

Deep Geothermal Briefing

An REA briefing on the geothermal sector and its potential for the UK

What is geothermal energy?

Geothermal energy is generated from the heat of the earth's core and is a source of **low-carbon renewable energy**. It can be used for **heating, cooling** and **power generation**.

Deep Geothermal energy is accessed by drilling wells to depths of more than 500m to access temperatures that are high enough for direct use (50 to 200°C¹). Three types of Deep Geothermal systems are highlighted in the diagrams below. Hydrothermal or hot sedimentary aquifers can be used directly in heat networks (Figure 1), whilst Petrothermal or Enhanced Geothermal Systems (EGS) are typically used for power generation (Figure 2). It is also possible to re-purpose oil and gas wells (Figure 3) for heat, power or subsurface heat storage.

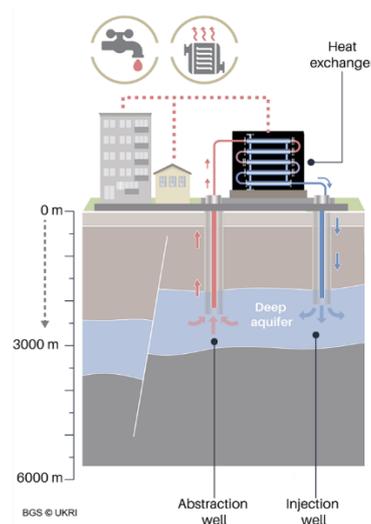


Figure 1: Geothermal Heat Network using a Hydrothermal system²

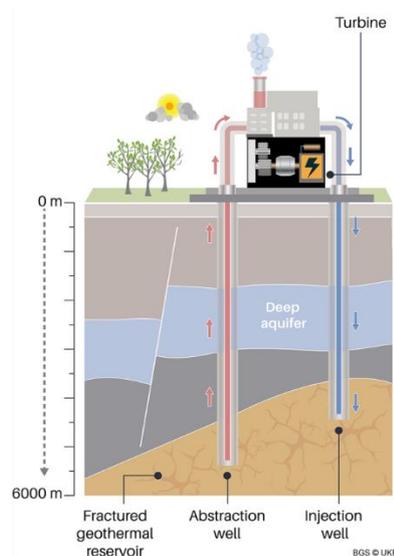


Figure 2: Geothermal Power plant using a Petrothermal or EGS system²

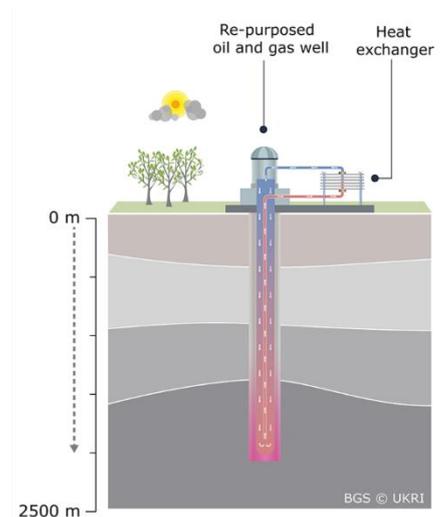


Figure 3: Repurposed onshore oil and gas well system²

Current state of Deep Geothermal in the UK

We are **far behind our European counterparts** in developing a geothermal industry. As of 2022, there were:

- 74 projects in France
- 31 projects in the Netherlands
- 190 projects in Germany

Due to lack of government support and viable routes to market, there are currently only a limited number of Deep Geothermal projects in the UK. Some of the most significant developments have occurred in the last year, all in Cornwall:

- 1) The UK's first operational Deep Geothermal heating plant since 1986 opened at the Eden Project in June 2023.

¹ Abesser, C. (2022) Geothermal Energy POSTbrief 46 <https://researchbriefings.files.parliament.uk/documents/POST-PB-0046/POST-PB-0046.pdf>

² British Geological Survey, UKRI, <https://www.bgs.ac.uk/geology-projects/geothermal-energy/geothermal-technologies/>

- 2) Allocation Round 5 of the Contracts for Difference Scheme saw the first geothermal power projects clear the auction – three projects delivering a total of 12 MW of capacity by 2027.
- 3) Langarth Garden Village became the first Deep Geothermal project to be granted Green Heat Network Funding to develop a heat network powered by Deep Geothermal.

The UK's potential

Deep Geothermal is available in a variety of geological settings across the UK – from deep sedimentary basins in East Yorkshire and Cheshire, to granites in Cornwall and Scotland (see Figure 2). Theoretically, Deep Geothermal could provide enough heat energy to meet **all the UK's heat demand needs for the next 100 years**.

REA research estimates that by 2050 the UK could have 360 geothermal plants producing: **15,000 GWh of heat annually** - providing equivalent heating to over 2 million homes primarily through powering heat networks; and around **400 GWh of electricity annually** - providing electricity to almost 150,000 homes.

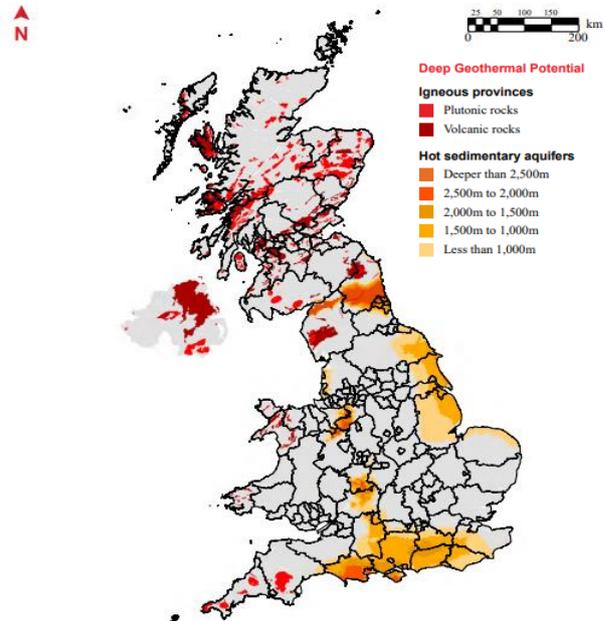


Figure 2: Map showing location of potential deep geothermal targets in the UK³

Reasons to support Deep Geothermal

Deep geothermal heat and power is an established renewable energy technology that could provide many benefits to the UK, including:

- ✓ **Decarbonisation of Heat** - the decarbonisation of heat remains one of the largest challenges facing the UK in delivering its net zero ambitions – with only 8.36% of heat consumption generated by renewables in 2022. Successfully decarbonising all UK heat demand will need a wide range of low carbon technologies, ensuring the right technology is used in the right situation.
- ✓ **Net Zero Targets** – 360 geothermal plants would save an estimated 3 million tonnes of CO₂ annually.
- ✓ **Energy Security** – geothermal is a home-grown renewable energy source, reducing our reliance on gas imports which are subject to volatile international pricing.
- ✓ **Reliability** – geothermal heat is constant, available 24 hours a day independent of the weather, making it a predictable and consistently firm renewable energy source.
- ✓ **Levelling Up** - 6 of the top 10 local authorities with lowest economic resilience, have some of the highest geothermal potential in the country.
- ✓ **Jobs and Green Growth** – 360 geothermal plants could generate 10,000 direct and 25,000 indirect jobs.
- ✓ **North Sea Transition** – it would provide an opportunity for those in the oil and gas sector to transition to the green economy, as many of the skills are directly transferable.
- ✓ **Wide variety of uses** – Deep Geothermal heat can be used directly for heating large buildings as well as homes via district heating systems, and in a wide range of industries, including manufacturing, process heat for greenhouses, and in distilleries.

³ Arup, REA (May 2021). Deep Geothermal Energy – Economic Decarbonisation Opportunities for the United Kingdom

- ✓ **City friendly** – geothermal can be used in urban areas as it takes up little land, has low visual impact, and produces little or no emissions. This is almost unique for larger scale energy sources, of any kind.
- ✓ **Minerals and metals** - Lithium has been discovered in the geothermal waters of Cornwall and Weardale. Companies are currently investigating the potential for the co-production of lithium and geothermal energy, which could create an extra revenue stream for geothermal energy.

Building a geothermal industry in the UK requires:

- **Support mechanisms** – there are currently limited financial support mechanisms for geothermal, the government has a key role to play in providing supportive policy and funding to enable a route to market for the sector, which would both drive investment and reduce costs. See our recommendations below for the best forms of support.
- **Regulation** – regulatory bodies that cover geothermal are currently not coordinated and there is no streamlined regulatory regime. Improving this would help reduce project development timescales. A big opportunity is that some existing regulations for the oil and gas industry, such as regarding planning, could be rapidly expanded to the sector, easing burdens and increasing deployment.
- **Exploration** – in-depth geo-physical surveys should be carried out to ascertain the feasibility of deep/shallow generation in strategic basin locations, as well as the underwriting of exploratory drilling in to help de-risk projects.
- **Licensing** – geothermal energy is not recognised as a natural resource in the UK and so there is a lack of clarity over its legal status and ownership. Developing bespoke permitting and licensing systems is key to enabling assurance for investors and developers.

Key Policy Asks to Deliver the Potential of Geothermal for the UK

Growth in Deep Geothermal projects is expected to continue to be slow without any government intervention or incentives. Therefore, we propose that the incoming government should, in the first 100 days, take steps to:

- Develop a **Deep Geothermal Strategy**, which sets out national targets for heat and power, and the policies and funding mechanisms that will enable industry to deliver these targets.
- Deliver a **Geothermal Development Incentive** by the end of 2025, targeted at shovel ready geothermal heat projects, to get the sector established in the UK.
- Review and amend existing **financial support mechanisms** so they better support routes to market for geothermal e.g., by ringfencing the Contracts for Difference budget for geothermal projects or reconfiguring the Public Sector Decarbonisation Scheme to deliver strategically important geothermal projects, such as NHS sites that require high heat loads.

Please do not hesitate to contact us for further information or to discuss any of this content further, at: heat@r-e-a.net