DARREN JONES

Utilising deep geothermal energy in the UK for decarbonising heat

British Geological Survey

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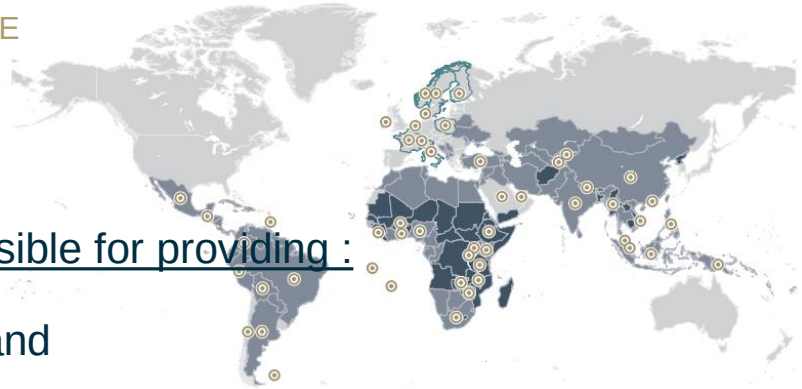


BGS is a public sector research organisation responsible for providing :

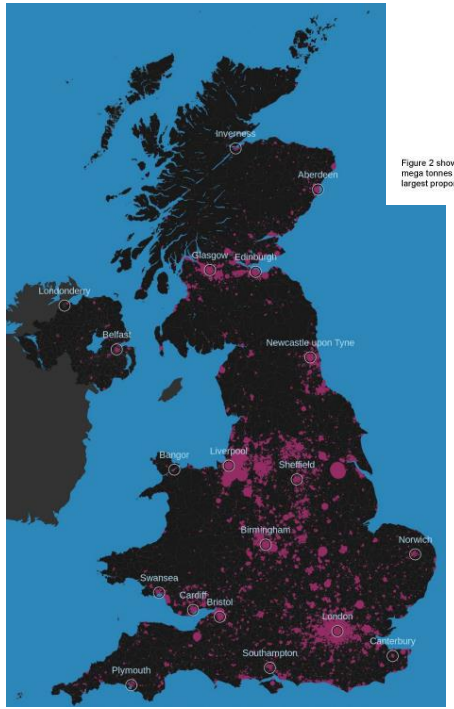
- **impartial and independent geoscience advice** and data to Government, Industry and the public
- national **repository of data, services and analytical facilities** in support of earth sciences research
- skills, expertise and knowledge **globally**
- undertake research to advance geoscience understanding, including availability of natural resources and their utilization for the **benefit of society**

UKRI / NERC **£30.5 million** | Other income **£24.05 million**

“Geothermal energy could make a significant contribution to the decarbonisation efforts of the UK.”

Decarbonisation of heat challenge

- Heat - UK's biggest source of carbon emissions
- 85% (about 24.5 million) of UK homes using natural gas
- 20,000 homes a week (1 million annually) need to be converted to low carbon heating to meet our 2050 Net Zero targets
- No silver bullet
- Geothermal Energy is **low-carbon options for heating** that is available **now** and it **all parts of the UK**



UK Heat Demand

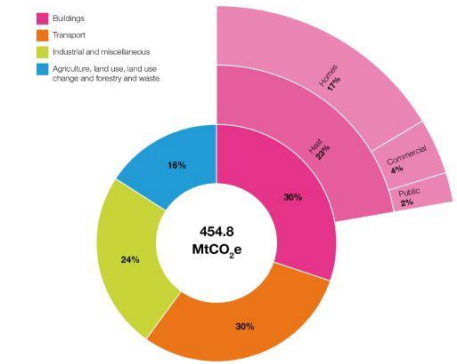
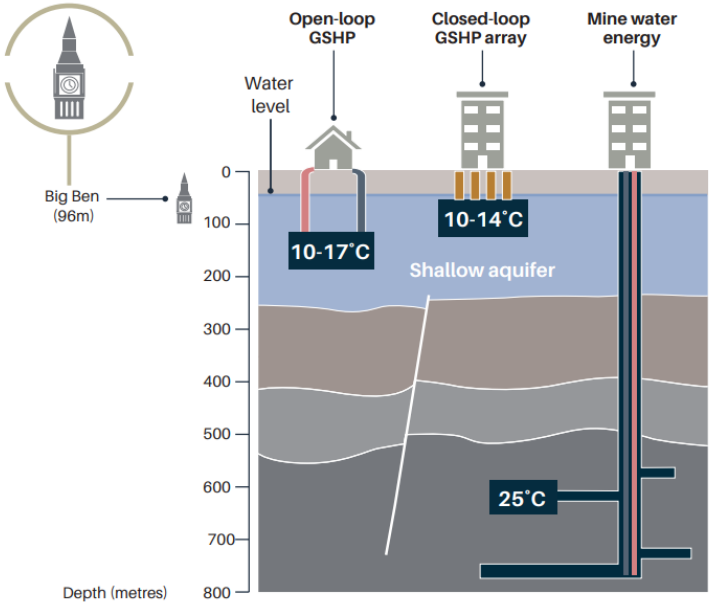


Figure 2 shows the proportion of emissions in 2019 from buildings to the nearest whole number; of the 454.8 mega tonnes of carbon dioxide equivalent ($MtCO_2e$) total emissions, 23% were due to heating buildings, with the largest proportion of this stemming from homes.[20]

UK Carbon Emissions

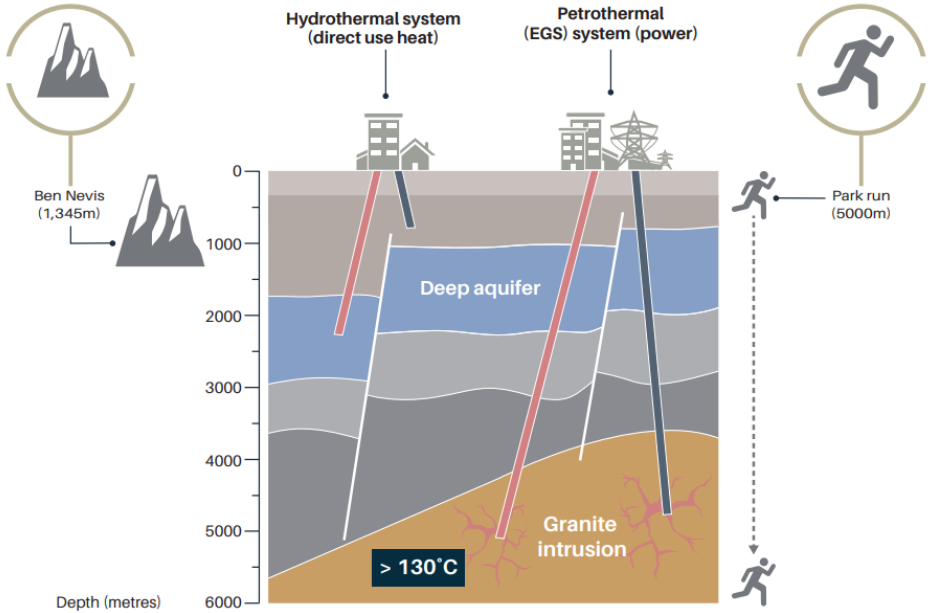
What is Deep Geothermal?

“shallow” geothermal



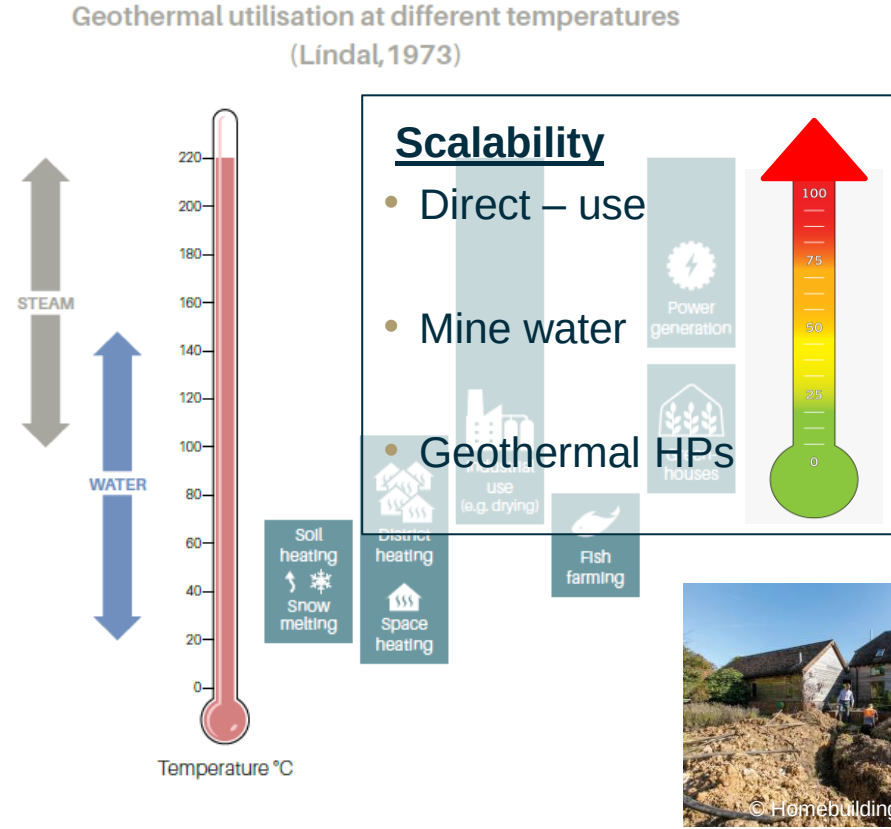
requires **heat pump**

“deep” geothermal



Heat for **direct-use / power generation**

Geothermal Energy – Utilisation & Scalability

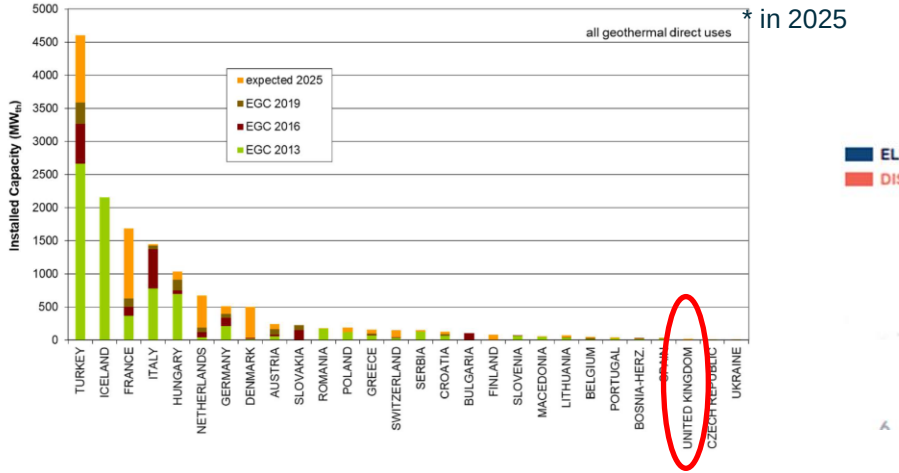


Scalability

- Direct – use (hundreds to tens of thousands)
- Mine water (tens to hundreds)
- Geothermal HPs (individual to tens of homes)

European context – DGE

Installed / expected* capacity in geothermal direct use [11]



* in 2025

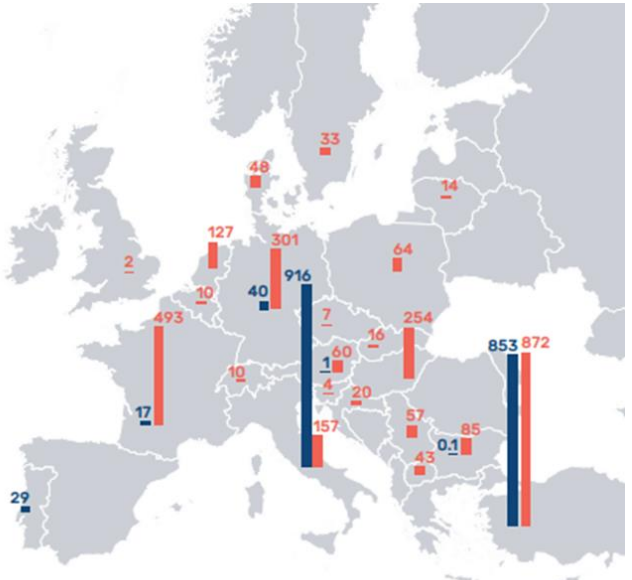
Sanner 2019

UK – 2MW

France – 600MW

Germany – 406MW

Netherlands – 221MW

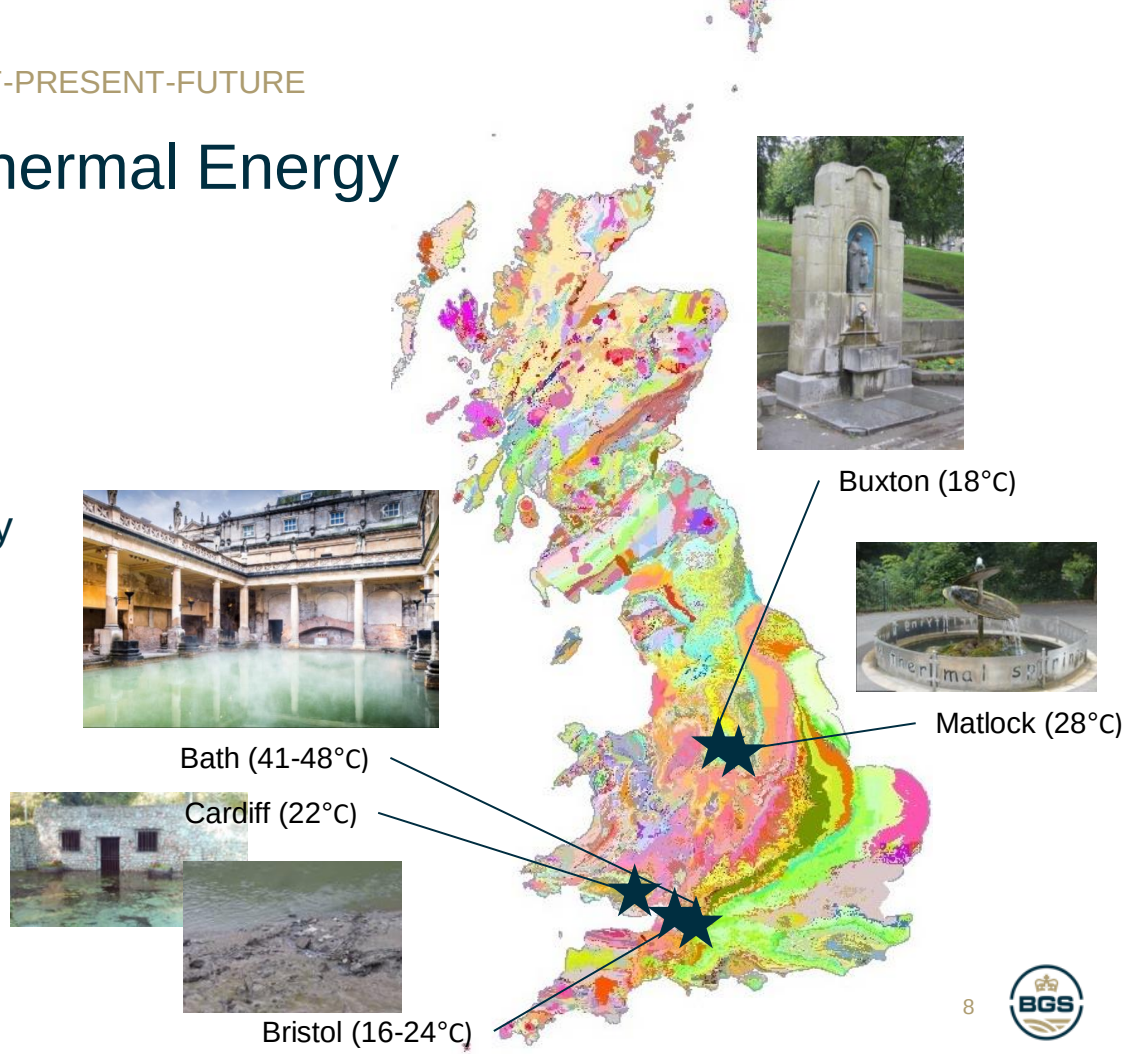


Installed geothermal capacity (MW) in 2016 [12]

EGEC 2017

Evidence for UK Geothermal Energy

- UK is part of the stable foreland of Europe
- Last major period of volcanic activity was in the Tertiary (63-52 Ma ago)
- A few thermal springs, e.g. Bath, Bristol, Buxton, Matlock and Cardiff



Where are DGE resources located?

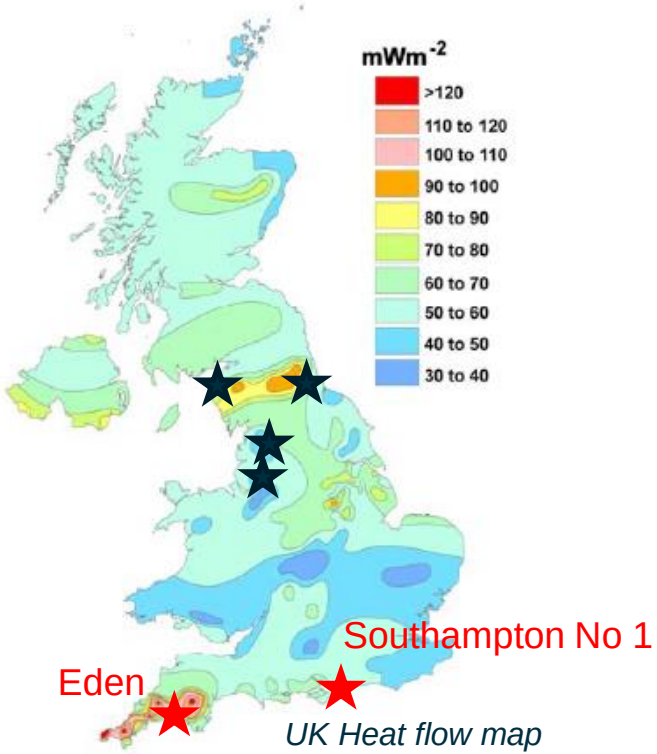
Direct-use heat & power

(1) Sedimentary Basins

- Permo-Triassic Sandstone
- Carboniferous Limestone
- Carboniferous/Devonian Sandstones

(2) Radiogenic granites

UK Geothermal Heat Resources



UK Heat flow map

★ Exploration wells

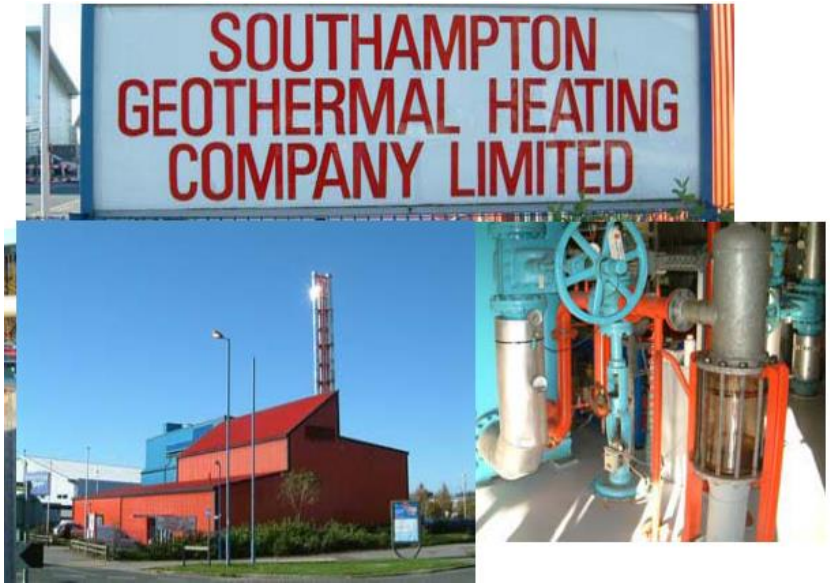
Estimated **heat** (direct use) **potential*:**

328 EJ (91 PWh) [1]

= sufficient to provide heating for more than 15 million homes for 300 years!

**excluding Carboniferous and Granites*

Active Projects



Today

UK Geothermal Roadmap

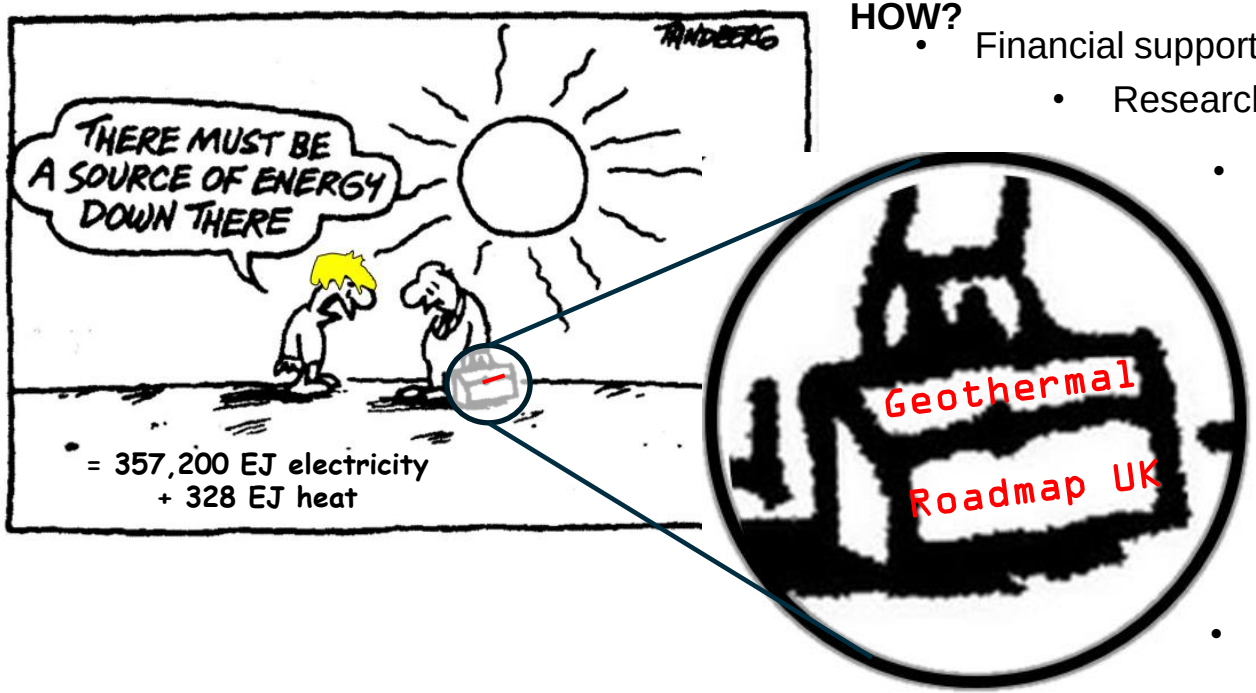
WHEN?

2025 2030 2035 2040 2045 2050

NetZero

WHAT?

- UK target



HOW?

- Financial support
- Research & Innovation
- Risk sharing measures
- Bespoke regulation & licencing
- Building a supply chain
- Skills

Key messages

- Geothermal energy is a low-carbon resource available **now**, **all across the UK** and **at all times**
- UK resources are sufficient to provide heating for more than **15 million homes for 300 years**
- Realisation of this potential **requires policy support and investment from government** (e.g. similar to offshore wind)
- With the right policies, geothermal energy could make a considerable contribution to the **decarbonisation of heat** in the UK

Further details

SCIENCE BRIEFING NOTE

British Geological Survey

September 2020

DEEP IMPACT: UNLOCKING THE POTENTIAL OF GEOTHERMAL ENERGY FOR AFFORDABLE, LOW-CARBON HEATING IN THE UK

DEEP GEOTHERMAL

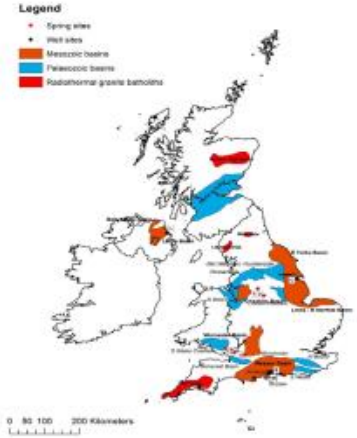
Dr Corinna Abesser
British Geological Survey, Maclean Building, Crowmarsh Gifford, Wallingford, Oxfordshire OX10 8BB, United Kingdom

https://www.bgs.ac.uk/about-bgs/our-work/science-briefing-papers/.

British Geological Survey

Unlocking the potential of geothermal energy in the UK

Decarbonisation and Resource Management Programme
Open Report OR/20/049



Research highlight

Unlocking the deep geothermal energy potential of the Carboniferous Limestone Supergroup

How understanding the subsurface beneath our towns and cities may allow us to access geothermal energy for heating homes and powering the UK.

28/06/2021

https://www.bgs.ac.uk/news/unlocking-the-deep-geothermal-energy-potential-of-the-carboniferous-limestone-supergroup/

Z. Dt. Ges. Geowiss. (J. Appl. Reg. Geol.), 172 (3), p. 227–249, 14 figs.
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Early Carboniferous limestones of southern and central Britain: Characterisation and preliminary assessment of deep geothermal prospectivity

Tim Pharaoh[1], Darren Jones[2], Tim Kearsey[2], Andrew Newell[3], Corinna Abesser[3], Tom Randles[2], Ashley Patton[4] & Rhian Kendall[4*]

Pharaoh, T., Jones, D., Kearsey, T., Newell, A., Abesser, C., Randles, T., Patton, A. & Kendall, R. (2021): Early Carboniferous limestones of southern and central Britain: Characterisation and preliminary assessment of deep geothermal prospectivity. – Z. Dt. Ges. Geowiss., 172: 227–249, Stuttgart.

Journal of Applied Regional Geology (ZDGG)

http://nora.nerc.ac.uk/id/eprint/528673/1/OR20049.pdf

THANK YOU

Any questions?

Darren Jones MSc, CGeol

email darjones@bgs.ac.uk
linkedin linkedin.com/in/darrenjones87/
twitter @geojonesUK

website www.bgs.ac.uk

British Geological Survey | The Lyell Centre | Research Avenue South | Edinburgh | EH14 4AP | UK