



Using geothermal mine water energy for food production in Leeds

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Using geothermal energy from unused coal mines for food production in vertical farms or glasshouses may increase food resilience in a low carbon way. An action plan to establish a pilot in Leeds was developed with stakeholders. There is an opportunity for Leeds to spearhead this approach for the UK and internationally.

Covid-19, Brexit, and current high energy prices due to conflicts and other factors, have shown how susceptible both our food and energy systems are to shocks. The impacts of these will be felt most by more vulnerable members of society, many of who are already experiencing high levels of food poverty and health inequalities. With future food security threatened by climate change (over 70% of total agriculture is rainfed) and the UK currently importing about 50% of its food, it is vital that we increase the climate-resilience and social and environmental sustainability of our food system.

Vertical farms and glasshouses provide a controlled growing environment that can contribute to resilient local food production. But they are energy intensive so require a low carbon energy source to comply with our Net Zero ambitions. As a former coal mining area with an increasing urban food production network, Leeds has a unique opportunity to spearhead the use of geothermal energy from mines for food production in vertical farms and glasshouses, so as to supply hospitals, care homes, food banks and schools with healthy and sustainably sourced local food.

In order to identify the benefits of this approach, as well as potential barriers and how to overcome these, we engaged a wide range of stakeholders from industry, academics, Local, Regional and National Government, Civil Society and NGOs, and Finance and Investment (52 interviews and a reaction workshop in March 2022, N=45). This led to the creation of an Action Plan towards establishing a pilot project that pioneers the use of geothermal energy from mine water for vertical farming in Leeds.

“The legacy of coal mining in Great Britain has resulted in significant environmental challenges. The Coal Authority has implemented over 70 mine water treatment schemes to protect the environment from damaging mine water, however it is now possible to turn a liability into an asset and recover heat from mine water, offering a low carbon heating solution for the future” Gareth Farr, Head of Heat and By Product Innovation – Coal Authority



Opportunities and benefits

By reducing food miles and exploiting clean energy from an existing resource, this approach presents a strong contribution to the **Net-Zero Strategy**, the **Climate Resilience Programme**, and the declaration of a climate emergency by many councils. By localising food and energy production, prioritising vulnerable members of the population, advancing local skills, jobs and knowledge and using the mining legacy to benefit “forgotten communities”, it adds value to the Leeds Health and Wellbeing Strategy, City’s Food Strategy and overall Core Strategy, and contributes to the national **Levelling Up White Paper**. It is also a prime opportunity to capitalise on the market opportunity of Controlled Environment Agriculture in North and West Yorkshire (**UK DIT**) and **decarbonise the region**.

In addition, using geothermal mine water energy for food production is a novel idea, meaning that Leeds has an opportunity to lead the way both nationally and internationally.

We found sites with the optimal potential for this approach lie mostly in the south of Leeds (see map). We conducted spatial analysis taking into account criteria that stakeholders identified: geothermal potential, above ground space that is economically viable, a supportive land owner, high **climate-vulnerability**, brownfield site, and links to waste heat sources and heat networks.

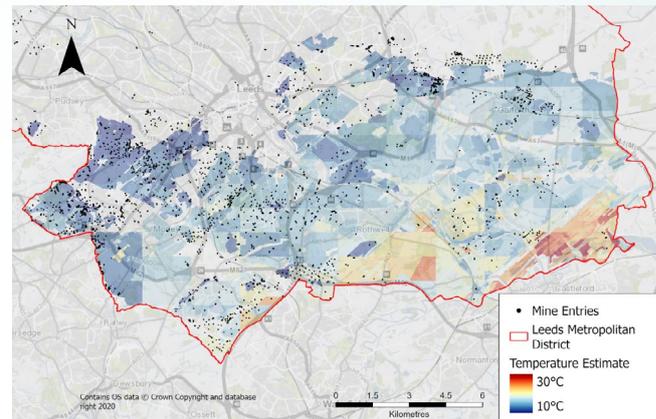
Barriers

The key barrier stakeholders identified was making the economic case, followed by political and regulatory barriers. These include the amount of investment, high risks linked with a lack of incentives, blurred regulation, and lack of acknowledgement of the potential of geothermal and mine water energy. Other key barriers included issues around land availability and ownership, technical barriers around modelling and knowledge gaps, as well as social barriers, with the main focus on social acceptability.

Action plan

An action plan was developed with the stakeholders to establish a pilot in Leeds and path the full-scale take up of geothermal energy from mine water for vertical farming and glasshouses.

1. **Conduct a feasibility study** and research to assess the financial and non-financial benefits and build the business case. **Identify business models** that generate the income needed for financial sustainability but also affordability for hospitals, schools, care homes and food banks. **Choose a site** for the pilot considering the criteria identified.
2. **Get senior leaders’ buy-in** from Leeds City Council, Coal Authority, and University of Leeds to continue leading change.
3. **Strengthen and develop partnerships**, advancing the existing Public and Private Research and Innovation Partnership to overcome economic, social, technical and regulatory barriers. Key partners include Leeds City Council, the Coal Authority, University of Leeds, land owners, **the LEP**,



Map of Leeds showing sites of geothermal mine water. ©Copyright Coal Authority data used under licence (2021) & OS data © Crown Copyright

Angel investors, and strategic partners (e.g. **STC, Yorkshire Water, Feed Leeds**), amongst others. **Appoint a board** to take ownership and responsibility for the business case, communication strategy, and attracting investment.

4. **Adjust local policy** to support geothermal energy for food production by: changing planning policy to include geothermal mine water energy as an option; change procurement rules to favour local food production; include geothermal energy as a possible energy provision in the City’s Food Strategy; and develop a food label for ‘local food production’.
5. **Lobby at a national level** for 1) the importance of mine water energy for food production, engaging local and backbench MPs; 2) the need to set up a governing body like in the oil industry that sets out rules and levels the playing field; 3) the urgent need for incentives, support, and grants for research and development for geothermal and horticulture technology - showing examples of how other countries are incentivising the industry to develop.
6. **Develop an engagement strategy** to develop social acceptability and prevent misinformation among the public. Engage community leaders or local ambassadors and organise events with local residents to provide a space for knowledge exchange and the consideration of concerns.
7. **Employ early knowledge sharing** on an international level with the industry, academia, relevant institutions and organisations to facilitate knowledge and data flows. Increase engagement with current professionals from the oil and gas industry, particularly around modelling and drilling.

Further information

This policy note reports on the **Food for Our Own Good** research project, and builds on **Sakai et al., 2020**. The research is part of a Public and Private Research and Innovation Partnership (2019).

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