed excellent international geothermal networks (see 1c) and gained extensive knowledge of the challenges and barriers pertinent to geothermal energy developments in the UK and worldwide, including research gaps. She has produced various briefing papers on the topic of geothermal energy[13], including material for parliamentary audiences[22] and delivered commissioned research reviewing research gaps[15] and policy requirements[23] for [REDACTED], respectively. Dr [REDACTED] has a track record of scientific publications in geothermal energy (see CV) and regularly reviews scientific paper as well as proposals for research and innovation project, nationally (e.g. REDACTED) and internationally (e.g. EU).

Dr [REDACTED] currently holds the role of UK alternate delegate at the REDACTED, having taken over in 2020 from her BGS colleague Dr [REDACTED] (in post since 2017). She has led various contributions to the REDACTED, including provision of UK case studies on shallow geothermal applications for REDACTED, contribution to the preparation of the REDACTED ([REDACTED] & [REDACTED] 2022), initiation of a UK-led Mine Water Energy Task REDACTED - which is led by BGS colleague Dr [REDACTED] [REDACTED] as well as support for formation of a new working group on geothermal policy and regulations – which Dr [REDACTED] will be following up on at the next ExCo meeting , if her role as alternative delegate for the UK is confirmed.

The MREDACTED evolved from the REDACTED (with circa 500 attendees), which [REDACTED] (BGS) had initiated and chaired, and the same event in 2022 (with circa 200 attendees from 34 countries), chaired by Dr [REDACTED] with The Coal Authority. Drs [REDACTED] and [REDACTED] recognised that through a new task within REDACTED, the UK (as one of only a few countries that are currently developing this technology) could take a leading role in the promotion and knowledge exchange on mine water energy, and they presented the case to BEIS to initiate the group. A first meeting was organised by Dr [REDACTED] (BGS) in June 2022 with 16 people from across regulators, local government, industry, and academia with actions to produce several case studies, a data and regulatory summary for dissemination on the IEA geothermal website. These activities have raised the profile of the UK within REDACTED and directly meet its stated objectives of enhancing "cooperative research, analysis and information sharing concerning the sustainable development and utilization of geothermal energy".

[22] [REDACTED] et al. 2021: Commons library debate pack; [REDACTED] & [REDACTED] (2022) POSTbrief 46.
[23] Geothermal Technology and Policy Review for Northern Ireland Department of Economy

From 2016 onwards, Dr [REDACTED] has led the scientific delivery of the REDACTED – an underground observatory focussed on mine water geothermal and environmental impacts. The design stage included producing review reports on the science case, science questions and participating in workshops with academia, industry and regulators to understand research needs and translate to infrastructure capability[24]. She initiated a during-drilling sampling program for academics and a proposal review process around that, and has delivered on a wide range of open geoscientific data and publications [17,19]. She sits on the steering board for the 'REDACTED project that utilises mine water geothermal.

Proposed research topics for annexes - BGS has been instrumental in initiating the mine water energy task. Focusing initially on information sharing via case studies of demonstration projects and summaries of technical lessons learnt (e.g. drilling risk), the vision is then to expand the international reach and document best practices, standards, knowledge of effective regulation and policy. Together these aim to enhance cost-effective and sustainable deployment of the technology whilst building on the UK's significant and growing experience in the field.

Furthermore, we would propose the topic of policy and regulation of geothermal resources. Suitable policies and regulations are paramount for the success of geothermal development within each country. Yet there is little compounded learning / international knowledge exchange on this topic. As geothermal developments increase globally, an annex on this topic would benefit the UK by providing direct access to the knowledge and learning from international partners while, at the same time, the UK would bring unique expertise – Dr [REDACTED] through her broad knowledge in international policy/regulation and Dr [REDACTED]the REDACTED with practical experience in the field of mine energy environmental impact and licencing. A further topic that we would propose is the management of geothermal resource in dense urban settings: Understanding impacts and interactions. The UK (through REDACTED) has unique knowledge, networks and research infrastructure to lead or support this topic, including research observatories in Cardiff and Glasgow.

Demonstrating of capability to chair at UK and international level - In addition to her experience as IEA alternate delegate, Dr [REDACTED] has a track record in providing expert advice as well as in chairing and contributing to panels and committees. She regularly advises different groups in BEIS on geothermal energy and also contributes to parliamentary and government inquiries on this topic, through written submissions and as an expert witness (e.g. to the REDACTED).[25] Dr [REDACTED] sits on the REDACTED Committee as well as on the REDACTED Committee of the REDACTED Her previous roles include Chair of the REDACTED (2014-2019), UK Representative for REDACTED (2007– 2019).

Dr [REDACTED] in addition to the lREDACTED and expert group (section 1b) , has chaired 2-monthly partner meetings for a £1.3 million consortium project (REDACTED) which she successfully led and delivered for REDACTED) and 49 oil companies, in 2014-2016. Frequently requested as a keynote conference/webinar speaker on mine water geothermal (e.g. REDACTED), she has also provided evidence to UK and Scottish Government elected representatives, consultations and staff.

[24] [REDACTED] et al. 2017, [REDACTED] et al. 2019

[25] Written and oral evidence to EAC inquiry Geothermal technologies ; 1922 BEIS Backbench Committee inquiry

2. Links with community in the technology area

BGS has links to a wide range of geothermal experts and stakeholders with whom we interact through various activities as listed in Table 1 below.

Table 1: List of geothermal stakeholders and interactions

	Stakeholders		Type of interaction	Evidence
	National	**International**		
Industry/ operators/ trade associations	• Eden geothermal[a,b] • GEL[a,b] • GSHPA[b,c] • Geosciences Ltd[a,b] • Arup[a] • ShiftGeothermal[f]	• Stadtwerke München[b] • Electricity de Strasbourg[4]	Consultations[a]; Collaborations relating to provision of services and tools; Utilisation of geothermal opportunities, e.g. through research[d] / commercial funding[e]; Knowledge exchange[f]	[a] [REDACTED] et al., 2019 – Report and Briefing paper [b] [REDACTED] & [REDACTED] (2022) Postbrief 46 [c]BGS online tool: Open loop GSHP viewer (link) [d]EU project proposal – PUSH-IT [e]Report for NI Department of Economy
Academia & research	• Durham Energy Institute[f,h], Universities of Glasgow[f], Aberdeen[g], Belfast[g], Newcastle[f], Edinburgh[h] Cambridge,[g] Birmingham [g], Exeter[h], Liverpool Anglian Ruskin[h], Imperial College[h], Heriot Watt[g], • BritGeothermal[f]	• Various European universities/ research institutes[9] • European Geological Surveys[i]	Research collaborations Student supervision Joint publications	[f] [REDACTED] Adams, [REDACTED] et al., 2018: Keeping warm: a review of geothermal potential of teh UK, Proc Inst Mech Eng. [g] joint project proposals, e.g. AHEAD, SMART, FRACTION [h] successful UK projects: e.g. ATESHAC, GEMS, UKUH Risk perception project, GWatt [i] successful EU projects: PUSH-IT, GeoERA projects: MUSE, Hotlime; Geotwinn; CSA

Government & Regulators	• BEIS[j] • Scottish Government[n] • Northern Ireland Department for Economy[k] • Parliament / MPs[l,m] • EA/ SEPA/ NRW/ NIEA[o] • Coal Authority		Advisory & Expert roles [j-n] Consultation response[p] Witness to enquiries[p,q] Briefing papers[o]	[j] IEA Geothermal TCP alternate delegate [k] Geothermal Technology and Policy Review for Northern Ireland Department of Economy [l] [REDACTED] et al. 2021: Commons library debate pack [m] Academic fellowship with POST [n] Secondment to Scottish Gov [o] [REDACTED] et al., 2019 – Report and Briefing paper [p] Written and oral evidence to EAC inquiry Geothermal technologies [q] 1922 BEIS Backbench Committee inquiry
Funders / Research Councils	- UKRI - NERC/ EPSRC/ Social Sciences Research Council[r-t]		Commissioned research Expert advice presentations	[r] [REDACTED] [REDACTED] et al.,(2019) Landscape review for NERC geothermal infrastructure study, IR/21/022, unpublished [s] [REDACTED] & [REDACTED] Summary: Landscape review of geothermal infrastructure, Presentation to EPSRC Energy Specialist Advisory Committee, 06 September 2021 [t] Regulation and public decision making workshop, 20 July 2022, London
Committees/ panels	Geological Society of London – Energy Group Hydrogeology group	European Energy Research Alliance (EERA) Geothermal Joint Programme IEA geothermal TCP[u] IEA District Heating TCP IEA Heat pump TCP Annex 43	Contribution to planning and organisation of meetings/ events Contribution to reporting, [u,v] provision of case studies	[u] [REDACTED] & [REDACTED] (2022) 2021 UK Country report, IEA geothermal [v] [REDACTED], [REDACTED] et al., (2022) 2022 UK Country Update, EGC, 2022, Berlin, Germany.

Specifically in **mine water geothermal**, BGS has a wide range of links to stakeholders (Figure 1) through a portfolio of projects and infrastructure including: operator of UK Geoenergy Observatory Glasgow; collaborative research projects e.g. GEMS (Figure 2); recent technical report and risk matrix for Coal Authority; collaborative academic research around UKGEOS[19].

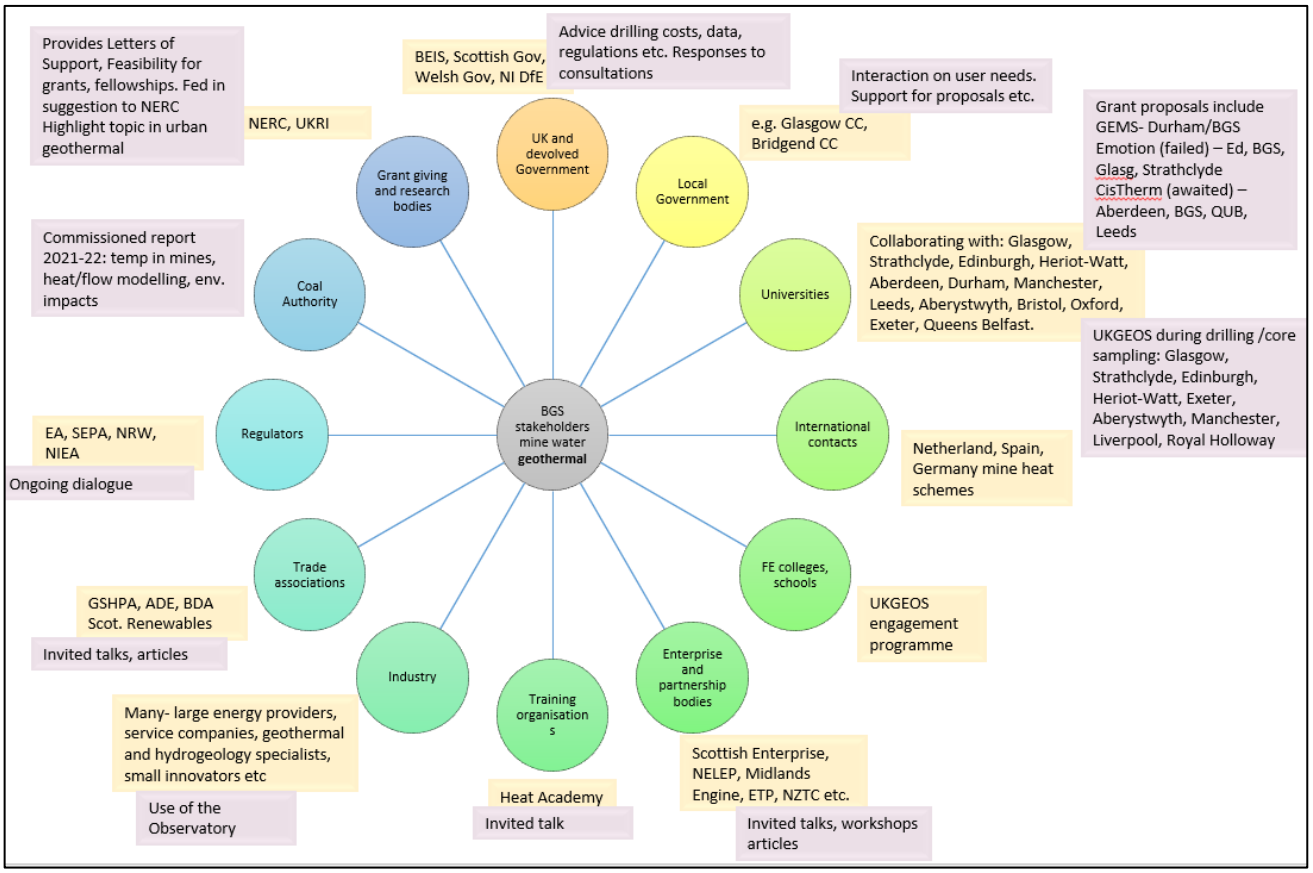

Figure 1 BGS stakeholders in mine water geothermal including examples of specific organisations with active ongoing engagement (yellow boxes) and recent tasks/examples (pink boxes). The multiple and complex links between these stakeholders are not shown.

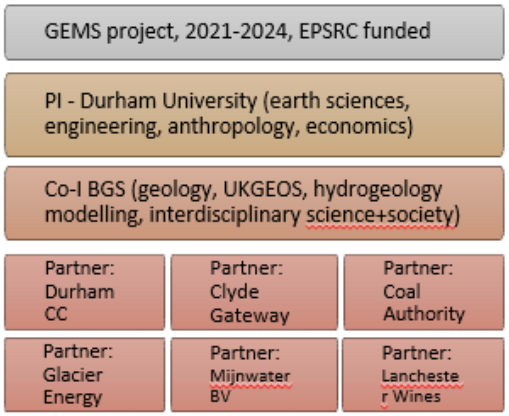

Figure 2 Example of the researchers (PI and Co-I) and collaborative partners in an active BGS research project GEMS.

3. Knowledge Transfer Plan

We propose to build knowledge and understanding of the technology area through the following activities:

Communication / imparting knowledge to BEIS

(1) BGS will attend the ExCo meetings where we share updates of UK progress and developments in geothermal energy developments as well as to learn about new developments and innovations in other member countries. Following the meetings, BGS will provide notes of the meeting for distribution within BEIS through the BEIS delegate, including highlights of new developments in technology, policy, regulation and other areas that may be relevant for the UK.
(2) At the start of our appointments, BGS will agree a schedule of regular (e.g. monthly) virtual meetings with the BEIS delegate where we provide oral briefings on latest geothermal developments and activities in the UK and worldwide.
(3) Throughout our appointment, BGS will be available to answer queries from BEIS related to geothermal technologies via email or ad-hoc meetings between BEIS and BGS. Where BGS has not got relevant expertise, we will provide links and facilitate introductions between BEIS and relevant experts from industry/ academia/ regulation.
(4) In addition, BGS will liaise with the BEIS delegate to gauge interest for geothermal talks/ webinars (by BGS and/or other subject experts) to other groups within BEIS.

Communication/ imparting knowledge to wider geothermal community

(5) On appointment, BGS will coordinate with BEIS to build a national team of geothermal stakeholders and agree mechanisms (e.g. newsletter, email updates, virtual meetings) of keeping them informed of activities within the TCP and its member countries.
(6) BGS will present at national and international conference where we share updates of geothermal developments in the UK, including at
    - European Geothermal Congress 2022, Berlin, Germany, (2 papers accepted)
    - 9th UK Geothermal Symposium, November 2022 (invited speaker)
    - World Geothermal Congress, 2023, Beijing, China (2 abstracts accepted)
    - Energy Geoscience 2023 (with Coal Authority)

BGS has recently been in conversation with an IGC committee member about hosting a major geothermal conference in 2024, working towards a bid to hold the World Geothermal Congress in the UK in 2029.

As part of our role, BGS will

(7) Gather information for and prepare the draft of the annual report of UK activities, jointly with BEIS.
(8) Provide an annual report to BEIS on activities of the TCP.

In mine water energy specifically, BGS will continue its track record via the IEA geothermal symposia (started in 2021, 2022 and planned for 2023) of delivery to global audiences. We will engage via the mine water expert group that has been set up with a Teams area for collaborative working, email address/inbox and lead the publication of case studies produced on the IEA geothermal website, which has global reach (https://iea-gia.org/areas-of-activity/geothermal-heating-and-cooling/). BGS has already led on an abstract about the mine water energy expert group which has been accepted for the 2023 World Geothermal Congress. In addition, as operators the UK Geoenergy Observatory in Glasgow, BGS will continue to publish articles, contribute to webinars, speak at conferences and follow up interest, all related to mine water energy research and innovation. That knowledge will be transferred to BEIS and IEA using the mechanisms listed above.

4. Service Delivery

BGS operates a time allocation system which manages and tracks time requirements of individual staff to fulfil contractual commitments and roles. Thus, delivery of the tasks described in this tender will be slotted into the alternate delegate's work programme and managed through BGS' central allocation system.

Attendance to ExCo Meetings – To ensure availability of the alternate delegate, meeting dates will be blocked in the diary as soon as the schedule for the next ExCo is announced, including time for a catch up meeting with BEIS delegate and an allowance for meeting preparations.

Gathering information for an annual report - This information will be gathered as part of the alternate delegate's existing responsibilities as head of geothermal energy research which requires constant monitoring of and involvement in geothermal developments in the UK, including all activities related to research, funding, industry and policy/ regulation etc. Additional information will be gathered from interactions with the national team of geothermal stakeholders (see KE plan).

Research Support – This will involve horizon scanning of international reports and outputs, highlighting aspects that could potentially be of benefit to the UK.

TCP administration, meeting and conference arrangements, minutes– We have included administrative support in our costing to support the alternate delegate with these tasks.

Producing reports: Timeframes of annual reports are known in advance for the TCP and will be confirmed with BEIS on appointment to the role for reporting of TCP activities to BEIS. Time will be blocked in the diary at the start of the financial year to ensure that the alternate delegate and support staff have availability to complete these tasks within the agreed timeframe.

Participation in TCP activities: A total of 26 days per year will be allocated to the alternate delegate and the expert group task lead through the BGS allocation systems. That way, time will be reserved for both to complete tasks such as liaising with secretariat, developing strategy, representing the TCP at external meetings, developing a Programme of Work for new research and active participation in a sub-task led by another country (e.g. information gathering, fact sheet writing, data analysis). In our costing, we have allowed 15 days for the alternate delegate and 11 days for the task lead for mine energy expert group to engage in these tasks.

The delivery plan for the **mine water energy expert group** (Table 2) includes running 3 meetings per year and in the first year, producing a short report on international regulation, innovation and challenges to shallow mine energy geothermal sites. To achieve the objectives of the group including increasing international learning, better understanding of regulatory systems and best practice for technology development, the detailed delivery plan for year one includes initial steps on gathering short information sheets and case studies from experts in the group.

These first-year deliverables have already been initiated at the June 2022 mine water energy expert group organised by BGS. Two-page documents to form an online resource on the IEA geothermal webpage are being written by volunteer members of the expert group for an intended industry and local authority audience. They include 6 case studies of mine water schemes – UK and internationally, 3 technical summaries (e.g. drilling risk), 1 comparison of regulatory approaches across the nations of the UK, 1 on wider benefits for economic analysis and 1 on UK data sources. Collaborators currently include representatives from the Coal Authority, environment agencies (SEPA, EA), devolved government, universities and companies. The initial focus is the UK for the first case studies, with

actions to do similarly with contacts in Germany, Netherlands, Spain and USA. In years two and three the individual studies will be both added to and integrated, to achieve the objectives of this annex. It is also intended to run the mine water energy symposia in 2023, towards these objectives.

Table 2: Mine water energy expert group plan

Activity	Apr-June 2022	July-Sept 2022	Oct-Dec 2022	Jan-March 2023	2023-2025
Online meetings	June		Oct	Feb	
Assemble voluntary working groups for specific tasks/areas *(complete)*					
Design templates for information, distribute *(complete)*					
Fill in templates, gather information *(ongoing)*					
Bring together templates, information to short report				Jan 23	
Publication on IEA website. Short summative report on regulation, innovation and challenges					
Organise Mine Water Symposium 2023 with Coal Authority Community feedback on next steps for 2023-2025			Call for talks	Agree talks, publicise	
World Geothermal Congress paper about the expert group					*abstract accepted*
Continue expert group meetings Extend international reach Add to case studies and by combination analyse towards best practice, learning from internationally					3 meetings per year
2024 – possibly - UK combined, international geothermal conference (with IGC), in person, with fieldtrips					

Dr [REDACTED] works Monday to Thursday and so will not be available as a rule on a Friday. She can potentially switch her working days for important conferences or meetings.