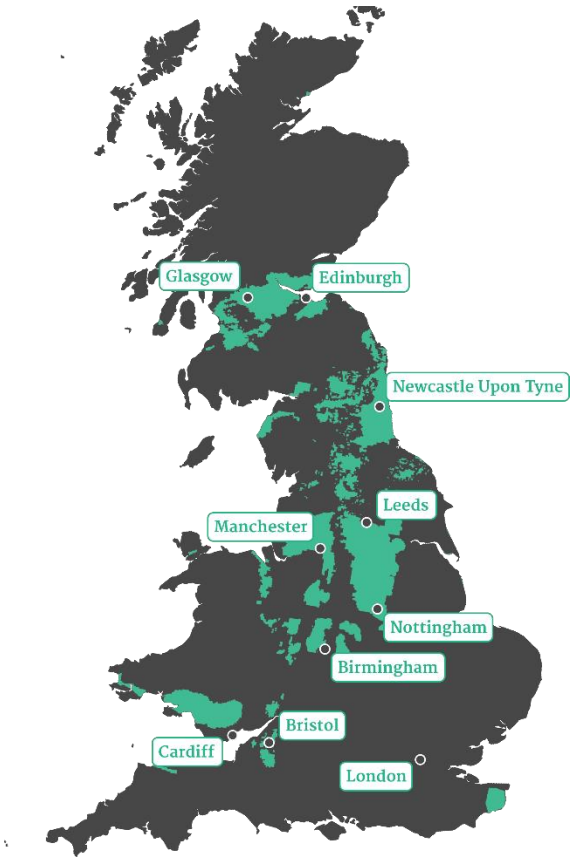
The Coal Authority

Delivering mine water heat as a strategic resource in Great Britain – March 2022

Heating and hot water for buildings in the UK makes up about 40 % of our current energy consumption and 20 % of our greenhouse gas emissions[1], however much of this is generated by non-renewable fossil fuels.

Taking heat off the electric grid will release capacity for a range of other uses including electric vehicles and green initiatives. This is even more important in light of the Government's commitment to stop using Russian oil by the end of the year and to increase domestic fuel security

To accelerate our path to NetZero [2] and realise a green industrial revolution[3] we need secure, low carbon solutions for space heating and hot water that can provide skilled jobs and help level up former coal mining communities.



Coalfield areas in Great Britain

Using mine water to deliver British Produced low carbon heat

Great Britain's coal industry was nationalised in 1947 and the UK Government own the assets (and associated subsidence and other liabilities) underground. When the industry reduced significantly from the 1980s onwards the abandoned mines filled with water which is constantly warmed geothermally by the rocks around it.

Until recently, minewater was considered purely a liability (pollution and contamination of drinking water) but it can be repurposed into a 'geo-energy' asset[4] using heat pumps and heat networks to recover and distribute British produced and delivered, low carbon heat for homes and businesses via heat networks.

[1] Climate Change Committee, 2016. Next Steps of UK Heat Policy.
[2] HM Government, 2020. The Ten Point Plan for a Green Industrial Revolution.
[3] HM Government 2021 NetZero Strategy: Build Back Greener
[4] Younger, P.L. 2016. Abandoned coal mines: From environmental liabilities to low-carbon energy assets. Int J of Coal Geology, 164. P1-2

The majority of mine shafts were closed off when the workings ceased. Currently, the two main methods to access mine water are:

1) **Drilling Boreholes –** Following geological reviews to identify the potential best locations, operators access the mine water by drilling boreholes. Permits are required from the Coal Authority and the Environment Agency, as well as arranging access agreements with any landowner. This is known as a 'Stand-Alone' Scheme.

2) **Accessing via a Coal Authority Mine Water Treatment Scheme –** The coal authority have 76 mine water treatment schemes bringing water to surface and treating to remove impurities to protect drinking water and the environment. Where there is sufficient heat, the Coal Authority can provide access to this water for addition to a Heat Network. Permits are required from the Coal Authority and the environmental regulator. This is known as a 'Bolt-On' Scheme.

Studies[5] have shown that water temperature is relatively stable and seasonally unaffected. Correctly designed mine water heat schemes are sustainable and can support energy security with UK generated solutions delivered by UK based energy providers.

Potential users of mine water heat

There are millions of people across England, Wales and Scotland living and working in areas underlain by abandoned mine workings who could potentially benefit from mine water heat. It is estimated that 25 % of homes and 9 out of 10 of Great Britain's largest cities are located above our coalfields. Mine water heat can contribute to levelling up by creating green jobs and economic opportunity in former coal mining communities.

Currently, development has concentrated on applications in new build developments and adding heat into existing heat networks. Retrofit technology and expertise has yet to be progressed but could be moved on at pace with sufficient funding and policy drivers.

Current Schemes

Recovering heat from mine water is not a new concept and it uses tried and tested technology. Large schemes in the Netherlands, Spain and Germany have proved this can work at scale[6].

The north-east of England is leading the deployment of this technology in the UK with several mine water source heat networks in construction or nearing completion[7]

a) **Gateshead** – An example of a Stand Alone Scheme. A Heat Networks Investment Project (HNIP) grant of £5.9m has enabled the council-owned Gateshead Energy Company to install 5.5 km of new heating pipes to the east of Gateshead Town Centre. Gateshead Council

[5] Farr et al., 2020. The temperature of British Coalfields https://qjegh.lyellcollection.org/content/qjegh/54/3/qjegh2020-109.full.pdf
[6] Ramos et al. 2015. Geothermal heat recovery from abandoned mines: Environ Earth Sci 73: 6783-6795
[7] Coal Authority, 2021. Mine Water Heat. https://www.gov.uk/government/collections/mine-water-heat

should soon realise 3 MW of mine water heat providing 1,250 homes and other buildings with secure low carbon heating via an existing Heat Network. The Gateshead project has an estimated saving of 72,000 tonnes of CO_2 over 40 years which is about 1,800 tonnes per annum.

b) **Seaham Garden Village –** An example of a Bolt-On Scheme. In partnership with Durham County Council, and the Coal Authority, Tolent Construction are developing an exemplary Garden Village at Seaham, County Durham, with an investment of £165 million.

The development will include 1,500 homes (750 private, 750 housing association), a primary school, shops and an innovation centre. Providing an attractive place to live, with a low carbon heat source and better air quality for the people living here.

The planned district heating network will provide heating across the development.

Seaham Garden Village has an estimated lifetime saving (40 years) of 90,000 tonnes of CO_2 when the scheme is fully built out which equates to annual savings of about 2,250 tonnes CO_2.

The Coal Authority is working with MPs, Local Authorities and private companies to develop opportunities for Mine Water Heat adoption in Great Britain. Appendix 1 lists schemes under consideration in Great Britain, many of which are looking for additional funding to move them forward – easier and quicker provision of finance (or additional support to bridge the transition to when bill payer income would begin) would help develop these as key sites for domestically produced, secure heat supplies on the former coalfields.

Considerations to deployment of mine water heat at scale

The Mine Energy Paper[8] published by the NELEP Mine Energy Task Force in July 2021, was very supportive of Mine Water Energy as a low carbon solution for the United Kingdom and recognised the importance of the role of the Coal Authority. The paper summarised a number of key barriers and recommendations, which the Coal Authority have been looking to address where appropriate:

1) Stakeholders identified the requirement to develop heat resource estimates and national scale opportunity mapping tools that can be used to support site selection, characterisation and feasibility studies for mine water heating schemes

   Appendix 2 outlines the resources, cost and timescale to develop Mine Water Heat Opportunity Maps for the whole of the United Kingdom, identifying areas with heat demands that are most suitable for development of mine water heating schemes with a national opportunity map being delivered in Year 2.

   This would support Local Authorities and developers to select and integrate this technology during early stages of planning and development. Opportunity maps could be delivered on an open

[8] NELEP.2021. The case for Mine Energy – unlocking deployment a scale in the UK. https://www.northeastlep.co.uk/wp-content/uploads/2021/05/Mine-Energy-White-Paper_FINAL.pdf

access platform using resource estimates coupled with heat demand data and other constraints. This would also enable a more detailed calculation of the resource available and best locations.

2) Uncertainty regarding the future of existing support schemes for low carbon heat and in particular the HNIP and RHI.

   The Green Heat Network Fund is now available and supportive of Mine Water Heat, although early capital costs remain significant for those accessing via Boreholes.

3) Uncertainty regarding the Coal Authority's plans regarding a potential charge for access to the mining infrastructure.

   Costs are currently being finalised, but will be on a cost recovery basis only.

4) Perceptions of risk deterring potential developers and investors and potentially undermining public confidence. Specific concerns include:

   - The risk of expensive borehole-based schemes failing to locate a viable and sustainable resource
   - The possibility of a decline in the projected heat yield over time or of access to heat being subject to interruption as a result of the collapse of underground workings.

   Schemes at Gateshead and Seaham Garden Village (outlined above) are progressing, with the former expected to use Mine Water Heat as a live energy source later in 2022.

   The Coal Authority provide paid advisory services to undertake early-stage strategic assessments for individual projects to assess best opportunities and best placement for boreholes.

5) Supply chain constraints identified by stakeholders include a lack of information, capacity and capability (skills and expertise):

   - Stakeholders identified a need for enhanced tools to our mine water heat map to better enable early-stage strategic assessment
   - The embryonic status of the sector with lack of expertise, specifically technical consultants, scheme design engineers (borehole and pump system) and drilling contractors.
   - Lack of expertise in relation to mine energy development, and heat network development as well, among clients and their project managers.

   The Coal Authority are working with Durham University to consider the development of training opportunities with Higher Education to develop appropriate skills.

   Early schemes have also shown a need for industry best practice guidance which the Coal Authority is well placed to develop.

6) There was concern that the Coal Authority mine energy team could become overstretched and act as a constraint on the growth of the mine water heat sector.

   The Coal Authority Team is sized in line with our current role promoting mine energy, working with a number of MPs & Local Authorities and providing paid advisory services to a small number of projects and will need to expand.

The Coal Authority has provided some training and support to the sector and could role things out more widely. We also provide cost effective technical services so that dedicated resource can support projects from inception to heat provision.

Appendix 2 outlines the estimated additional resources required by the Coal Authority to facilitate growth, assuming 10 schemes per year over a 5 year period. If faster delivery of schemes and opportunity maps are required the Coal Authority can review these costs and requirements.

Further considerations

1) Heat Networks are fundamental to the adoption of delivery of Mine Water Heat as outlined in BEIS Heat and Buildings Strategy. Supporting policies will help all types of heat networks be successful, this includes sector regulation to give consumer confidence (which OFGem are leading on) and therefore developer confidence, planning policy and encouraging decisions on retrofitting homes to provide low carbon heat.
2) Each site varies with geology and the Coal Authority are undertaking ongoing research and development to enable the widest potential for Mine Water Heat. We are committed to working with partner organisations, including BEIS and the British Geological Survey to investigate the potential for mine water heat across historic mining areas of the UK.
3) Early adopters of mine water heat currently do not have any liability underwritten and this cannot be provided by the Coal Authority. A system to provide assurance for schemes would assist in the adoption by both public bodies and private developers.

Conclusion

Mine water heat networks can provide heat to homes, businesses, industry and horticulture and to multiple users on one heat network. It could really contribute to levelling up by providing heat security and attract new employment and investment to former coal mining areas which have largely remained affected since the main coal industry closed.

The Coal Authority expertise is fundamental to the facilitation and successful development of this opportunity, but requires further funding to enable this work to continue at the required pace.

The costs included assume the undertaking of a national resource estimate of mine water heat, and national opportunity mapping whilst also providing support to facilitate an average of 10 schemes per year over a five year period, with an ongoing Research and Development Programme to support. If faster adoption was required and funding / policy co-operation was available to facilitate this then the Coal Authority would be happy to advise further.

A recent letter from Greg Hands MP, Minister of State for Energy, Clean Growth and Climate Change is attached at Appendix 3 which gives more context on the policy drivers that would help to facilitate mine water heat more quickly.

Contacts

For more information or to set up a meeting to discuss any aspect further please contact Richard Bond, Innovation and Engagement Director on 07584 617897 or richardbond@coal.gov.uk

Appendix 1 – Current Potential UK Mine Water Heat Schemes

STAND ALONE PROJECTS WITH OPPORTUNITY, BUT POTENTIALLY IMPACTED BY FUNDING

Mine Heat Project	Location	Client	Comments
Sheffield City Region (Now South Yorkshire Combined Mayoral Authority)	Sheffield City Region	Local Authority	Aspirations for 5 mine heat schemes set out in SCR Energy Strategy document P.61https://southyorkshire-ca.gov.uk/getmedia/423b1606-ad2b-4261-93b0-f712b7fef6e8/SCR-Energy-Strategy.pdf.
Sunderland	Sunderland city centre, Tyne and Wear	Local Authority	Number of opportunities within the Borough
Oldham	Oldham Town Centre	Local Authority	Oldham failed to get funding for Pilot Study drilling.
Rockingham	Rockingham	Private Developer	Initial Coal Authority study undertaken shows the site has potential
Cresswell and Whitwell	Cresswell and Whitwell	Local Authority	Initial Coal Authority study shows that the Creswell site is ready now; Whitwell will be ready in four or 5 years when mine water has recovered further.
Wakefield	Wakefield City	Local Authority	Initial Coal Authority study complete shows the site has good potential
Gateshead	Gateshead Borough Wide Study	Local Authority	Borough wide study now being undertaken to identify opportunities

STAND ALONE PROJECTS IN DISCUSSION WITH BARNSLEY BOROUGH COUNCIL

Mine Heat Project	Location	Client	Comments
Barnsley	Barnsley Borough Wide	Local Authority	Council had requested a borough wide opportunity study, but did not have appropriate funding available.
Barnsley	Goldthorpe	Local Authority	Major retro fit opportunity for existing housing stock plus new development, currently awaiting formal funding
Barnsley	Barugh Green/Higham	Local Authority	Major development masterplan
Barnsley	Kendray	Local Authority	Major refurb of housing stock. Refurb of houses already funded through LADS programme. Barnsley main no.4 shaft potential for inclusion of mine heat.
Barnsley	Darton, Barnsley	Manufacturer	Initial Coal Authoriry study shows potential. Private sector manufacturer very keen. May include some community heating.

Appendix 1 – Current Potential UK Mine Water Heat Schemes

BOLT ON PROJECTS IN DISCUSSION WITH COAL AUTHORITY

Mine Heat Project	Location	Client	Comments
Northumberland	Bates Mine Water Treatment Scheme	Local Authority	Potential for heat network to serve new buildings on Blyth Port Redevelopment
Blindwells & Lothia District	Scotland - Lothian	Local Authority	Interest in 6 different schemes across the area
Horden	Durham	Local Authority	Community centred project linking horticulture, new build homes & an industrial estate

EXPRESSIONS OF INTEREST

Mine Heat Project	Location	Client	Comments
Stoke-on-Trent	Stoke Centre	Local Authority	Discussions held with by MPs (Jack Brereton; Jo Gideon; Jonathan Gullis) regarding utilising Mine Water Heat as a source for the installed, but non-commissioned Heat Network. Council would require funding to progress.
Stoke-on-Trent	Chatterley Whitfield	Coalfields Regeneration Trust	Potential to develop site to use Mine Water Heat & provide learning centre and business park
Staffordshire	Rugeley & other locations	South Staffordshire Community Energy Group	Interest from energy group to use Mine Water Energy for a major housing development at site of old Rugeley power station, as well as other potential locations
Nailsea	Nailsea, N Somerset	Local Authority	Wish to commission an initial Coal Authority Study, but currently lack funding
Town Fields	Newcastle City	Local Authority	Wish to commission an initial Coal Authority Study, but currently lack funding
Rhondda Heritage Centre	Rhondda	Local Authority	Wish to commission an initial Coal Authority Study, but currently lack funding
Avenue	Wingerworth, Chesterfield	DoE/Local Authority	Potential scheme using two open shafts at a site to heat a school. Funding/risk management assistance would assist in progressing
Midsomer Norton	Midsomer Norton, Bath	Manufacturer	Private company keen for industrial process as well as community.

Appendix 2 – Coal Authority Resource Requirements

National Mine Water Heat Resource and Opportunity Mapping

	Yr 1 £k	Yr 2 £k	Yr 3 £k	Yr 4 £k	Yr 5 £k	Total £k
Staff Costs	1,250	1,250	1,250	500	300	4,550
Website & Viewer Capex Development	-	100	100	100	100	400

Year 1 Deliverable	Data Improvement & Development
Year 2 Deliverable	Resource Estimate & Opportunity Map Part 1
Year 3 Deliverable	Opportunity Map Part 2
Year 4 & 5	Ongoing Update and Maintenance

Support to Facilitate 10 Mine Water Schemes per year over 5 years

	Yr 1 £k	Yr 2 £k	Yr 3 £k	Yr 4 £k	Yr 5 £k	Total £k
Project Delivery Costs	1,400	1,400	1,400	1,400	1,400	7,000
R&D Capex Programme	300	300	300	100	100	1,100

Note: Assumes an even mix of Bolt-On and Stand-Alone Schemes

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Lee Anderson MP
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23 February 2022

Dear Lee,

The Coal Authority and Geothermally Heated Mine Water

Further to our recent conversation in the Tea Room, regarding the support you have been giving to the Coal Authority, in relation to Geothermally Heated Mine Water, where you shared the letter from the Authority, updating you on their activities resulting from the "Clean Energy from the Coalfields" event you co-hosted with the Authority, in Westminster, on 20th October 2021.

Thank you for your continued interest and action in this area. I know the Coal Authority are extremely grateful for your support; for example hosting the House of Commons event last October and encouraging interest, meetings awareness across coalfield MP colleagues. I understand that you also met with the Coal Authority and Dr Kieran Mullan MP recently to explore the potential for geothermal / heat network opportunities on a city wide and coalfield wide scale to support the No 10 delivery unit thinking on this and promote opportunities for inward investment in infrastructure and technology and that the Coal Authority are preparing a proposal to support this.

BEIS continue to encourage the Coal Authority in their work to develop the potential for using Geothermally Heated Mine Water as a low carbon source of heat for homes, businesses and agriculture, using heat network schemes in the United Kingdom. We recognise this has the potential to significantly help towards targets for Net Zero, promote green jobs and growth in former coal mining communities and also help lower future energy bills for consumers in those areas. All of this could make a significant contribution to levelling up and the commitments made in the Government's Levelling Up White Paper, published earlier this month.

BEIS are continuing to develop policy drivers for heat networks in line with our recent Heat and Buildings Strategy, published last October, working with the Department for Levelling Up, Housing and Communities and other government departments. We recognise that consumer confidence is a key aspect of this and have commissioned OFGEM to advise on proposals for heat networks. Our partnership with Triple Point Heat Networks Investment Management is bringing forward funding to support key schemes in this sector.

As you know the Coal Authority is actively working with a number of stakeholders to raise awareness of this opportunity, develop supporting research and development and practical aspects such as permitting with fellow arm's length bodies and regulators and to facilitate projects. These include the UK Government (BEIS, the Heat Network Development Unit, the Green Heat Network Fund), Welsh and Scottish Governments (with heat being a

devolved matter), the British Geological Survey (BGS), the Environment Agency and other regulators, investors, developers, energy companies, universities, local authorities, and local enterprise partnerships. The Coal Authority undertake some of this work on a consultancy basis and we are aware that there is also a wider funding need for research and resource to move through the transition to where this technology is established and able to be funded through energy bills. We will continue to support this transitional need where we are able whether directly from BEIS, though other government departments, investment approaches or specific bids.

I am pleased to note that the Gateshead scheme will be operational shortly, the Seaham Garden City scheme should begin the build phase this year and that there are a number of wider schemes in the pipeline. I know that BEIS Minister Lord Callanan has already visited the Gateshead scheme and I would welcome the opportunity to undertake a visit with you to one of these projects in due course.

In the meantime, I know that the Coal Authority will continue to actively engage with you and other Members of Parliament who have expressed an interest in this area and I thank you again for your work and focus on this area.

Yours ever,

THE RT HON GREG HANDS MP
Minister of State for Energy, Clean Growth and Climate Change