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Geothermal Energy

Using regulation to overcome barriers

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Infrastructure Engineering

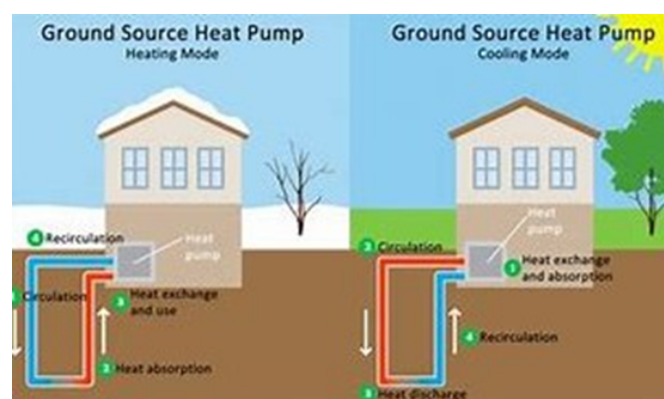


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Geothermal energy is a constant, reliable, low carbon source of energy and the UK has enough geothermal energy to meet its heating requirements for approximately 100 years. Despite this, geothermal energy technology (including ground source heat pumps) delivers just 0.3% of the UK's annual heat demand, and its usage is less than in other European countries with similar geothermal resources. This paper identifies the main regulatory and financial barriers that are contributing to the underutilisation of geothermal energy in England and makes recommendations for how these barriers could potentially be addressed through the introduction of measures that are being used in Denmark, Germany, Italy and the Netherlands to regulate and try to promote expansion of the geothermal energy industry.

The licensing regime

There is no bespoke regulatory regime for geothermal energy in England and although geothermal operations involve drilling into the ground, unlike oil and gas operations they do not require a mining licence. They are instead regulated through a number of authorisation regimes, including water abstraction licences, environmental (discharge) permits, planning permission and environmental impact assessment. The need to obtain multiple authorisations creates a complex and potentially lengthy licensing process. Furthermore, the reliance on the water abstraction and discharge regulatory regimes to address the environmental impacts of geothermal operations means that those that use a closed-loop heat extraction system fall outside the Environment Agency's regulatory remit and it falls on the local planning authorities to assess and manage the impacts of closed-loop geothermal operations. Moreover, some smaller, and albeit low risk, shallow geothermal operations (including some ground source heating and cooling systems) require neither authorisation from the Environment Agency nor planning permission from the local authority.



<https://electrek.co/2019/03/17/dandelion-energy-geothermal-heating/>

Alternative licensing regimes that provide a more coherent and comprehensive oversight of geothermal operations include:

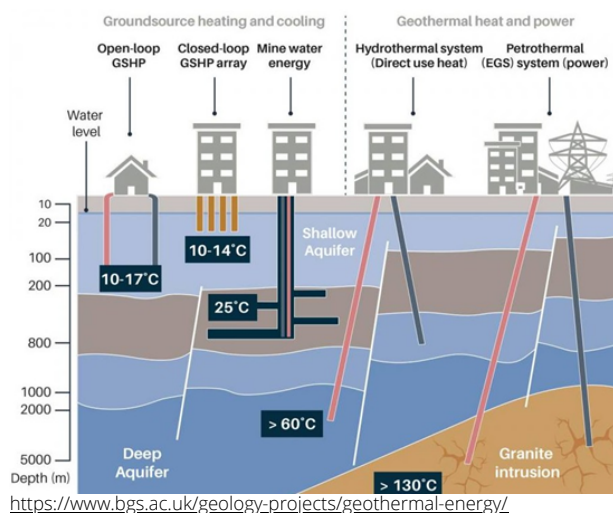
- a regulatory regime that covers both open and closed-loop systems. Denmark's Subsoil Act regulates all underground natural resources and activities, and in Germany and the Netherlands, mining law applies to geothermal operations that require drilling down more than 100m or 400m respectively. Italy has a specific geothermal regulatory regime that applies to all geothermal operations.
- a simplified licensing procedure for low- risk small/shallow geothermal operations (including ground source heating and cooling operations). Denmark, Germany, Italy, and the Netherlands all leave permitting of ground source geothermal operations to local, municipal or regional authorities. Italy's geothermal licensing regime contains a simplified procedure for small local uses of geothermal energy and pilot schemes.
- a permitting regime that enables the drilling and construction works and the environmental impacts to be dealt with in one application and one permit, thus providing a more holistic and comprehensive regulatory regime. In Germany, the mining permit includes planning permission and some environmental authorisations. The Netherlands grants all-in-one permits that cover the construction works and the environmental permit.
- the development and use of best practice guidelines. These can be used to set out the technical detail and best practice for different types of geothermal operations, reducing the need for an overly detailed and bureaucratic licensing regime. The Danish Energy Agency has prepared a number of good practice guides for the geothermal industry. Germany has guidelines relating to the design of geothermal operations and the use of techniques and materials to mitigate the environmental impacts. Italy has developed national guidelines for both shallow and deep geothermal operations and has implemented internationally developed best practices regarding seismicity. In the Netherlands, the mining regulator has prepared guidelines for geothermal operations that explain the legal framework and expectations regarding health, safety and the environment, and the Dutch Association of Geothermal Operators has published industry standards and guidelines. England at present only has industry developed guidelines regarding ground source heat pumps.

Management of geothermal resources

Geothermal energy is not currently recognised in English law as a resource in its own right. The regulatory regime therefore does not address the need to prevent unsustainable extraction rates nor manage the potential interference between geothermal operations. The lack of comprehensive regulatory oversight also means that there is no comprehensive record of geothermal operations or strategy for managing the exploitation of geothermal resources.

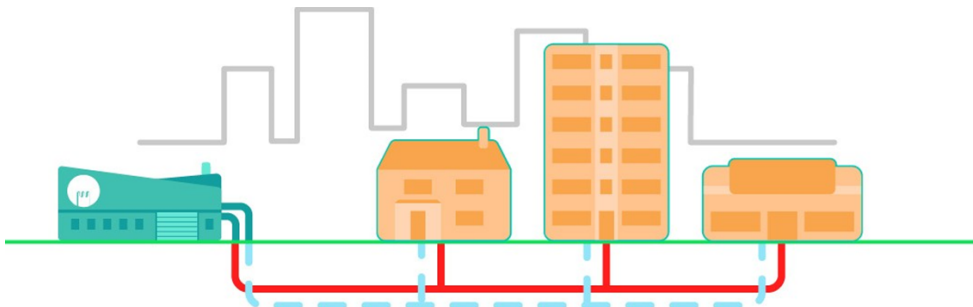
Measures to manage geothermal resources include:

- development of a national strategy for the exploitation of geothermal resources to ensure optimal use. In the Netherlands, a Master Plan has been drawn up by the Dutch Association of Geothermal Operators, Platform Geothermie, the state owned Energie Beheer Nederland, and the Heat Network Foundation. This sets out a roadmap for increasing the production and use of geothermal energy, including proposals for a more streamlined licensing regime
- establishing an organisation that has responsibility for overseeing and co-ordinating geothermal activities. In Italy, the Italian Geothermal Union is an independent, non-political, non-profit organisation dedicated to the promotion of geothermal energy. The Netherlands has the Stichting Platform Geothermie, a non-profit organisation that focuses on the responsible use of geothermal energy, and the Energie Beheer Nederland, which is an independent company established by the Dutch government to obtain maximum social and economic value from the Dutch subsurface.
- compulsory registration for all geothermal operations to provide a central record of all geothermal operations. In Germany, all drilling activities have to be reported to the Geological Survey of the relevant state. In Italy, those closed-loop geothermal operations that do not require a permit have to be notified to the relevant regional authority. In the Netherlands, there is compulsory reporting to the municipality of new closed-loop geothermal operations and voluntary registration of existing ones. The Dutch reporting system requires compliance with a set of general rules aimed at protecting the soil, ensuring efficient use of geothermal resources, and preventing interference between operations, as well as giving the municipality an overview of geothermal operations in the area and helping the government monitor climate change objectives.



Promotion of district heat networks

The need to secure long-term contracts for the supply of heat to consumers is an important factor for a geothermal operation to be economically viable. District heat networks can turn what is otherwise a fragmented demand from individual households into a structured demand in a quantity that presents a viable business case for geothermal development. In England, district heating is largely unregulated and just 2% of the UK's heating demand is met through district heat networks. The main barriers to the adoption of district heat networks are the high capital costs and uncertainty of revenue. There is therefore a need for the adoption of a regulatory framework that provides financial support for investors, reduces revenue uncertainties, and encourages consumers to connect to heat networks.

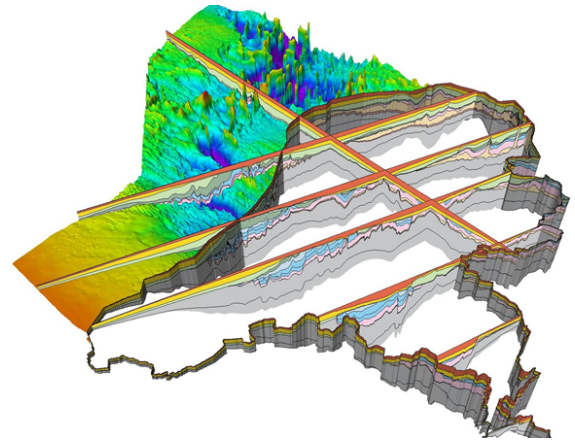


<https://energetik.london/how-it-works/community-heat-networks/>

Regulatory measures that could help address the barriers to district heat networks include:

- the strategic planning of heat networks to reduce costs. The 2020 Energy White Paper commits to the implementation of local authority zoning in which areas that can be readily connected to a heat network are identified and connection mandated. Some local authorities in England, such as Newcastle City Council, have taken an active role in the planning and implementation of district heat networks, but they are not obliged to do so. In Denmark (in which 63% of private homes are connected to district heating), municipalities are legally required to plan for the supply of heat in the area and are responsible for approving heating projects (whilst being overseen by the Danish Energy Regulatory Authority).
- compulsory connection to heat networks to reduce demand uncertainty. In Denmark, municipalities have the ability to impose obligations on buildings to connect to the district heat network, as well as obligations to purchase heating from it. Some German states have laws that allow for compulsory connection.
- regulation of the price of heat to provide consumer protection and further revenue certainty for investors. In Denmark, the Heat Supply Act sets a price cap for a specified number of years, but also allows the geothermal operator and district heat company to enter into a longer term agreement (to accord with the length of the supply agreement) that agrees a different price cap and the sharing of efficiency gains). The Dutch Heating Act similarly regulates collective heating systems and a maximum tariff for supply and connection is set annually by the Consumer and Market Authority.
- tax incentives for connection to district heat networks. In Italy, there are tax incentives for users connected to district heat networks fed by geothermal resources.

Currently, the financial risks relating to geothermal energy are a significant barrier to expansion of the industry. The most significant financial risks arise as a result of the high costs of exploration and drilling which are incurred when there remains significant uncertainty as to whether the project will be successful.



<https://www.nlog.nl/en/geological-maps>

Measures to address the financial risks and incentivise investment include:

- reducing uncertainty regarding geothermal resources. In Denmark, the Geological Survey has responsibility for assessing and mapping geothermal potential to reduce investment risks. The Italian Geothermal Union collects and disseminates data with the aim of promoting geothermal development. In the Netherlands, there is a government initiated programme (the Dutch Seismic Campaign for Geothermal Energy 'SCAN') to map the Dutch subsurface to help determine geothermal potential.
- the availability of grants, loans and insurance. In Germany, there is a segmented insurance scheme that covers (i) the risk of excess drilling costs, and (ii) general project risks, such as cost increase or business risk. There is also a risk mitigation scheme in respect of the risk that the project is not successful under which the developer can apply for a loan covering up to 80% of the drilling costs. A high interest rate is initially payable but if the drilling is successful the loan continues at a reduced rate. If the drilling is not successful the developer is indemnified against repaying the rest of the loan. The Netherlands also has a segmented insurance scheme under which the operator is insured against the risk that the output is less than expected.
- feed-in-tariffs that guarantee a favourable fixed-rate compared to other energy sources and thereby provide investment reliability. In Germany, deep geothermal energy is guaranteed an above market price for electricity for 20 years and in the Netherlands producers of geothermal energy can be granted a 15-year feed-in-premium subsidy.

Conclusion

Geothermal technologies have the potential to make a significant contribution to the decarbonisation of space heating. A regulatory regime that recognises geothermal energy as a resource and provides for a licensing regime that covers the different technologies for its extraction and use would help achieve this potential. Such a licensing regime would provide a more coherent means of regulating the environmental impacts, whilst also being able to allow for the fact that different technologies carry different levels of risk. A comprehensive licensing regime would also facilitate the strategic management of geothermal resources and maximisation of their use in the public interest. Furthermore, regulatory reform could contribute to achievement of the market conditions needed to enable the geothermal energy industry to grow, in particular through the introduction of regulatory measures to promote district heat networks and additional measures and financial incentives to counter the financial risks for investors in geothermal operations.

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<https://www.ncl.ac.uk/law/>

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<https://doi.org/10.1093/jel/eqab038>

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