Supporting UK geothermal through new national data, maps and products

British Geological Survey

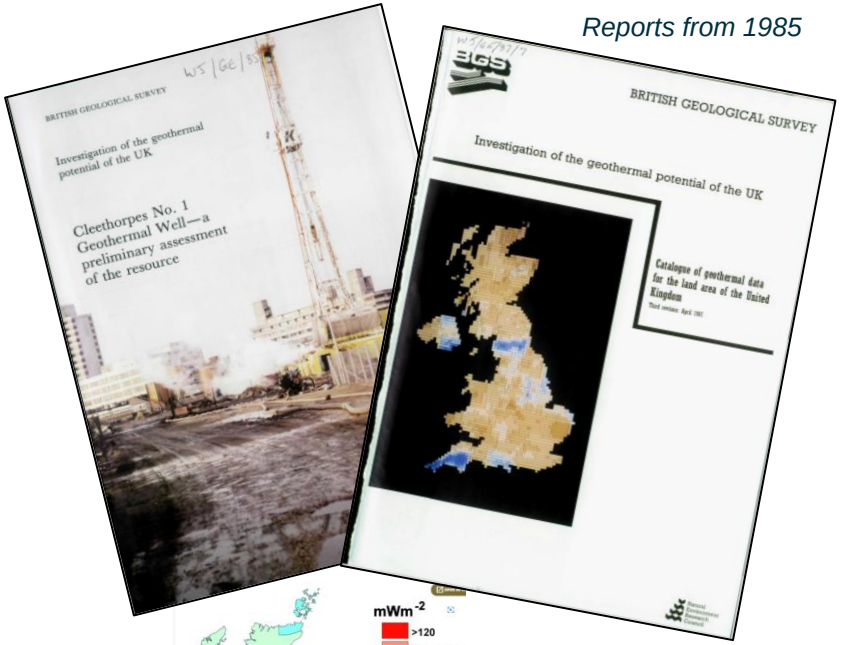
DR ALISON MONAGHAN

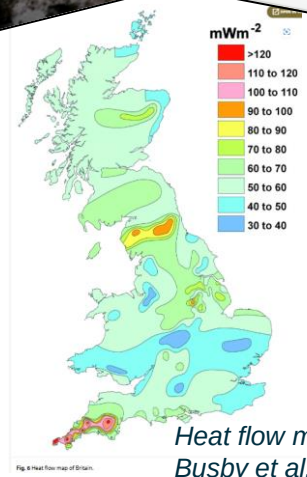
SPE GEOTHERMAL, 26/02/2025

BGS geothermal energy team

- BGS is the national Geological Survey est. 1835
- Host the National Geoscience Data Centre (NGDC)
- Major geothermal programme in the 1980s
- Country wide data, information, research projects since then
- Geoscience evidence base for policy and regulation
- Applied and responsive research with industry, academia, Government

Reports from 1985





Heat flow map from Busby et al. 2011

From challenges to solutions

IEA policy recommendation 2024: **Improve data quality and create open data repositories** to facilitate geothermal resource assessments for investors

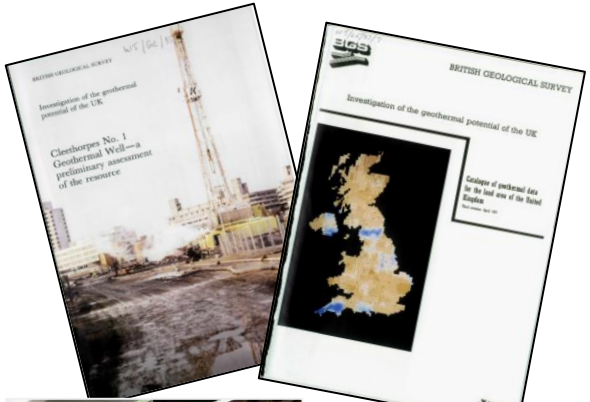
UK Deep Geothermal Energy White Paper and accompanying evidence report 2023, Recommendation 3**:**

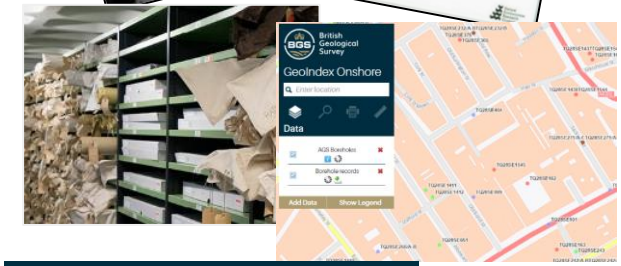
- Short term: **Review and share legacy data**
- Medium term: **Create data platform**
- Long term: Government exploration programmes, data sharing obligations

Funding and collaborator acknowledgements:

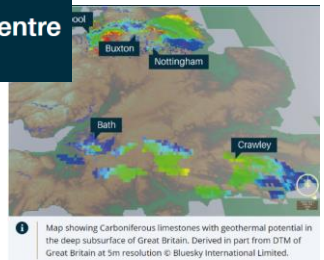
- NERC, Innovate UK, Department for Energy Security and Net Zero
- NHS England, Energy Systems Catapult, Mining Remediation Authority, North Sea Transition Authority, Environment Agency and many more

Legacy data, information → New research and products 2023-2028





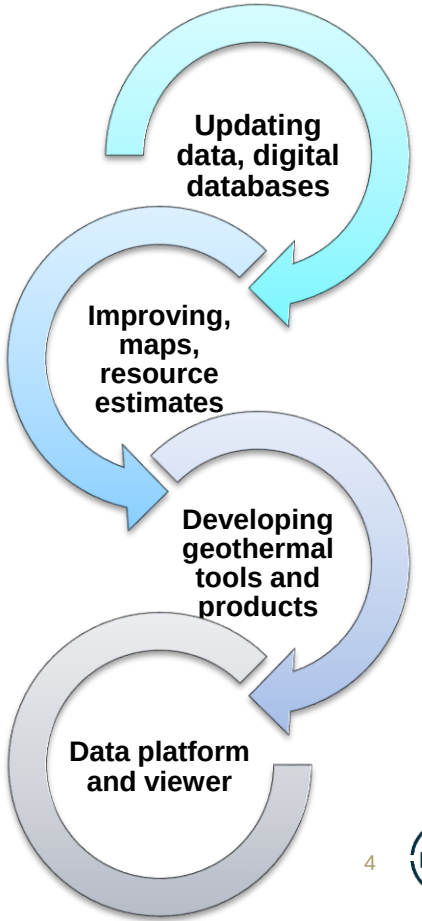
National Geoscience Data Centre (NGDC)



Making digitally accessible

Impartial, national scale datasets

With known limitations



User needs

Policy Maker

Shaping Geothermal Policy

Local and Regional Government

Driving Geothermal Adoption

Regulator / Government Body

Overseeing Subsurface Heat

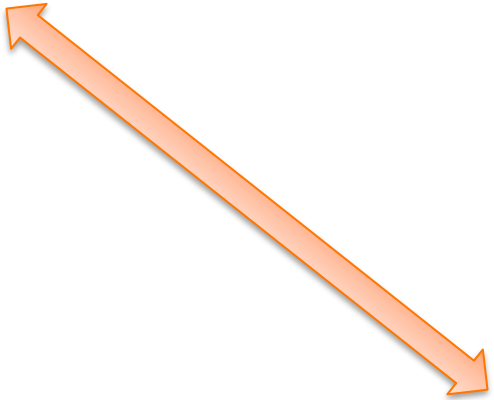
Geothermal Developer

Building Geothermal Solutions

Researcher

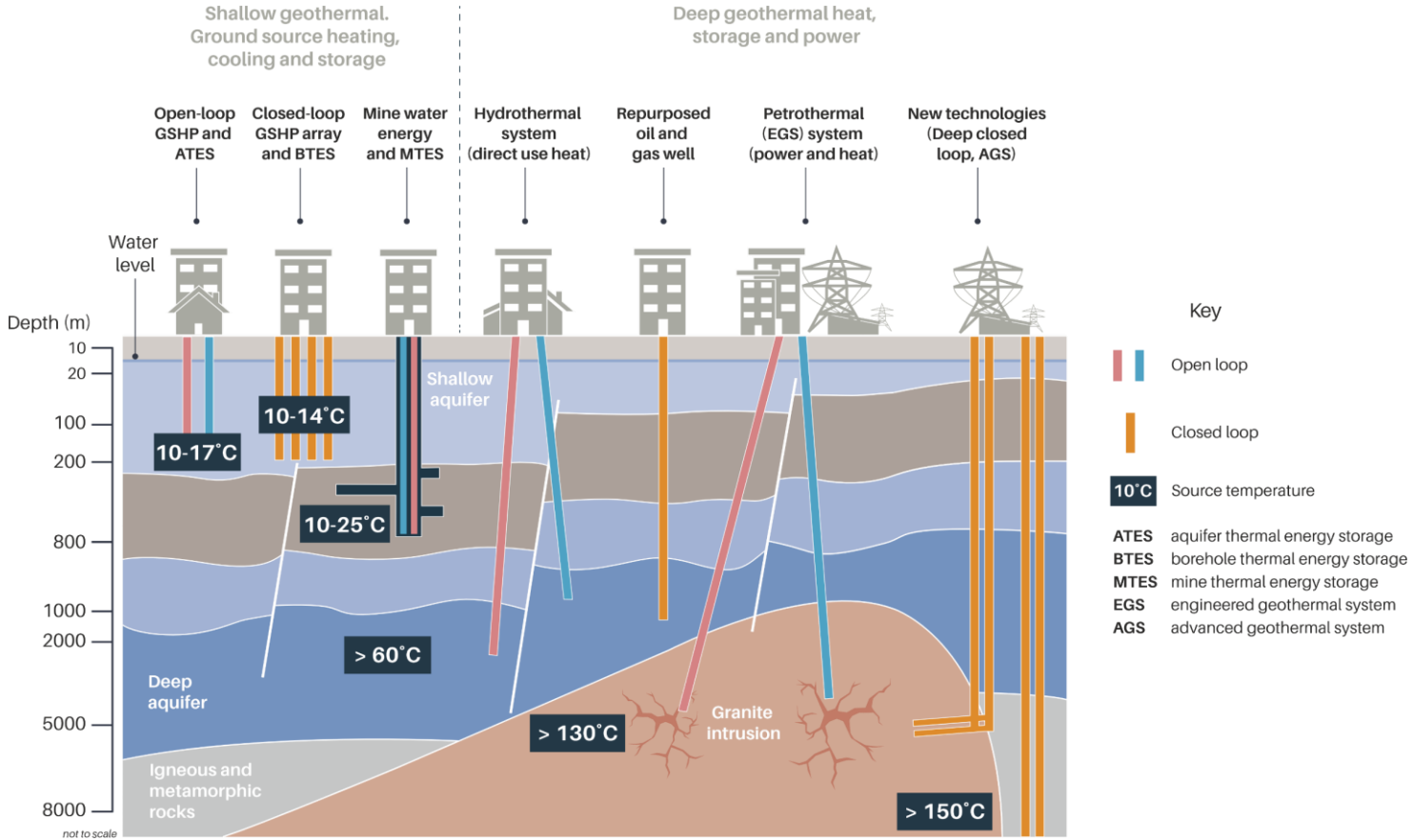
Advancing Geothermal Knowledge

Geothermal potential, opportunity maps, summary layers



Detailed data, information

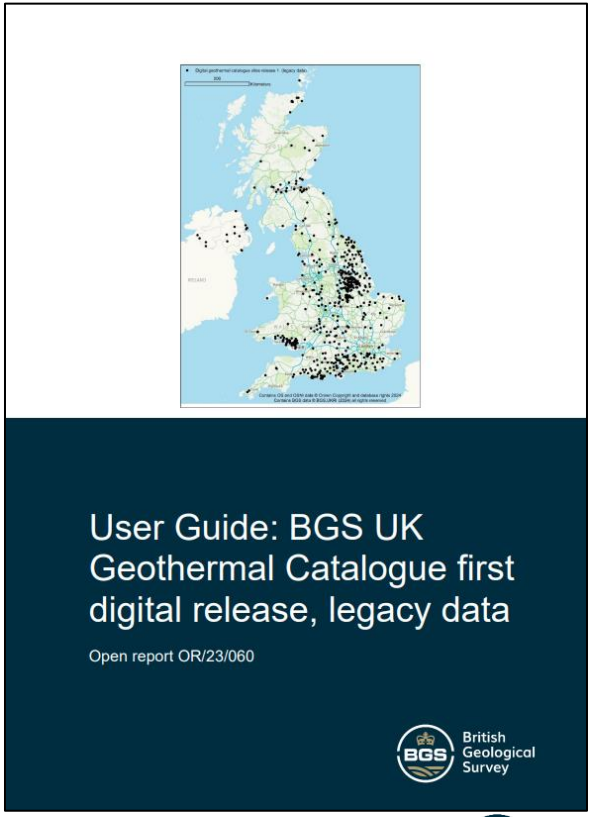
Geothermal technologies



Data, information, maps, tools

Data – legacy geothermal catalogue release

- 1980’s Geothermal Energy Programme legacy data
- First digital version released under **Open Government Licence**
- 11,821 data points derived from 743 sites
- Spreadsheets of
    - Measured temperature
    - Measured thermal conductivity
    - Calculated heat flow
- Variable data quality, caveats. Please read the user guide



- 5 original reports released to NERC open access repository
- 65 original reports available on BGS publications viewer
https://webapps.bgs.ac.uk/data/Publications/series.html?code=WJ/GE

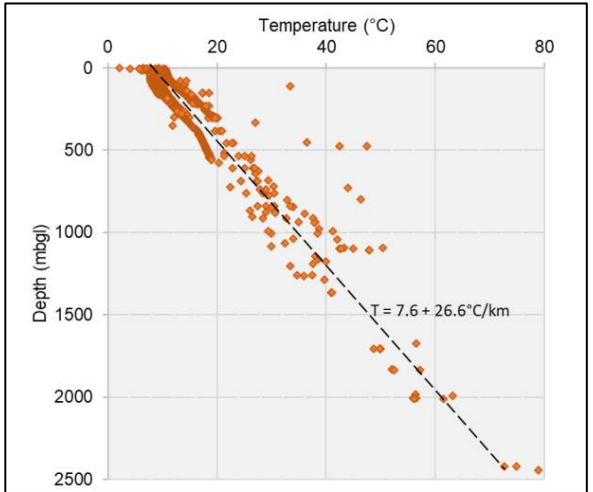
Data – geothermal catalogue

GEOTHERM	SITE_NAM	BGS_ID	BORE_REG	WELL_ID	EASTING	NORTHIN	EPSG_COD	DATE_KNC	DRILLED_L	DRILLING_RT	ELEVAT	GROUND_I	EST_MEAN	SITE_AND_	DATA_AVA	COND_TO	COND_BA	THERMAL_	THERMAL_	NO_OF_M	THERMAL_	COND_GE	LITHOLOG	LITHOSTRA	OLDEST_C	YOUNGEST_C
					M	M			M		M	M	degC			M	M	W/(m*K)								
162	BECKLEES	634007	NY37SE3	Not Applic	335166	571578	27700	1982	1370	Coal, Deep	104	100	9.4	Data sour	Site has m	244	244	1.7	-9999	-9999	Not entere	Middle, U	Mudstone	Not Entere	Not Entere	Not Entered
162	BECKLEES	634007	NY37SE3	Not Applic	335166	571578	27700	1982	1370	Coal, Deep	104	100	9.4	Data sour	Site has m	250	250	2	-9999	-9999	Not entere	Middle, U	Mudstone	Not Entere	Not Entere	Not Entered
162	BECKLEES	634007	NY37SE3	Not Applic	335166	571578	27700	1982	1370	Coal, Deep	104	100	9.4	Data sour	Site has m	256	256	2.15	-9999	-9999	Not entere	Middle, U	Mudstone	Not Entere	Not Entere	Not Entered
162	BECKLEES	634007	NY37SE3	Not Applic	335166	571578	27700	1982	1370	Coal, Deep	104	100	9.4	Data sour	Site has m	262	262	1.79	-9999	-9999	Not entere	Middle, U	Silty muds	Not Entere	Not Entere	Not Entered
162	BECKLEES	634007	NY37SE3	Not Applic	335166	571578	27700	1982	1370	Coal, Deep	104	100	9.4	Data sour	Site has m	271	271	2.2	-9999	-9999	Not entere	Middle, U	Siltstone	Not Entere	Not Entere	Not Entered
162	BECKLEES	634007	NY37SE3	Not Applic	335166	571578	27700	1982	1370	Coal, Deep	104	100	9.4	Data sour	Site has m	274	274	2.58	-9999	-9999	Not entere	Middle, U	Siltstone	Not Entere	Not Entere	Not Entered
162	BECKLEES	634007	NY37SE3	Not Applic	335166	571578	27700	1982	1370	Coal, Deep	104	100	9.4	Data sour	Site has m	281	281	3.35	-9999	-9999	Not entere	Middle, U	Sandy silt	Not Entere	Not Entere	Not Entered
162	BECKLEES	634007	NY37SE3	Not Applic	335166	571578	27700	1982	1370	Coal, Deep	104	100	9.4	Data sour	Site has m	284	284	2.65	-9999	-9999	Not entere	Westphali	Sandy silt	Not Entere	Not Entere	Not Entered
162	BECKLEES	634007	NY37SE3	Not Applic	335166	571578	27700	1982	1370	Coal, Deep	104	100	9.4	Data sour	Site has m	291	291	2.91	-9999	-9999	Not entere	Westphali	Sandstone	Not Entere	Not Entere	Not Entered

GEOTHERM	SITE_NAME	BGS_ID	BORE_REG	WELL_ID	EASTING	NORTHIN	EPSG_COD	DATE_KNC	DRILLED_L	DRILLING_RT	ELEVAT	GROUND_I	EST_MEAN	SITE_AND_	DATA_AVA	DEPTH	TEMP_OBS_TYPE	ELAPSED_	TEMP	EST_GEOT	CORRECTE	CORRECTED_TEM
					M	M			M		M	M	degC			M		HOURS	degC	degC/Km	degC	degC/Km
39	GLENROTHES	1013133	NO20SE38	Not Applic	325617	703144	27700	1986	567	Geologica	159	159	8.5	Data sour	Site has m	543.52	Equilibrium Temperatu	-9999	18.79	-9999	-9999	-9999
39	GLENROTHES	1013133	NO20SE38	Not Applic	325617	703144	27700	1986	567	Geologica	159	159	8.5	Data sour	Site has m	546.58	Equilibrium Temperatu	-9999	18.83	-9999	-9999	-9999
39	GLENROTHES	1013133	NO20SE38	Not Applic	325617	703144	27700	1986	567	Geologica	159	159	8.5	Data sour	Site has m	549.63	Equilibrium Temperatu	-9999	18.88	-9999	-9999	-9999
39	GLENROTHES	1013133	NO20SE38	Not Applic	325617	703144	27700	1986	567	Geologica	159	159	8.5	Data sour	Site has m	552.68	Equilibrium Temperatu	-9999	18.92	-9999	-9999	-9999
39	GLENROTHES	1013133	NO20SE38	Not Applic	325617	703144	27700	1986	567	Geologica	159	159	8.5	Data sour	Site has m	555.74	Equilibrium Temperatu	-9999	18.95	-9999	-9999	-9999
39	GLENROTHES	1013133	NO20SE38	Not Applic	325617	703144	27700	1986	567	Geologica	159	159	8.5	Data sour	Site has m	558.79	Equilibrium Temperatu	-9999	18.97	-9999	-9999	-9999
39	GLENROTHES	1013133	NO20SE38	Not Applic	325617	703144	27700	1986	567	Geologica	159	159	8.5	Data sour	Site has m	559	Bottom Hole Temperatu	12	21	22.3	22.9	25.7

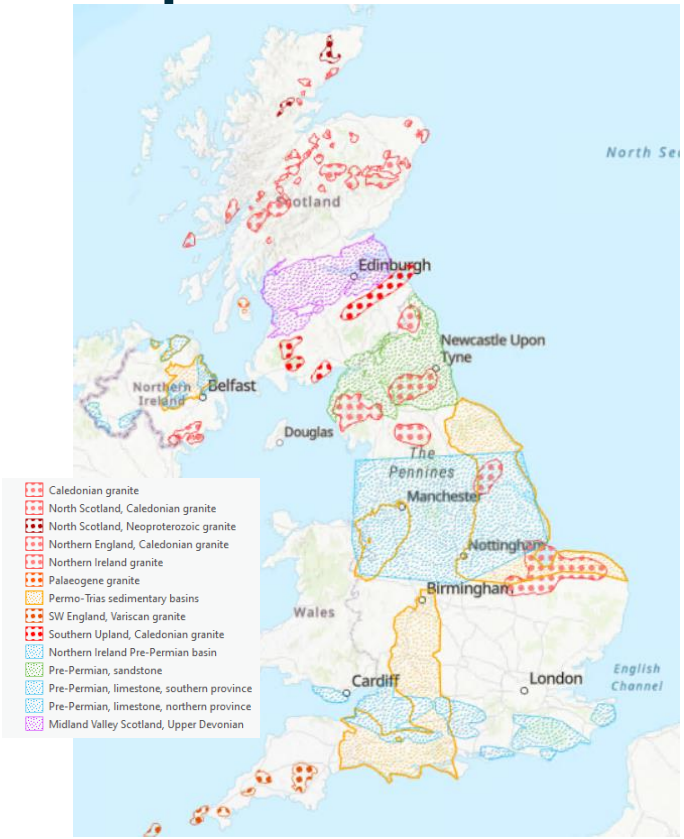
Working on Version 2 currently

- Complex copyright data not in V1
- Newer data than 1987



Use to estimate geothermal gradient in your AOI

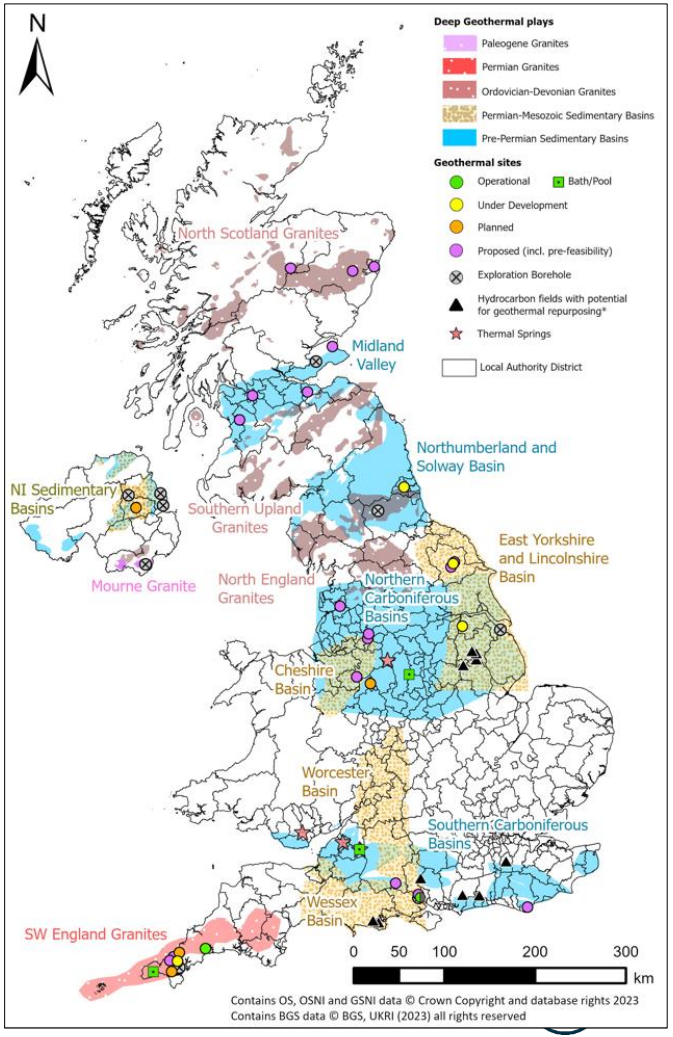
Maps and models



OGL v2 release basins, granites, deep geothermal

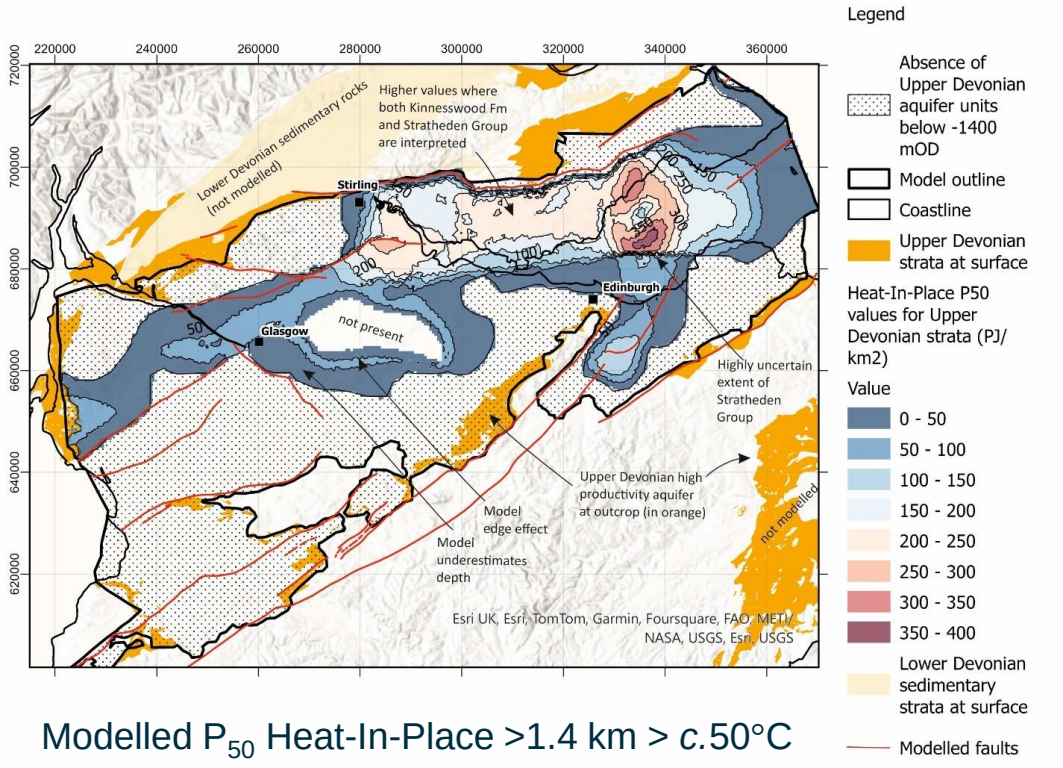
Ongoing

- Scoping work on geothermal opportunities in SE England
- Research into fractures, geochemical processes in granites
- Consistency of Permo-Trias resource estimation



New resource estimation for central Scotland

- Upper Devonian sandstone, ‘hot sedimentary aquifer’
- Temperatures of 44 -166°C are modelled at depths of 1.4 - 6 km
- Average porosity 11.5% ± 6.8% (n=286) + fracture flow
- 3D heat-in-place and heat recoverable using Piris et al. (2021) calculator
- **High uncertainty**, very limited deep data (>500 m)
- P_{50} estimated heat recoverable up to 22.6 MW/km^2 modelled beneath parts of Stirling, Glasgow and Edinburgh

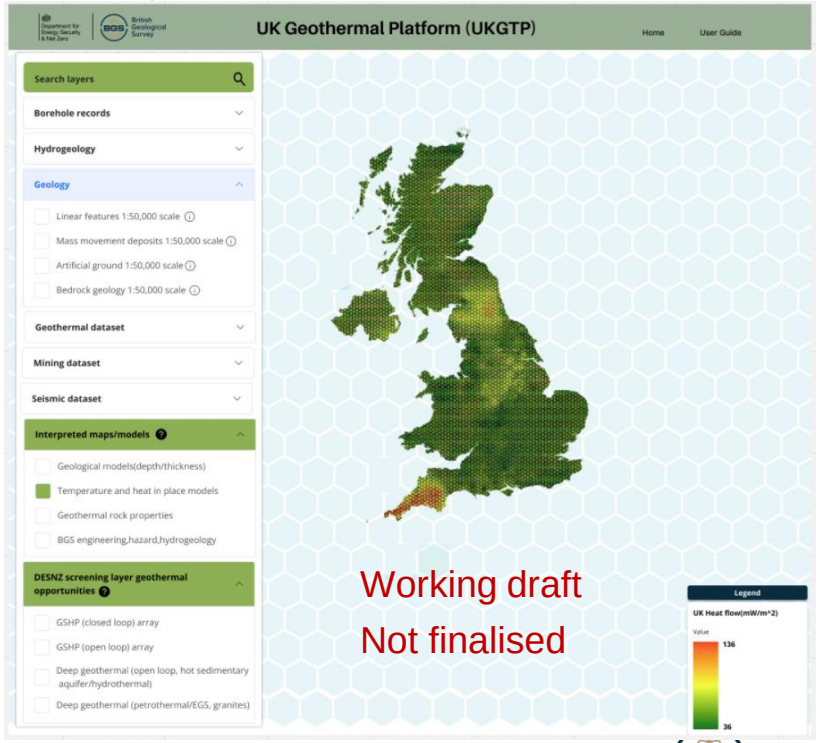


Modelled P_{50} Heat-In-Place >1.4 km > *c.*50°C

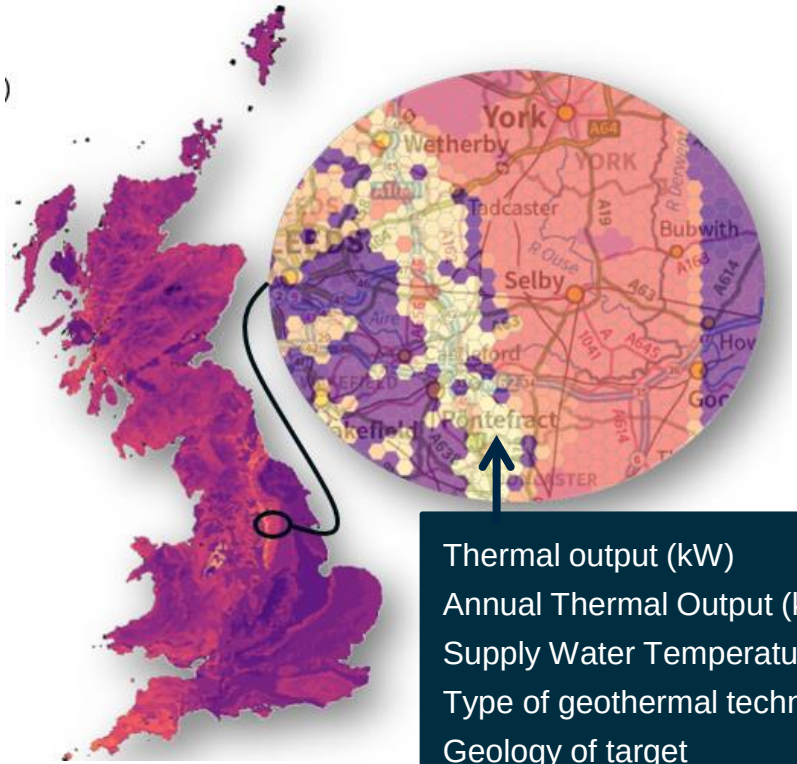
Open access report
https://nora.nerc.ac.uk/id/eprint/538341/

UK Geothermal Platform

- A geothermal energy information hub. Freely available
- 50+ detailed geoscientific datasets in a **map explorer**, or through a **data access** page
- **Summary layers** - UK map overview of geothermal energy potential for four technologies
- First release in Summer 2025
- Includes data from environmental agencies, MRA, NSTA, UKOGL, etc.
- Funded by UK Government Department for Energy Security and Net Zero. Delivered and maintained by the British Geological Survey.



UK Geothermal Platform – summary layers



Working example based on closed loop GSHP

- Thermal output (kW)
- Annual Thermal Output (kWh)
- Supply Water Temperature (ºC)
- Type of geothermal technology
- Geology of target
- Confidence descriptor
- Descriptive geothermal technical feasibility
- Cost information from DESNZ/Arup

Pre-feasibility, screening level information

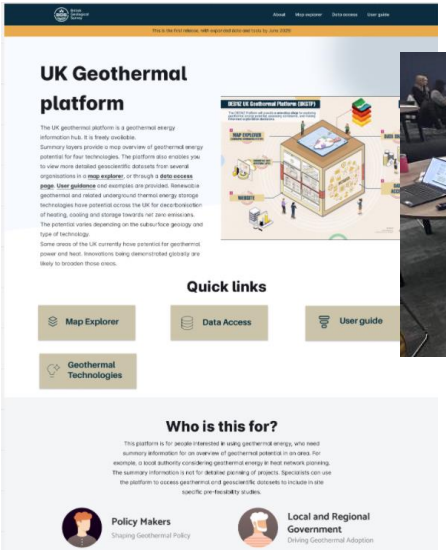
Delivered as 1km sided hexgrid

- Closed loop GSHP array
- Open loop GSHP array
- Deep geothermal - hot sedimentary aquifer (hydrothermal) for direct use, multi-depth > 1.5 km
- Deep geothermal, petrothermal/EGS – granites (qualitative only)

Incorporates cost information from DESNZ-Arup study

Key users: Government heat zoning model, clean heat teams, local authorities

UK geothermal platform



Geothermal summary layers	Geothermal data	Geothermal resource maps
Hydrogeology	Geology	Geoscience maps (other)
Boreholes, wells (incl. hydrocarbons)	Seismic data	Coal mine information
Heat demand	Environmental protection	

User needs

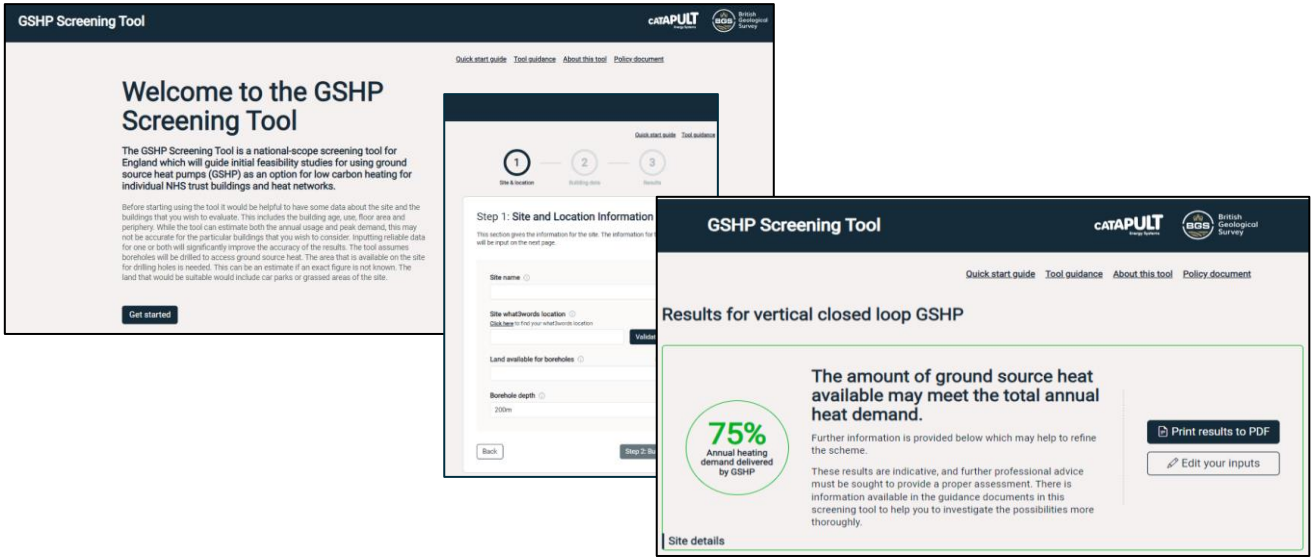
- 2 phase: stakeholder engagement + user testing
- Will make a lot more geothermal data accessible
- Will not be able to meet all user needs in first version

Currently in build phase

- Makes geothermal energy more visible to decision makers
- Aiming for geothermal data to be included in government heat zoning model for heat networks

NHS England shallow closed loop screening tool

- Funded by Innovate UK Knowledge Asset Fund, delivered by Energy Systems Catapult and BGS with NHS England
- For initial feasibility only
- Estimates heat outputs for closed loop boreholes, includes demand and buildings data



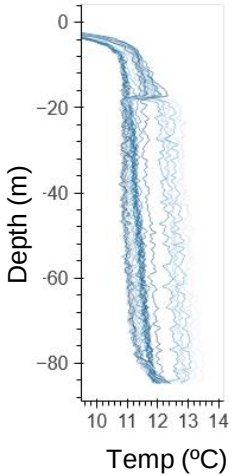
Screening level output:

- Geology description
- Planning prognosis
- Drilling prognosis
- (thermal) Power prognosis
- Ancillary information (including indicative CAPEX/OPEX)

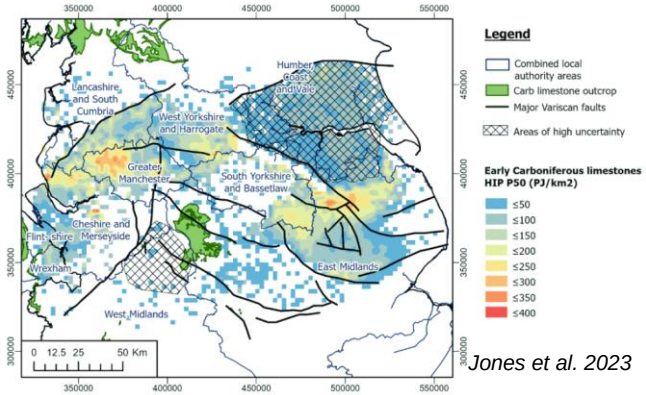
Summary

BGS geothermal team: accessible, national scale geothermal data and information

Data



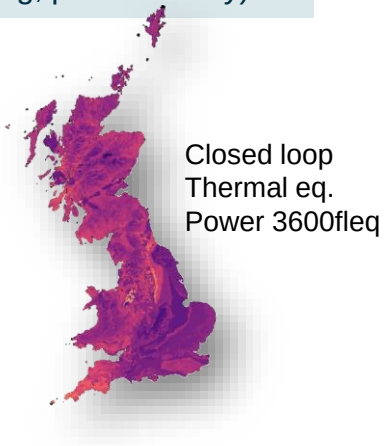
Maps & models



Jones et al. 2023

Products and tools

(screening, pre-feasibility)



Closed loop
Thermal eq.
Power 3600fleq

- Legacy information ➡ to new research and data collection
- Supporting heat decarbonisation and clean power mission

Links to digital resources

Deep geothermal White Paper
https://evidencehub.northeast-ca.gov.uk/downloads/668/nel1435a-geothermal-white-paper-report-v12.pdf

Evidence report for White Paper
https://nora.nerc.ac.uk/id/eprint/535567/

Legacy geothermal catalogue v1 download
https://www2.bgs.ac.uk/nationalgeoscienceddatacentre/citedData/catalogue/05569ed5-db0e-4587-807c-58e39ee240fa.html

Deep geothermal basins, granites v2 GIS shapefile download

https://www2.bgs.ac.uk/nationalgeoscienceddatacentre/citedData/catalogue/f99a6179-0040-443c-aa3b-2f489814a368.html

NHS closed loop screening tool
https://gshpscreeningtool.co.uk/

UK Geoenergy Observatories data downloads https://ukgeos.ac.uk/data-downloads

UK Geoenergy Observatories and BGS sensor data https://sensors-gui.bgs.ac.uk/

British Geological Survey

THANK YOU

ALISON MONAGHAN als@bgs.ac.uk