TownRock Energy

Geothermal Energy in the UK

For secure, clean & affordable heat, look beneath your feet

Who Are We?

TownRock Energy is a multi-award winning geothermal energy consultancy based in Edinburgh, Scotland. We specialise in developing renewable energy systems in all of the UK's available geothermal resources

Our focused, dedicated team prides itself in its straight-talking approach to this frequently misunderstood renewable technology. We help our clients and partners understand how to unlock the value within the geological asset beneath their site.

For more information about our products and services and to meet the team visit townrock.com

TownRock Energy

For renewable heat

look beneath your feet

Why Geothermal Energy?

Low carbon, **renewable**, heating and cooling provision, with **attractive profits** and 40+ year lifetime

Only requires electricity to operate, which can be sourced from local renewables or the grid

Often **near to areas of heat demand**, no visual or noise impact, and generally **supported by local communities**

It's a **local**, **secure** and **sovereign** energy source

Government capital grant **support available**

Geothermal energy has the potential to be the most significant and sustainable source of heating and cooling globally by 2050

The Earth is constantly generating its own heat, primarily from the decay of radioactive isotopes, and will continue to do this effortlessly for billions of years to come.

This low carbon energy source has already been tapped into all over the world, but we have only begun to scratch the surface of its true potential.

The UK continues to burn natural gas for heat, even though it has to import over 40% of the fuel used - but the UK geology is capable of being harnessed to produce a booming geothermal industry akin to the Netherlands.

The TownRock Energy team has travelled the world to understand best practices and policy for developing geothermal energy. We are now poised to demonstrate the viability of geothermal energy in the UK and help meet its 2050 net-zero targets.

How Does Geothermal Energy Work?

Geothermal energy - the use of naturally occurring heat from buried rocks - is a proven, sustainable technology. The UK's geothermal resource is significant and remains largely untapped at present.

In locations such as Iceland magma is near the surface and large quantities of steam can be produced from relatively shallow wells to turn turbines that generate electricity. The UK does not have active volcanoes but there is enough geothermal heat available - the wells just need to be drilled deeper.

A geothermal heating and/or cooling system typically involves a production well to deliver warm water from the rocks beneath the site; a heat centre, pumps and pipework to deliver thermal energy to the end user; and a re-injection well to dispose of water and maintain resource pressure.

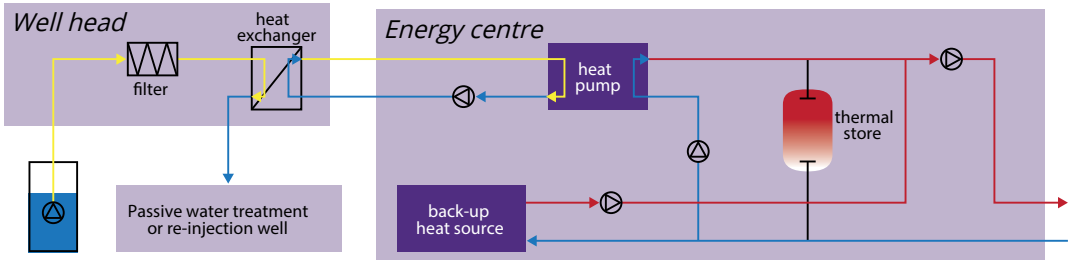
The production well will typically be drilled into the ground to a depth of 50-4000 m where the rock contains large quantities of ground water. Some project developers are considering wells as deep as 6000 m, and as drilling technologies improve and costs come down this may become common.

When the hot groundwater reaches the surface, it passes through a heat exchanger which transfers the heat into a separate loop of pipe containing clean water.

The temperature of this clean loop can be increased further by using a heat pump, to match the customer's heating requirements. The heat pump can be centrally located in an energy centre, or located in each building, depending on the customer needs.

After passing through the heat exchanger, the ground water is piped to the injection well or surface disposal facility where it is either pumped back into the ground or treated before being pumping into the sea. The injection and production well are spaced away from one another to allow the groundwater to sufficiently heat up before returning back to the production well.

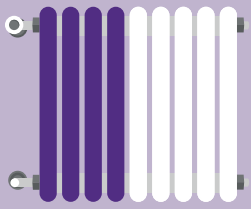
Directional drilling from a single well pad can help minimise surface pipework while achieving the desired well spacing in the subsurface.



Schematic of a geothermal well doublet connected to a heat pump energy centre

The **carbon footprint** for a standard gas boiler is

210–380 gCO_2eq/kWh



45% of UK energy use is **heating**

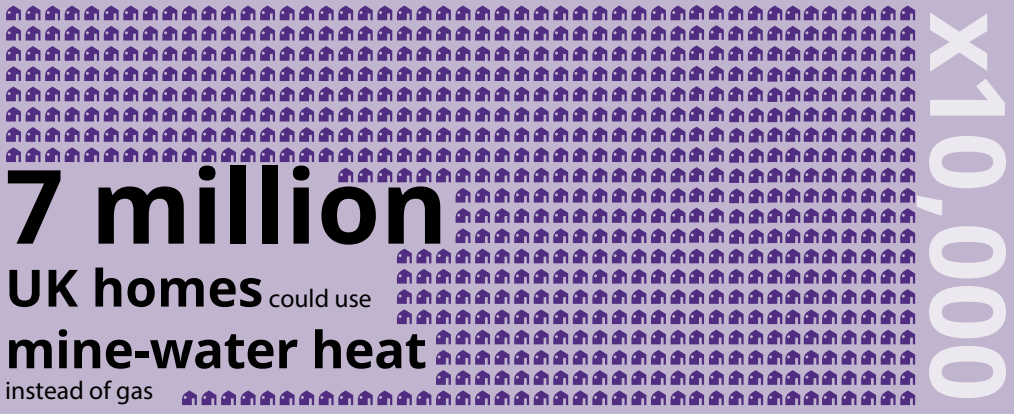
25% of UK homes sit above coal mines

In the UK the temperature at 1km is typically **30–50°C** and increases linearly with depth

Earth's core is **6000°C**

Heating accounts for **40%** of UK carbon emissions

UK abandoned mines contain **75 billion m³** of water



7 million **UK homes** could use **mine-water heat** instead of gas

What Geothermal Resources ?

The term "Geothermal" refers to thermal energy in the ground but it covers a wide array of different resource types. This diagram Illustrates the different types of geothermal resource found in the UK and most other countries.

Ground-Source Heat Pump

A ground-source heat pump extracts thermal energy from the very shallow surface. The thermal energy is primarily from the sun which charges the near surface with heat and some geothermal energy. Ground-source heat pump systems can be closed loop (pumping water through buried pipes) or open loop (pumping water through porous rocks via a production and injection well). We allign our shallow geothermal technical services with the RIBA Plan of Work for new build developments and renovation projects.

Surface-Water Heat Pump

A similar technology to the ground-source heat pump except the resource is using the thermal energy in bodies of water such as lakes, rivers and the ocean. This can be a great option for renewable heating and cooling.

Mine Water

Abandoned coal mines in Scotland's central belt and across large areas of England and Wales are full of warm water. These legacies of the fossil fuel age can be recycled into vast sources of low-carbon heating and cooling at relatively low cost. Heat exchangers and heat pumps are usually used to elevate the temperature of the water to be delivered to the customer.

Hot Sedimentary Aquifers

Aquifers are rocks with pore-spaces and natural fractures that exist across much of the UK, and in particular can overlap with onshore oil fields. Geothermal aquifers are often referred to as Hot Sedimentary Aquifers ("HSAs" for short) and typically aim for targets at depths of 1 to 3 km.

Granites

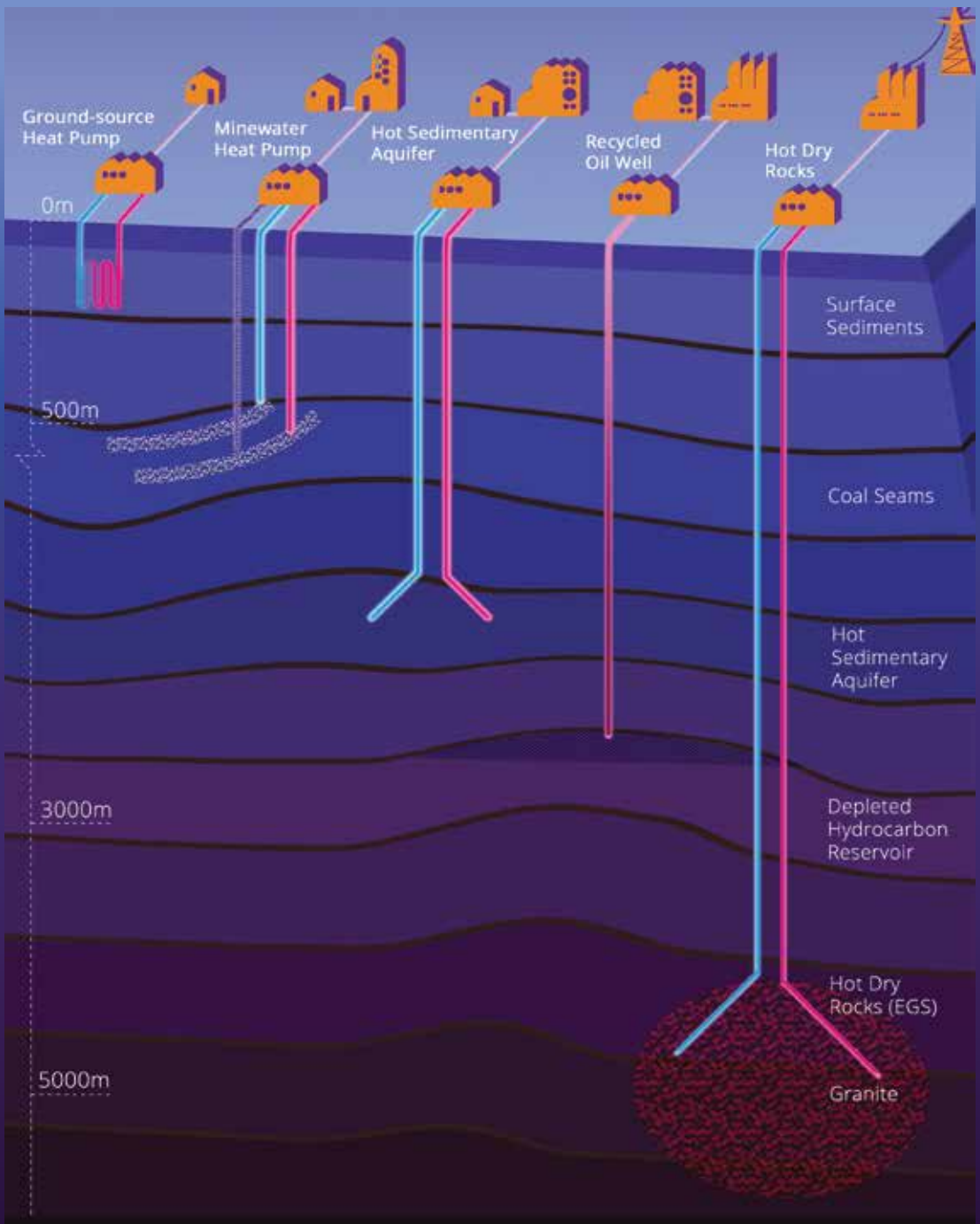
Radiothermal granites found in the Scottish highlands, Northeast England and in Cornwall can supercharge the ground with heat. If enough heat is produced it can be converted to renewable electricity using Engineered Geothermal System (EGS) technology. EGS are often referred to as "Hot Dry Rock" systems because they target naturally occurring fractures for improved subsurface fluid flow. The geothermal fluid from these systems can also contain lithium and other metals which are critical to the renewable energy transition, adding an additional revenue stream along side geothermal energy production.

Disused Oil Well

When oil and gas wells are near the end of their economic life, they often produce large quantities of hot water. When local heat demand exists, or if a business which requires low cost heat (such as a heated greenhouse or anaerobic digestion plant operator) wants to invest locally, the oil well can be given a low-carbon geothermal afterlife.

CCG Well

TownRock Energy's Cyclic Circulating Geothermal (CCG) well produces warm water and injects cold water via the same well, and can be deployed in any geology. This is an effective mitigation strategy, providing heat from wells where open-loop abstraction and injection is not possible. Cyclic operation preserves near wellbore formation temperatures and increases the sustainable life-span of geothermal heat supply.



50 - 6000m
Project Depth

0.2 - 20MWth
System Capacity

£0.2 - 50mil
investment

3 - 12Years
Payback Estimates

2 - 30g per KWh
Baseline CO2 Output

TownRock's Target UK Project Characteristics

Where Are Geothermal Resources?

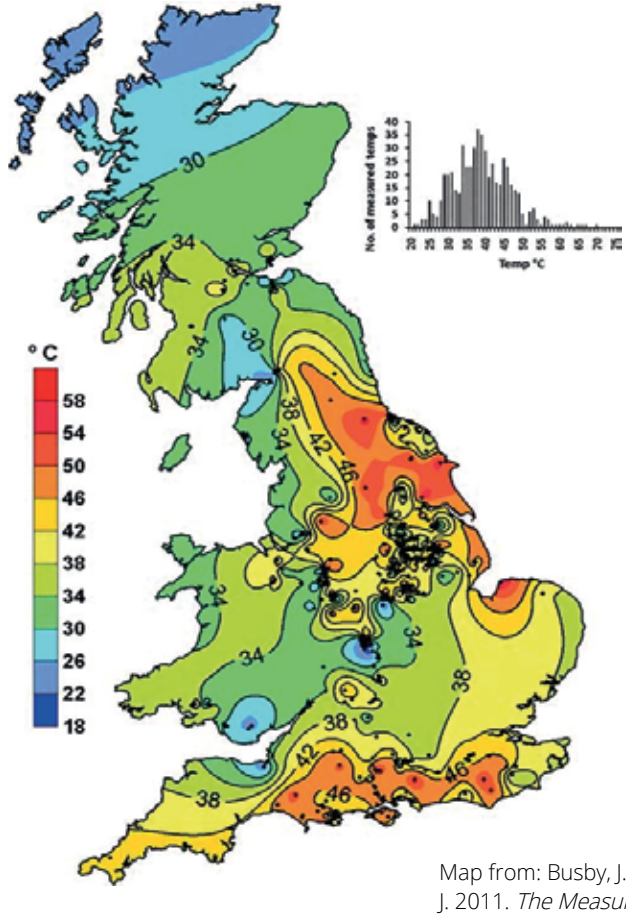
Ground-source heat pumps can be installed nearly everywhere in the UK. This map highlights the areas of greatest geothermal energy potential. Hot sedimentary and mine water resources are found in the sedimentary basins. Hot Dry Rock resources are in areas near places with granite batholiths.

Sedimentary Basins (which include HSA's and flooded mines)

Radiothermal Granites

What Is The Temperature At 1 Km Depth?

The flow of heat from deep underground to the surface of the planet varies from place to place, which affects the temperature of the rocks. Data collected from boreholes, wells and mines show the temperature at 1 km depth. Areas with higher geothermal gradient are shown in red and orange but heat is available everywhere.



Map from: Busby, J., Kingdon, A., Williams, J. 2011. *The Measured Shallow Temperature Field in Britain.* Quarterly Journal of Engineering Geology and Hydrogeology, 44. 373-387

How Does Our Process Work?

We work with a diverse array of clients so our services are customised to fit each client's needs. We apply a consistent approach to our site evaluations in a 4 phase process that minimises risk and maximises the client's return on their investiment. Those 4 phases are described below.

Project Phase	Outcome	Timeframe
Phase 1 **Discover**	In the **Discover** phase, we deliver an intial **Options Appraisal** of the renewable systems available and geological assessment at the site, in line with RIBA stages 1 and 2.	1 - 6 Months
Phase 2 **Prove**	In the **Prove** phase, a **Detailed Feasibility** assessment of the geology, heat pump engineering, test drilling, finacial performance, risk mitigation and regulatory stakeholder engagement in line with RIBA stage 3.	6 - 12 Months
Phase 3 **Deliver**	For the **Deliver** phase we follow RIBA stages 4 and 5 where we perform a supervisory role as **Client Engineer** and **Client Geologist** providing review of contractor design packs, expert witnessing of drilling programme and plant room / heat supply integration.	12 - 18 Months
Phase 4 **Operate**	After geothermal heat pump installation in the **Operate** phase, we will ensure that the project continues to operate smoothly, **Maintaining** and **Optimising the System** using operational data and assuring regulatory compliance throught its lifetime in line with RIBA stages 6 and 7.	25 - 50+ Years

Timeframes will vary depending on the resource type and scale of the project

The **RIBA** ***Plan of Work*** is an **8 stage** design and construction plan that was created by the Royal Institute for British Architects (RIBA). This is an internationally applied approach for how architects work with clients in the 21st century, and is industry standard for engineering and construction firms.

We support projects thoughout the entire life cycle following the RIBA standard of practice. This includes bringing in drilling and construction contractors at the appropriate stage and providing a lifetime of operation services so our client's assets are protected.

Image source: RIBA Plan of Work - Morse Webb

Who Are Some of Our Clients?

VITAL SOLUTIONS

HEMIKO

University of Strathclyde Glasgow

GeoLogica

HERIOT WATT UNIVERSITY

SCENE

THE UNIVERSITY of EDINBURGH

THE LANCHESTER GROUP

Scottish Enterprise

What next?

To discover your geothermal project opportunity, email **hello@townrock.com** or visit our website at **townrock.com**

Local Address
36 St Andrews Square, Edinburgh, EH2 2YB

Registered Address
East Woodlands House
Dyce, Aberdeen
AB21 0HD

Company No. SC454937
VAT No. 171 3361 29

40% of the UK's carbon emissions are produced by burning fossil fuels for heating.

The estimated **carbon footprint** for **geothermal energy** is over **90% less than an average gas boiler*.**

If you're looking to reduce your carbon footprint and reliance on fossil fuel, then geothermal is the way to do it and we at TownRock Energy can help get you there.

*Estimated footprint for gas boiler is 210-380gCO_2eq/kWh for geothermal the the figure is 2-30gCO_2eq/kWh.