

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





look beneath your feet

For renewable heat

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

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 50–4000m where the rock contains large quantities of groundwater. Some project developers are considering wells as deep as 6000m, and as drilling technologies improve and costs come down this may become common.

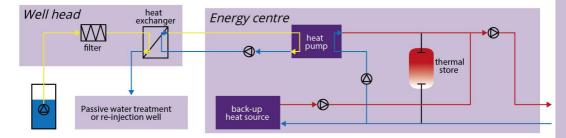
When the hot groundwater reaches the surface, it passes through a heat exchanger

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 customers needs.

After passing through the heat exchanger, the groundwater 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



for a standard gas boiler is 210–380_{gCO2}eq/kWh

25% of UK homes sit above coal mines



45% of UK energy use is heating

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Earth's core is **6000°C**

Heating

accounts for

40% of UK carbon emissions



75 billion m³ of water

7 million

UK homes could use

mine-water heat



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 fluid through buried pipes) or open loop (pumping water through porous rocks via a production and injection well). We align 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

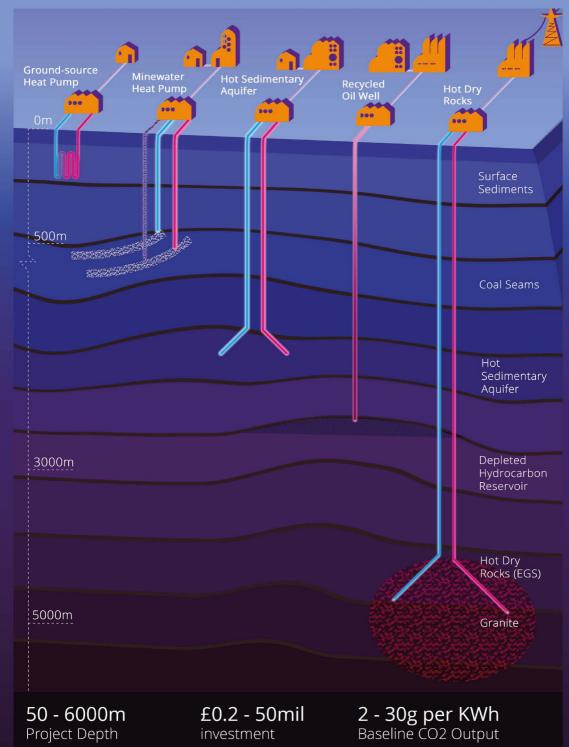
Radiothermal granites found in the Scottish highlands, Northeast England, and in Cornwall can supercharge the ground with heat. If enough heat is produced it can be converted to renewable electricity using Engineered Geothermal System (EGS) technology. EGS are often referred to as "Hot Dry Rock" systems 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 openloop abstraction and injection is not possible. Cyclic operation preserves near wellbore formation temperatures and increases the sustainable life-span of geothermal heat supply.



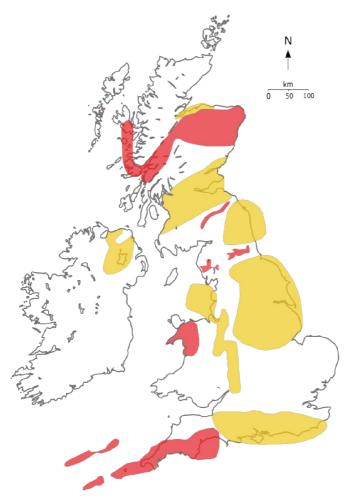
0.2 - 20MWth System Capacity

3 - 12Years Payback Estimates

TownRock's Target UK **Project Characteristics**

Where Are Geothermal Resoures?

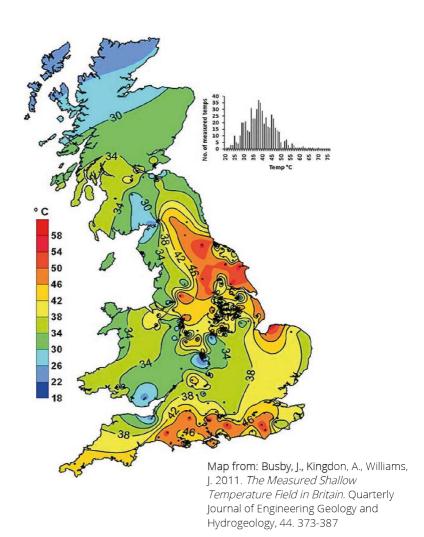
Ground-source heat pumps can be installed nearly everywhere in the UK. This map highlights the areas of greatest geothermal energy potential. Hot sedimentary aquifer and mine water resources are found in the sedimentary basins. Hot Dry Rock resources are in areas near places with granite batholiths.



- 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 in turn 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 is shown in red and orange, but heat is available everywhere.



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 phased process that minimises risk and maximises the client's return on their investment. Those 4 phases are described below.

Discover	Prove	Deliver	Operate

Project phase	e Outcome	Timeframe
Phase 1 Discover	In the Discover phase, we deliver an initial 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, financial 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 Operation phase, we will ensure that the project continues to operate smoothly, Maintaining and Optimising the System using operational data and assuring regulatory compliance throughout 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 throughout 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.

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Who Are Some of Our Clients?







Strathclyde Glasgow







LANCHESTER GROUP

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 $_2$ eq/kWh for geothermal the the figure is 2-30gCO $_2$ eq/kWh.