Dig Deep

Opportunities To Level Up Through Deep Geothermal Heat & Energy On The Way To Net Zero

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Executive Summary

- Deep geothermal heat and power is an established renewable energy technology
- A number of countries in Europe with comparable geology have well developed deep geothermal sectors including France, Germany and the Netherlands
- The greatest potential in the UK is for developing deep geothermal heat
- There are strong overlaps between those areas with high potential for realising deep geothermal heat and areas in need of levelling up
- Developing a UK deep geothermal industry can support the North Sea transition given the matched skill sets and techniques in both sectors
- In contrast to a number of comparable countries, government support for developing the industry in the UK is limited
- Deep geothermal heat can be cost competitive with the Green Gas Support Scheme and Nuclear
- A fixed tariff or bid for tariff are considered by industry to be the most effective way to kickstart a UK deep geothermal sector
- With the right support, it is estimated that by 2050 we could have 360 geothermal plants producing 15,000 GWh annually
- A tariff based approach would transfer the risk from the taxpayer to industry in comparison to grant based support and would also enable the scale needed to bring down costs and reduce risk which are currently significant barriers

Introduction

That must be too good to be true.

That was my reaction when first introduced to deep geothermal technology.

An environmentally friendly, dependable and cost effective source of heat that can be found right under out feet? Surely not.

I have been pleasantly surprised to learn that deep geothermal, is in fact, just as good as it sounds.

Since my election as Member of Parliament for Crewe & Nantwich in December 2019 I have been introduced to the technology and was honoured to be asked by the Prime Minister to produce this review.

Theoretically able to provide enough heat energy to meet all of our heating needs for the next 100 years, even a conservative estimate of what we could utilise suggests it could provide 15,000 GWh for the UK by 2050. By adopting geothermal we could reduce our need for gas to the point where our own North Sea resources meet demand providing energy security for our remaining fossil fuel requirements for future generations.

Deep geothermal energy is heating 250,000 homes in Paris and across France more than 600 MWh are produced annually as the government aims to increase the number of schemes by 40 percent by 2030. Munich is pouring in one billion euros through to 2035 to develop the geothermal energy and make the city's heating carbon neutral. Germany is already producing more than 353 MWh annually and the government is targeting at least 100 new geothermal projects.

In the UK, perhaps as a result of our past success in drilling for oil and gas and our current status as world leaders for cheap wind and solar, we have fallen further and further behind.

But getting to net zero by 2050 is going to require us to pull every possible lever. Transitioning our heating systems is a particular challenge (see inset). We will need to share the proceeds of investment and utilise as much of our existing skills and workforce as possible to be successful.

The UK has more than 28.5 million homes, and another 1.9 million other buildings – offices, hospitals, shops, warehouses and more. The majority of these are heated by gas boilers, which also provide hot water – the bulk of the rest use petroleum for the same end. Burning these fuels produces carbon dioxide, making buildings the second-largest source of greenhouse gases after surface transport. Nearly a fifth of all the UK's emissions come from buildings, and that is before we even consider electricity used within buildings
Climate Change Committee, 2022

What needs to be done?

Like wind and solar at their outset, and mirroring the schemes of support available in Europe, long term financial incentives would help unlock millions in capital investment and kick start the industry. This transfers all the risk to the private sector instead of using taxpayer grants to drill for a resource that won't be realised every single time.

This does not need to be a repeat of open ended subsidies that drove the wind and solar industries forward. Proposals from industry asking for a capped amount of support which would still produce the results we need.

The strength of our oil & gas sector can still yet provide us an advantage as we decarbonise with 37,000 direct jobs and 250,000 in the supply chain that could still be redeployed to deep geothermal.

With the recent set aside for tidal power as part of Contracts for Difference and the introduction of the Green Gas Support Scheme I know that the benefits of diversity in supply are recognised by government. I hope this report and other recent efforts by others to highlight the opportunity deep geothermal presents will spark the beginning of an effort to dip deep on geothermal and reap the rewards this will provide.

What is deep geothermal technology?

Deep geothermal technology is based around relatively simple concepts.

Firstly, heat radiates from the Earth's interior.

Secondly, whilst it dissipates as it reaches the surface, the heat remains significant at depths accessible with established drilling technology.

Thirdly, water can be used to absorb and transmit this heat to the surface.

These mechanisms are what heat hot springs-most famously in the UK as demonstrated by the Roman Baths. Iceland has uniquely conducive geology and enjoys vast utilisation of geothermal energy. However, whilst natural occurrences of any significance are relatively rare, bore holes can be drilled to access this natural resource.

This heat energy, captured and transmitted through water, can be used for heating and electricity generation.

Theoretically, if the cost or feasibility of drilling did not place any restrictions on the depth that could be reached, deep geothermal energy could provide the world with all the energy it needs.

However, current technology creates cost and depth limitations.

As a result, current deep geothermal technology is utilised to exploit heat energy that has been identified at locations nearer to the surface and with geological properties that support the natural flow of water through the rock formations that are at higher temperatures.

Whilst the technology is rapidly advancing, the current mainstream approach involves drilling a bore hole at depths of between 1-6km through which cold water can be flowed, with a second bore hole at an adjacent location through which warmed water is returned. The sites are chosen exactly because the geology allows water to flow at low pressures, rather than needing to "frack" the rock to create artificial flows. Though newer technology involves the use of a closed single loop through which both heating and cooling takes places without the need for a permeable reservoir.

Is deep geothermal environmentally friendly?

Deep geothermal technology is supported by Greenpeace, Friends of the Earth, and the United Nations, evidencing widespread recognition of it as an environmentally friendly source of heat and power.

In the UK one of the currently in construction deep geothermal plants is hosted by Cornwall's Eden Project, the leading environmental education charity.

"Since we began, Eden has had a dream that the world should be powered by renewable energy. The sun can provide massive solar power and the wind has been harnessed by humankind for thousands of years, but because both are intermittent and battery technology cannot yet store all we need there is a gap. We believe the answer lies beneath our feet in the heat underground that can be accessed by drilling technology that pumps water towards the centre of the Earth and brings it back up superheated to provide us with heat and electricity"
Sir Tim Smit, Eden Co-Founder

Deep geothermal technology distinguishes itself from shallow geothermal technology by way of the depths utilised. By drilling to greater depths, even with the associated cost, higher temperate and therefore much greater amounts of heat energy can be captured in comparison to shallow geothermal technology such as ground source heat pumps. 500m is generally considered the distinguishing depth between the two approaches.

This review was primarily concerned with deep geothermal technology, though it does briefly consider mine water heat as an area of similar high potential in relation to the levelling up agenda.

Deep Geothermal In Action

In 2022 I had the opportunity to visit Pullach, a suburb of Munich, which has had heat supplied by deep geothermal since 2005. Currently supplying 1,119 properties with 30 MWh, the supply is due to expand with more bore holes being drilled so it can provide 59 MWh.

Local government authorities supported the drilling of the bore hole I visited yards from a school and next to a park, evidencing confidence in the safety and environmental credentials of the technology. Children attending the school were invited to view the progress of its construction from a viewing platform. Feeling the heat from the 100 degree water radiating through the pipework and seeing the hot water flowing through a viewing port can't be beaten for bringing the potential of this technology to life.

The town hall, municipal hall, swimming pool and schools, church institutions, commercial enterprises and private homes are all making use of the technology in Pullach.

Pullach swimming pool heated by deep geothermal

Visiting a plant with a school and green space in the background

Viewing a deep geothermal well

Pullach Town Hall heated by deep geothermal

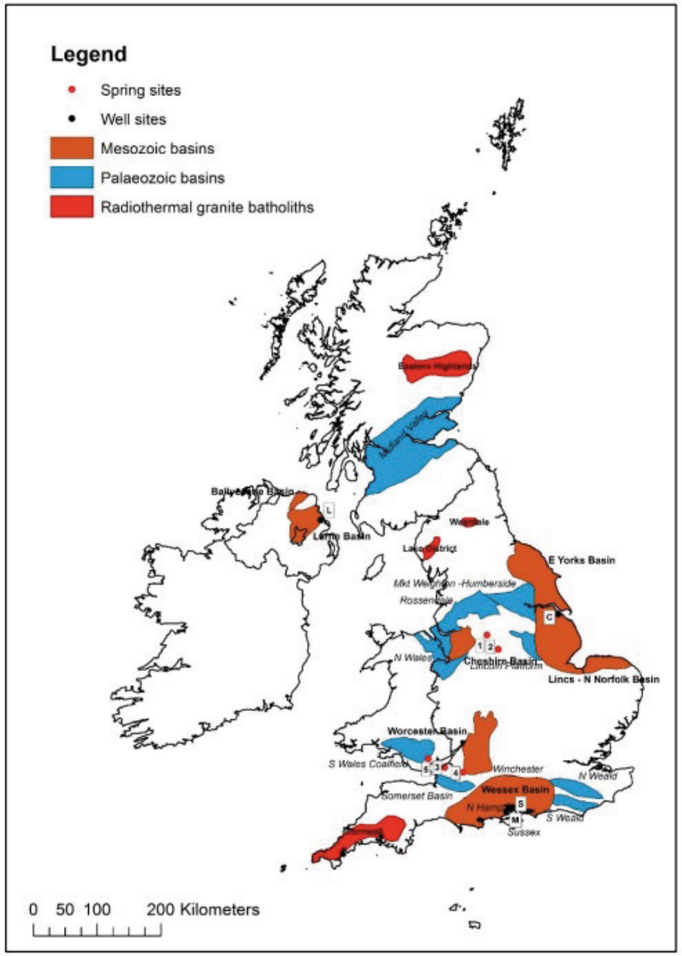
Where could we do this in the UK?

The primary method through which we can assess the scale of the opportunity for geothermal heat in Great Britain is through geological temperature data that has been collected from petroleum borehole data, mining records, and a number of boreholes drilled as part of geothermal studies.

This activity was not universally undertaken so there may well be further opportunities where we lack any temperature information to make an assessment. A lack of data does not represent a lack of opportunity. The scale of accessible heat may well be much greater than we shall go on to describe.

As previously outlined, the primary technology requires suitable geology as well as suitable temperatures. The British Geological Survey has identified 11 aquifers in the UK, 9 of which are at sufficient depths to provide appropriate temperatures. Figure 1 gives a helpful graphical representation of the spread of the resource as it is currently understood (taken from British Geological Survey - Unlocking the potential of geothermal energy in the UK OR/20/049 (2020)).

Fig 1 Deep geothermal resource locations according to existing data, BGS, 2020



A study by the Durham Energy Institute estimates deep geothermal resources could provide all of the UKs heat demand for 100 years. The challenge that remains is understanding in a practical sense the realistic prospects for the full realisation of this potential as it would in reality require a perfect alignment of the opportunities with potential users and the necessary infrastructure to connect the two. But if only 25% of it could be realised it would be significant.

A key aim of this report was to attempt to further refine our understanding of this resource by moving beyond the description of large geographically described opportunities to specific localities where the potential is greatest.

Durham University were commissioned to produce a much more refined analysis than has been produced to date to identify at local authority level where there is the greatest potential for geothermal heat resource utilisation.

The full study is included as Appendix 1 but it has produced a list of 45 local authority locations with the likely greatest potential exploitable opportunity (Fig 2).

The full report further divides and ranks these locations based on resource depth, data certainty and population density. It is not exhaustive-there are advanced plans for a deep geothermal plant in Stoke on Trent for example based on local research. The above list provides a starting point for both local authorities, central government, businesses and Members of Parliament to prioritise the development of deep geothermal resources.

Bolsover	County Durham	Lewes	North Tyneside	Shropshire
Allerdale	East Hampshire	Mansfield	Northumberland	South Kesteven
Bassetlaw	East Lindsey	Melton	Nottingham	Test Valley
Brighton and Hove	East Riding of Yorkshire	Mid Sussex	Pendle	Waverley
Broxtowe	Eastbourne	Middlesbrough	Redcar and Cleveland	Wealden
Carlisle	Hambleton	Newark and Sherwood	Ribble Valley	West Lindsey
Cheshire East	Harrogate	Newcastle upon Tyne	Rother	Wiltshire
Chesterfield	Hartlepool	North East Derbyshire	Rushcliffe	Winchester
Chichester	Horsham	North Kesteven	Sheffield	York

Fig 2 45 Local authorities identified as having the highest likely deep geothermal potential

What are the opportunities for the Levelling Up agenda & the North Sea transition?

Importantly, there is a strong overlap between these locations and at least one important metric of economic resilience. The index of priority places for the UK Community Renewal Fund rank local authorities based on a number of factors including productivity, skills and unemployment rate.

In a stark finding, of the top 10 local authorities found to have the lowest economic resilience, 6 are included in the list above of high potential locations.

- Redcar and Cleveland
- Middlesbrough
- East Lindsey
- Hartlepool
- Northumberland
- Bassetlaw

Fig 3 Local authorities identified as having the highest likely deep geothermal potential that are also in the top 10 of local authorities with the lowest economic resilience

44% of the list of high potential locations fall within the top 100 UK Community Renewal Fund locations, 3 times the amount you would expect as a result of chance. This highlights that investment in deep geothermal is investment that is likely to contribute to the levelling up agenda which remains a key government priority.

As mentioned previously, one of the reasons the UK has lagged behind Europe is that our drilling and geological expertise has been concentrated in the oil and gas sector, both on the mainland and in the North Sea. The technology and skill sets concerned with drilling for oil and gas are largely identical to those used in the deep geothermal industry.

Whilst there are differences in mapping and analysis of the resource and final stage resource extraction, drilling is largely the same. This provides a unique opportunity for the UKs oil and gas sector to transition their jobs and economic activity to a Net Zero compliant technology.

Furthermore, Hirst et al (2015) identified the potential to extract deep geothermal heat from existing oil field well sites.

How are projects developed?

As outlined, there is a broad understanding of the nature of the deep geothermal resource available to us. The key stages in developing a project are as follows.

1. Outline resource identification:
As has been undertaken by the study commissioned for this review, it is possible to identify high potential locations with pre-existing information that can be supplemented by further relatively low cost surface based investigations (for example ground radar studies).

2. Demand identification:
Where a high potential location has been identified there is then a need to identify and further quantity an end user or users to begin building a business case. As outlined, despite the high efficiency of heat exchangers, large distances between the source exchange and end customer exchanges reduce the efficiency and therefore cost effectiveness of any plant. End users may be existing ones, or a location chosen in partnership with a potential end user planning to be collocated with a plant.

3. Risk and investment strategy:
If a potential resource and the end users to utilise are identified, the next stage would be to scrutinise any proposal like any other investment with an element of risk. This will include consideration of the price at which the resources would be set and long term return on investment, the confidence in the resource data at present and any opportunity costs. It is beyond the scope of this review to quantify this process but as will be discussed this remains the key barrier to resource development at present.

4. Test well drilling:
If a decision is made to proceed, test wells will be drilled. They can be designed to become production wells if the resource is captured. Their use in confirming the presence of a resource is true not just for the immediate site, but for the wider area, which is why we have seen expansion of existing geological formations already with a proven resource in Europe. If you drill once and are successful you can drill with much more confidence of success at co locations.

5. Full bore hole drilling:
If the test well drilling proves successful, then drilling to create a production well can proceed. Not all risk is eliminated at this stage because until a flow of water between the two bore holes is established (and this cannot be guaranteed) the site will not be viable.

6. Connecting to end users:
If a deep geothermal resource is realised, the heat energy is then transferred from an originating closed loop system via heat exchangers to a heat network and then to end users via another heat exchanger.

What are the costs & barriers?

Drilling to significant depths into the Earth's surface comes at significant costs. Exact costs will vary depending on depth and geological conditions but range from £4-£20 million.

Whilst nearly all economic activity will generate a saving at scale, a key feature of the costs for deep geothermal energy is that whilst drill heads cannot be re-used and are subject to scale savings in the typical manner, drill rigs are a significant cost feature that can be very significantly reduced through redeployment at multiple sites.

The overwhelming feedback from industry through this review was that the uncertainty of market development and the absence of government support in comparison to comparable markets lowered the appetite to invest at scale and was the single most important barrier to investment and progress.

The saving at re-use for drilling rigs can work in tandem with the improved understanding of the resource in a locality that is realised after the first bore hole is drilled.

Recognition of this challenge is what has led to a number of support schemes for the deep geothermal industry in comparable European neighbours. This raises the opportunity cost for UK projects-investors in the UK geothermal industry will carry risks that are eliminated or reduced in other competitor countries.

Fig 4 Examples of support schemes in place in other comparable countries

France	Germany	Netherlands
For heating production, the Renewable Heat Fund (Fonds Chaleur Renouvelable) was created in 2009 for collective housing, tertiary, industry and agriculture	Created incentives for new projects by offering a feed-in tariff for geothermal electricity under the Renewable Energy Sources Act (EEG).	Under RNES (the National Economic Affairs Subsidies Regulation) operators can insure themselves against a realised capacity lower than the expected P90 value for the well.

The second barrier relates to the need to not only access the resource, but supply it to customers. Unlike wind or solar electricity, heat energy cannot connect to the existing grid but must connect to a heat network. This is a challenge in domestic housing that would require individual connections for each user. This is less of an issue with high usage single customers for example hospitals, universities and other municipal buildings. Stakeholders regarded widespread domestic use would likely any come to fruition after an established industry reduced the cost as described through high usage single customers or new housing developments with heat network integration from the outset.

An additional challenge exists in relation to the suitability of existing government support schemes aimed at decarbonising heat for deep geothermal technology. Grant based application schemes such as the Green Heat Networks Fund (GHNF) are based around tight timescales from submission to completion. This can be challenging given that test and full bore drilling can sometimes take longer than other similar renewable projects. They also don't allow for scale as grants are awarded on a case-by-case basis. There is also stakeholder feedback that the funding amounts available will make it extremely difficult for any significant number of projects to secure funding given the capital costs involved in deep geothermal projects, even if they are in fact cost effective over the longer term.

There are also regulatory concerns. Unlike other utilities such as water and electricity, heat networks are not included in regulations that allow for their placement with or without landowner consent. This means individual landowners can disproportionately increase costs or even block developments entirely.

There was some discussion about licencing and whilst the review recognises this is likely to be needed at some point, this was not considered a priority by most stakeholders given the infancy of the industry at this stage. The Eden and United Downs sites have been able to successfully progress lawfully within the existing legal framework.

How can we kickstart our industry and what would it cost?

As outlined in the previous chapter, the challenge we face is addressing high capital costs and risk. This has been tackled in other comparable countries by a mixture of government backed insurance schemes or feed in tariffs to create price certainty (see Fig 4 above).

As mentioned deep geothermal energy can be used to generate heat and electricity. The Green Heat Network Fund (GHNF) for networks and low carbon technologies supplying heat networks and the Contracts for Difference (CfD) for electricity generation are the principal government support schemes currently available to support deep geothermal energy deployment in the UK. As outlined, a site-by-site grant based approach does not provide sufficient scale of opportunity. CfD has not yet seen a successful bid for geothermal both because of the less favourable conditions for power in comparison to heat and the fact it must compete for price with more mature UK based industries such as wind and solar.

The key recommendation of the 2021 ARUP report "Deep Geothermal Energy: Economic Decarbonisation Opportunities for the United Kingdom" was for the creation of "Geothermal Development Incentive" for the first 30 projects for a duration of 20 years at a cost of £55p/MWh, though this price could now be revised in light of recent fluctuations in energy prices.

This recommendation was echoed by the 1922 BEIS Backbench Business Committee Inquiry Report (Deep geothermal and Mine Water: Valuable new sources of low carbon heating).

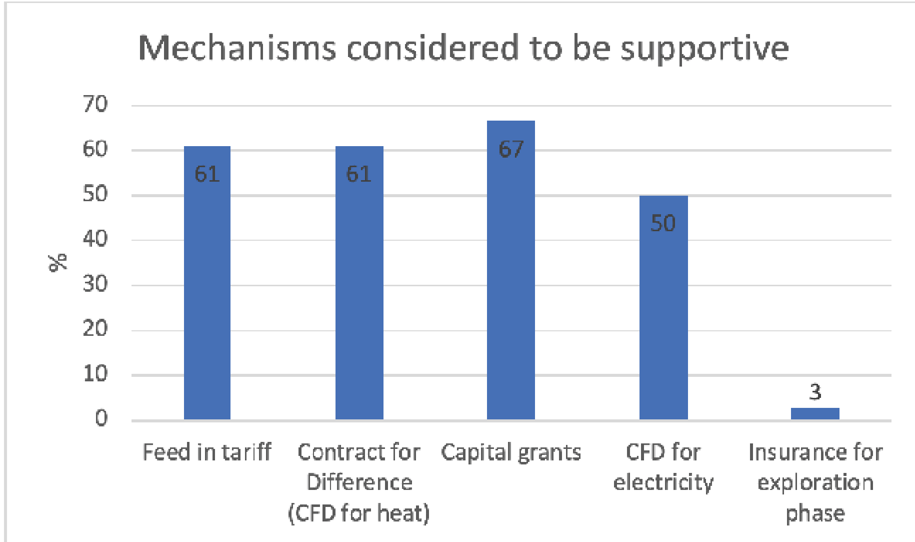
Until the end of March 2021 the Renewable Heat Incentive was in place and provided a similar subsidy. Whilst technically adequate, stakeholder feedback makes clear that the timing was wrong. The same factors previously outlined that saw a lack of appetite for deep geothermal in the UK to date have only recently shifted and been further accelerated by the strategic necessity to secure greater energy security.

In addition to a fixed tariff for heat energy and insurance support, stakeholder feedback identified an approach based around the existing Contracts for Difference (CFD) programme whereby blind bids are made to supply electricity to the grid by renewable energy providers. A similar approach for a set amount of heat energy could potentially reduce the risks of the government paying an artificially high price through the introduction of a market mechanism. Whilst the focus of this review has been on deep geothermal heat energy, a set aside within the existing CFD programme for deep geothermal energy (as recently introduced for tidal power) was also seen as a route to kick starting the wider industry.

To better quantify the likely positive impact of any support schemes on the growth of the deep geothermal industry in the UK, a stakeholder survey was undertaken to assess what they regarded as desired. 36 respondents took part including specialised deep geothermal companies, oil & gas extraction companies, finance providers and renewable energy developers.

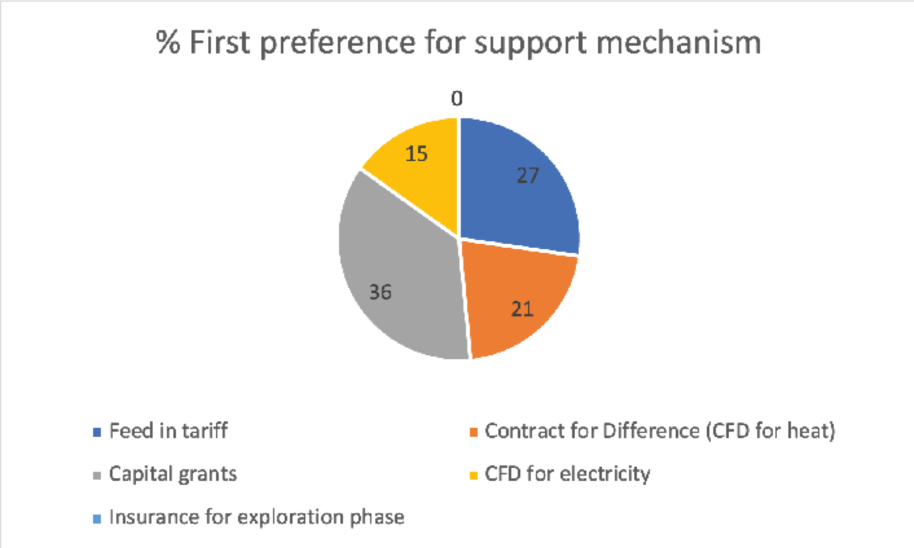
Respondents were asked to choose both which mechanisms they thought could support the industry and then which was their first choice. More than 60% of respondents thought a feed in tariff (61%), CFD for heat (61%) and capital grants (67%) would support the industry. 50% also thought CFD for electricity would help but only 3% chose insurance.

Fig 5 Respondent views of the most desired mechanisms of support for developing deep geothermal industry in the UK



Capital grants was the first choice of support for 36% of respondents but combined a feed in tariff or contracts for difference for heat was at 48%, supporting stakeholder feedback for a system funding outcomes, not capital. But of the two mechanisms, a feed in tariff was preferred to a CFD for heat (first choice for 27% and 21% respectively). A set aside CFD for electricity was the first choice of 15% of respondents. Interestingly, insurance support was not the first choice of any respondents.

Fig 6 Respondent views of the first choice for mechanisms of support for developing deep geothermal industry in the UK

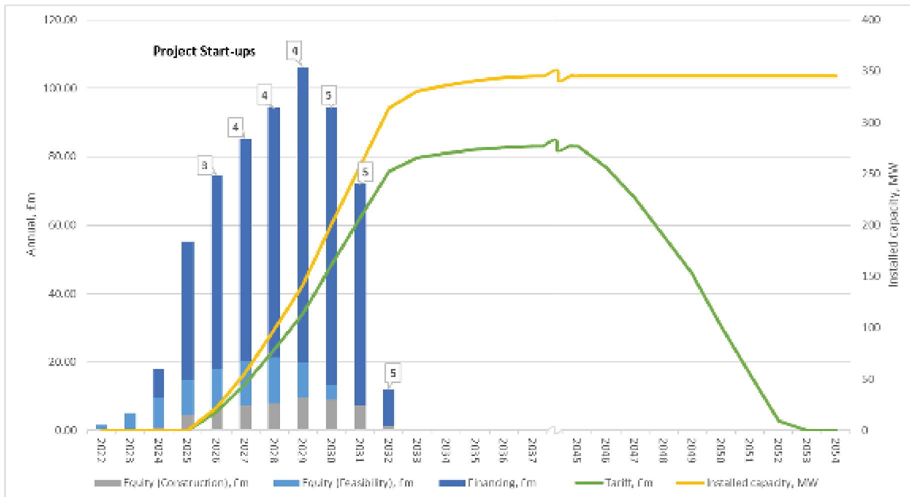


In order to better understand the total cost and financial profile of any state support, GT Energy were asked to try and provide a cost profile estimate for the likely development roll out of a tariff based support mechanism given their experience of the development of projects in Europe.

The modelling presented in Fig 7 shows the scheme starting in 2026 and then concluding after 20 projects have been approved, which in this model is 2030. The coloured bars show the capital expenditure associated with these 20 projects – and the breakdown of the origin of the funding e.g. tariff support or different types of private funding. The numbers at the tops of the bars represent the numbers of installations "going live" in any given year. The Yellow line then shows the installed capacity delivered by these projects (metrics on the right hand axis). Similarly, the green line is the tariff cost per year (against left hand axis) and clearly tracks the shape of the previous line as it is a direct ratio per MWh. As the programme is modelled to reach steady state by 2035 there is graphical break. It is important to note the provision that MWh would continue to be provided for the lifetime of the facilities (estimated at 100 years). Assuming a full uptake for all 30 possible sites the total outlay would of course be fixed and stands at £1.6 billion over an estimated period of 32 years (outlay duration would depend on speed or projects coming online).

In addition, they have overlayed an estimate of the additional private sector investment and related capacity this would unlock. This is likely to be more difficult to predict but is included nonetheless.

Fig 7 Modelled expenditure profile of possible support mechanism, the investment it would realise and installed capacity (provided by GT Energy UK)



Period between 2037 and 2045 excluded for ease of visualisation
Tariff and MW of installed capacity remain constant during this time

There are other steps that could be taken to help drive the industry forward, not just by government. Ireland et al (2021) recommend a dedicated data acquisition programme with dedicated geophysical surveys to provide up to date and location specific data of the potential resource. Dickinson & Ireland (2022) recommend mirroring the dedicated publicly available databases found in the Netherlands and Germany. Whilst the government could play a role in this, these are also projects that could feasibly funded pan industry initiatives. The recent formation of the pan industry Geothermal Energy Advancement Association may enable these sorts of programmes to be facilitated.

Mine water heat

As previously outlined deep geothermal technology capitalises on the higher temperatures found at greater depths from the earth's surface. Ground source heat pumps capture heat energy from the surface.

But there are possibilities at depths in-between.

Where ordinarily it may not be economically advantages to aim for an "in-between" depth, with some of the costs of needing to drill (e.g., establishing a drilling rig) without the returns found at greater depths, coal mine water heat provides a low cost alternative.

Previous excavation work to extract coal has led to the creation of a vast network of underground spaces at depths of around 500m across hundreds of locations across the UK (See Fig 8). Over time, many of these mine workings have filled with water which is gradually heated by the heat in the surrounding geological formations.

This removes the need for extensive drilling and importantly, has created artificial flows of water beneath the surface-removing the necessary component of a natural water reserve for deep geothermal technology.

This allows for relatively low cost extraction of heat energy, usually at temperatures of around 25C.

As with deep geothermal this provides another series of locations, often overlapping with areas in need of levelling up, to allow for a wider geographical spread of the investment

Fig 8 Location of coal minefields

needed to get to Net Zero buy 2050.

The Coal Authority have identified 42 schemes based on initial feasibility work, which if successful, could provide £293m gross value added and create 4,227 jobs.

In addition to the creation of specific resources for this purpose, there are pre-existing water treatment plants (see below in relation to activities of The Coal Authority) that could be adapted for this purpose.

The challenge in this field is that the exact flows of water are not mapped, as the mine workings themselves may not have been mapped originally, may have changed through natural movement, or have experienced water entry in an irregular manner.

Any potential site requires study and analysis and then testing to try and establish a flow of water sufficient to enable the necessary flow of water.

The Coal Authority is an executive non-departmental public body, sponsored by the Department for

Business, Energy & Industrial Strategy that manages the effect of past coal mining and deals with mine water pollution, public safety and other mining legacy issues. It owns on behalf of the country the majority of the coal in Britain. They are not presently funded or directed to undertake the development of this potential resource.

Nevertheless, they have been funded by stakeholders to support the development of mine water heat schemes with two at an advanced stage of development.

One in Gateshead is utilising a £5.9m Heat Networks Investment Project (HNIP) grant of to enable the council-owned Gateshead Energy Company to install 5.5 km of new heating pipes to the east of Gateshead Town Centre which aims to realise 3 MWh of mine water heat providing 1,250 homes and other buildings with secure low carbon heating via an existing Heat Network.

Seaham Garden village is another, delivered in partnership with Durham County Council, and the Coal Authority, Tolent Construction are developing a district heating network to supply 1,500 homes, a primary school, shops and an innovation centre with an investment of £165 million.

Lanchester Wines is a private sector enterprise and the largest commercially operated scheme, successfully generating 4.0MWh to supply heat to a 360,000 ft2 of warehouse

In both a submission to this review (see Appendix 2) and a submission to the Environmental Audit Committee inquiry into geothermal energy, The Coal Authority identified a number of opportunities and barriers for exploiting this resource.

Amongst them, they highlighted that

- 25% of all properties in Great Britain are located above the coalfields
- Disused coal mines are often associated with urban areas where there is heat demand
- Generally social acceptance to mine water heat has been favourable
- Heat networks using mine water are technologically ready

And that

- The lack of resource opportunity mapping means there is a poor understanding of the exact nature of the resource
- As they are not funded to undertake related research development is taking place on an ad hoc basis
- Initial capital costs and risks of failing to establish a sustainable resource acted as a barrier

To support this review The Coal Authority were asked to consider how they might facilitate a more rapid uptake of coal mine water resources. The Mine Energy Paper published by the NELEP Mine Energy Task Force in July 2021, identified the requirement to develop heat resource estimates and national scale opportunity mapping tools. The Coal Authority has considered the resources, cost and timescale to develop Mine Water Heat Opportunity Maps for the whole of the United Kingdom, identifying areas with heat demands that are most suitable for development of mine water heating schemes. This would support Local Authorities and developers to select and integrate this technology during early stages of planning and development. They have estimated the cost at £4.95 million over 5 years.

In addition, they have outlined the estimated additional resources required by the Coal Authority to facilitate growth, assuming 10 schemes per year over a 5 year period. They have estimated the cost at £8.1 million over 5 years.

Fig 9 Budget for proposals from the Coal Authority for developing coal mine water heat initiatives

National Mine Water Heat Resource and Opportunity Mapping

	Yr 1 £k	Yr 2 £k	Yr 3 £k	Yr 4 £k	Yr 5 £k	Total £k
Staff Costs	1,250	1,250	1,250	500	300	4,550
Website & Viewer Capex Development	-	100	100	100	100	400

Year 1 Deliverable	Data Improvement & Development
Year 2 Deliverable	Resource Estimate & Opportunity Map Part 1
Year 3 Deliverable	Opportunity Map Part 2
Year 4 & 5	Ongoing Update and Maintenance

Support to Facilitate 10 Mine Water Schemes per year over 5 years

	Yr 1 £k	Yr 2 £k	Yr 3 £k	Yr 4 £k	Yr 5 £k	Total £k
Project Delivery Costs	1,400	1,400	1,400	1,400	1,400	7,000
R&D Capex Programme	300	300	300	100	100	1,100

Note: Assumes an even mix of Bolt-On and Stand-Alone Schemes

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