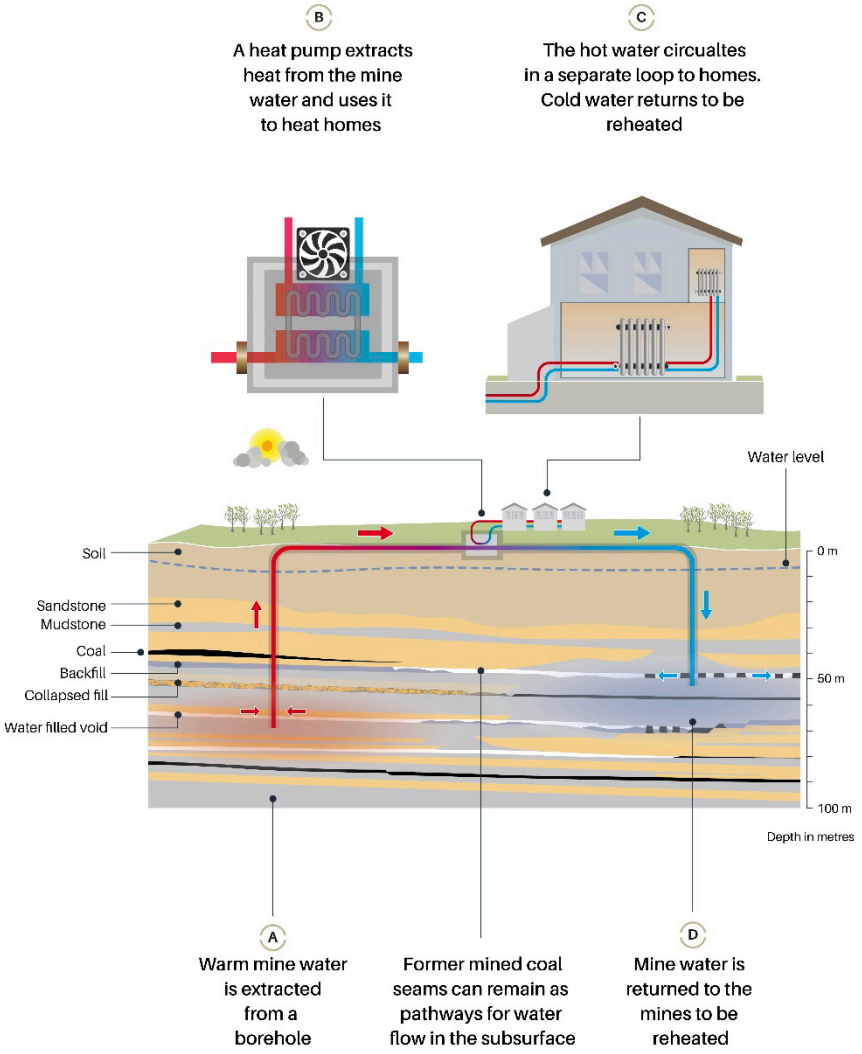
British Geological Survey

Natural Environment Research Council

Mine water geothermal energy

Many UK homes and businesses are located above abandoned coal mines. This means that sustainable mine-water energy systems using the heat stored in flooded mine workings could provide decarbonised heat for significant numbers of buildings. There also opportunities for cooling of buildings and for underground thermal storage to balance interseasonal heat demands and maintain a sustainable resource.

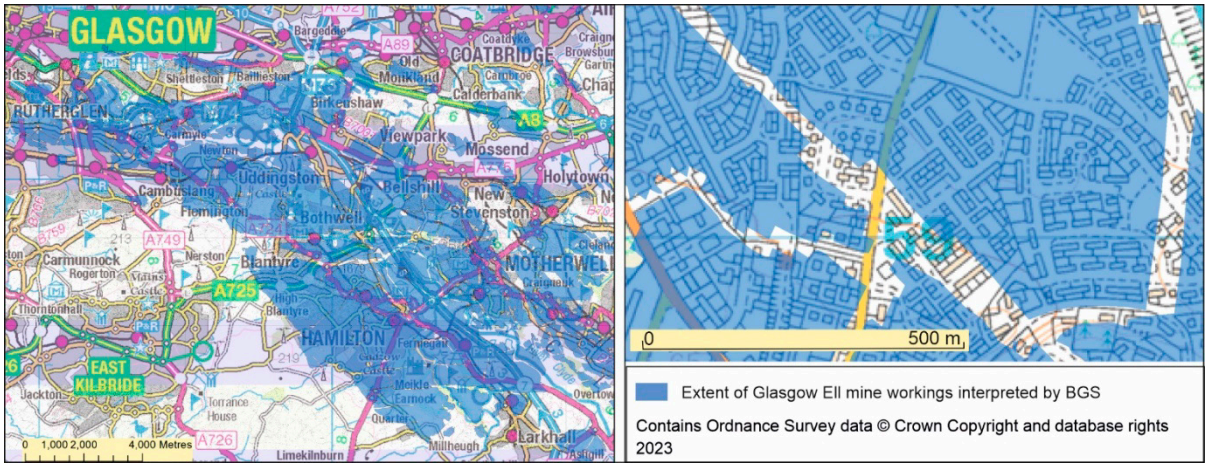
How does it work?



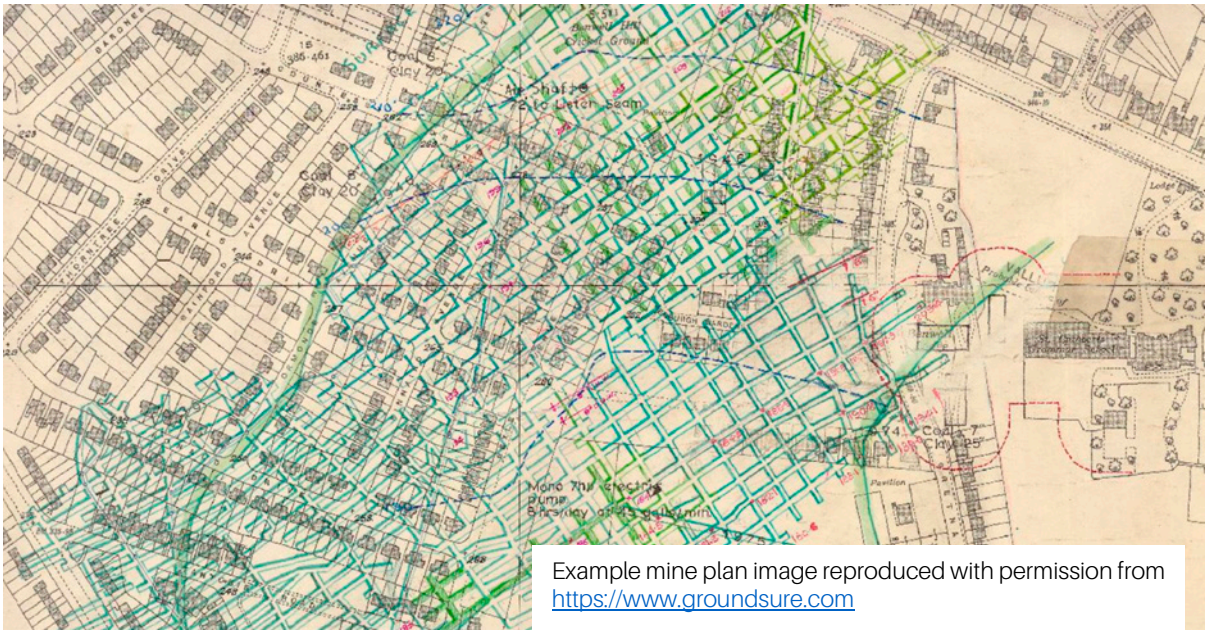
Mine water, commonly between 10 and 25°C, is pumped to the surface from boreholes. At the surface, heat pumps transfer and concentrate heat from the mine water, raising it to a temperature suitable for domestic or industrial applications (45–70°C). The water within this separate loop can be used to heat homes and offices. The cooler mine water is returned to a different part of the mine system, where it begins its journey to be reheated. BGS © UKRI.

How widespread is the opportunity?

Distribution of coalfields within Great Britain



To show the coincidence of urban areas with abandoned coal mine workings - extent of the Glasgow Ell mine workings interpreted by BGS from various mine plan data sources to the south-east of Glasgow (left) and zoomed in view showing the scale with respect to housing (right).



Example mine plan image reproduced with permission from https://www.groundsure.com

An example of a mine plan showing workings beneath an urban area.

Increasing numbers of mine-water energy schemes are being installed in the UK, as part of working towards net zero targets for sustainable heat. For example, several schemes are being constructed in north-east England for heating and cooling of industrial units, council-owned buildings in urban areas and a new housing development. Globally, there are a number of successful mine-water heating schemes. Heerlen in the Netherlands is a notable example, where mine-water heating and cooling is developed as part of an integrated, smart heating and cooling network.

Commercial demonstration of mine-water heat technology is critical in breaking barriers to widespread utilisation of mine-water heat such as cost, risk and regulation. Underpinning research and innovation are also essential in reducing cost and risk, understanding resource sustainability and environmental impact, and providing an open evidence base towards social approval.

The Glasgow Observatory is an underground mine-water research facility, with many unique features:

- representative of an urban setting
- at the scale of small mine energy schemes
- equipped with downhole sensors
- provides a growing body of integrated open data
- offers flexibility for interdisciplinary research, including flow and heat responses that are not possible within commercial schemes