Department for the Economy
An Roinn Geilleagair
www.economy-ni.gov.uk

GEO ENERGY NI
UNEARTHING THE HEAT BENEATH OUR FEET

CONSULTATION ON
GEOTHERMAL LICENSING

CONTENTS

EXECUTIVE SUMMARY

Geothermal energy is the natural heat stored underground beneath Northern Ireland. This heat can be used to warm buildings, provide hot water and, in some cases, cool buildings in summer. It is a local, low-carbon energy source that works day and night and does not depend on the weather. Using more geothermal energy can help cut carbon emissions, improve energy security and reduce reliance on imported fossil fuels.

Northern Ireland is well suited to many types of geothermal development. Shallow geothermal can be used almost anywhere for heating individual buildings, while parts of County Antrim are also suitable for deeper systems that could supply heat to larger sites or groups of buildings.

At present, there is no specific regulatory framework for geothermal energy in Northern Ireland. This consultation sets out proposals to introduce new legislation that would create clear, proportionate rules for larger geothermal developments, while keeping small scale domestic installations easy to access.

What these proposals cover

The proposed regulations would apply only in Northern Ireland and would focus on geothermal developments that are larger, deeper or more complex, where there is a greater need to protect the environment and manage how underground heat is shared.

Small domestic installations, such as horizontal ground loops or low-capacity systems for a single home, would not need a licence.

Larger or deeper geothermal developments, including heat storage and projects supplying heat beyond a single building, would require a licence from the Department for the Economy (DfE).

In practice, these proposals are expected to affect mainly commercial or public-sector geothermal projects, rather than householders.

Licensing and environmental protection

Under the proposals, developers of licensed geothermal projects would need to show that their plans are safe, technically sound and environmentally responsible before work begins. Applications would be reviewed by specialists in DfE and the Geological Survey of Northern Ireland (GSNI).

Licences would:

- Set clear conditions for how underground heat is used.
- Protect groundwater and the wider environment.
- Prevent nearby projects from interfering with each other underground.
- Require ongoing monitoring so problems can be identified early.

All licensed projects would be monitored throughout their life, and action could be taken if licence conditions are not met.

Public engagement and transparency

Public participation is a key part of the proposed approach. Details of licence applications would be made public, and communities would have the opportunity to comment before decisions are made. Information about approved projects, monitoring and enforcement would be published through a new geothermal data portal.

Ownership of geothermal heat

The consultation also proposes that geothermal heat below 100 metres depth should be publicly owned, while land ownership at the surface would remain unchanged. This approach is used in several other countries with successful geothermal sectors.

Public ownership is intended to:

- Make the rules clearer about who can grant permission to use underground heat.
- Ensure the resource is used fairly and sustainably.
- Give developers confidence to invest.
- Protect the resource for future generations.

Costs and consumer protection

The proposals do not introduce heat price controls. Instead, developers of licensed projects would provide cost information so DfE can understand how the market is developing and ensure the resource is being used responsibly. This information would support transparency and long-term consumer protection.

Separate work is under way on heat network regulations, which would apply where heat is sold to multiple customers. That work is not part of this consultation and would not affect the geothermal licensing proposals set out here.

Why your views matter

These proposals are intended to support a growing geothermal sector that delivers clean, affordable heat while protecting the environment and respecting communities. This consultation is open to everyone, and no technical knowledge is required to take part.

Your views will help shape how geothermal energy is regulated in Northern Ireland and how this local energy resource is used in the years ahead.

DOES THIS PROPOSAL AFFECT YOU?

Most households

If your system heats one home/building and is small scale (typically ≤60kW), you are unlikely to need a geothermal licence under these proposals.

Likely to need a licence

If your project is deeper, higher heat output, and or stores heat.

Heat ownership proposal

Heat below 100m would be publicly owned (this does not change land ownership at the surface). The proposal does not impact landowner's ability to use their land as they currently do.

1 PURPOSE OF THE CONSULTATION

This public consultation is seeking views on proposals to introduce a new geothermal regulatory framework to support the growth of a vibrant geothermal sector in Northern Ireland.

DfE recognises that new policy and regulations are needed to support and grow the geothermal sector. The proposals contained in this consultation set out the policy that will underpin a clear and robust regulatory framework.

The proposals include the introduction of new legislation to licence geothermal systems, establish public ownership of the heat, and regulations to ensure that systems are operated in an environmentally and economically sustainable manner.

Structure

This consultation is designed for both non-technical readers and technical experts.
The main document provides a non-technical overview of the policy proposals.

A Glossary of terms has been provided to help make the information easier to understand.

Annex A contains a Frequently Asked Questions (FAQ) section which aims to answer any geothermal related questions. The GeoenergyNI website contains a fuller FAQ section and easily accessible material if you are interested in finding out more about geothermal energy.

More detailed technical, geological and regulatory information is contained in Annexes B to E, and we would particularly encourage everyone to consider this additional information when they respond to the questions asked in the consultation.

Who should read this consultation?

This consultation is designed for everyone; Sections 1-9 cover the background to the proposals; section 10 and 11 cover specific requirements and Annexes B-E provide more detail.

You do not need technical knowledge to respond and we value everyone's views on the policy proposals.

Your views and any supporting evidence will be used to inform our decisions on geothermal policy and licensing proposals. These decisions will be made transparently and on the basis of evidence and expert advice. DfE's objective is to support a vibrant and growing geothermal sector, supporting self-sufficiency in affordable renewable energy, growing our green economy, while ensuring high standards of environmental protection and the sustainable use of geothermal resources for the long term.

How to respond

DfE welcomes your views on the proposals for geothermal energy detailed in this consultation document. In particular we are keen to receive evidenced responses from the geothermal sector on the policy proposals.

This consultation will be hosted online at the following website:
Proposals for Geothermal Regulation Consultation | Department for the Economy.

The Citizen Space website has been specially designed to be as user-friendly as possible for those who wish to complete the consultation questionnaire. It also allows DfE to rapidly collate results. For this reason, we would encourage anyone who is interested in responding to this consultation to utilise Citizen Space as the method of their response.

The Citizen Space survey is available at:
https://consultations.nidirect.gov.uk/dfe/consultation-on-geothermal-regulation

Alternatively, you can respond to this consultation via email to:
Geothermal_Policy@economy-ni.gov.uk

When responding, please state whether you are responding as an individual, or representing the views of an organisation (please state the name of the organisation). Please also state if you consent to your response being published as part of DfE's summary of responses to the proposals.

You can also respond in writing to the following address:
Geothermal Consultation
DfE Geothermal Team
7th Floor, Adelaide House
39 – 49 Adelaide Street
Belfast
BT2 8FD

The consultation closes on **7 August 2026.**

Privacy Notice

DfE is committed to protecting your privacy and ensuring that any personal information you provide in response to this consultation is handled in accordance with the law.

Use of Consultation Responses

- Responses will be used solely for the purpose of informing geothermal policy.
- A summary of responses may be published, but individual respondents will not be identified without their consent.

Freedom of Information (FOI) and Environmental Information Regulations (EIR)

Information provided in response to this consultation may be subject to disclosure under the Freedom of Information Act 2000 or the Environmental Information Regulations 2004.

If you wish your response to remain confidential, please clearly state this in your submission and explain why. While we will respect confidentiality requests, we cannot guarantee that information will not be disclosed, if required by law.

Data Protection

All personal data will be processed in accordance with the UK General Data Protection Regulation (UK GDPR) and the Data Protection Act 2018.

You have the right to access your data, request corrections, and object to processing.

For further information on how DfE handles personal data, please refer to our Privacy Notice.

2

GLOSSARY

Aquifer	Underground layers of water-bearing, permeable rocks that contain and transmit groundwater and from which groundwater can be extracted and discharged.
Aquifer Thermal Energy Storage (ATES)	Open loop systems that use aquifers for seasonal storage and recovery of thermal energy in the subsurface. In summer, warm water is stored to provide heating in winter; in winter, cool water is stored to provide cooling in summer.
Borehole	Deep, narrow holes made in the ground, either vertically or inclined often to extract or to locate water, oil or other liquids or gas.
Borehole thermal energy storage (BTES)	An array of boreholes configured underground. The ground heat exchanger array for a BTES system is designed and operated so that heat is stored or abstracted seasonally from rock or soil, essentially using the ground as heat battery.
Closed loop	Systems that extract heat or cold from the ground by circulating a heat carrier fluid around an array of closed pipe loops (ground heat exchanger). These systems are typically installed vertically or horizontally at depth of less than 500 m.
Department for the Economy (DfE)	Lead department responsible for providing the strategic vision for the future of energy here, as well as key aspects of the energy legislative environment including the licensing and regulatory framework.
Deep geothermal energy	Term used widely to refer to systems at a depth of more than 500 m below the surface.
Direct use geothermal	A system that is hot enough for geothermal heat to be used directly (for example for district heating) without requiring an electrical heat pump.
District heating	Communal heating systems that deliver heated water to a large number of homes and buildings via a network of heating pipes.
Geological Survey of Northern Ireland (GSNI)	GSNI is an office of DfE and provides geoscience information and services to inform decision making.

3 STRATEGIC CONTEXT

In 2021, the NI Executive published the Energy Strategy – The Path to Net Zero Energy[1]. The Strategy sets out how we will achieve our vision of net zero carbon and affordable energy. We are delivering self-sufficiency in affordable renewable energy; people will pay a fair price for the energy we produced locally; and end the importing of fossil fuels. The Climate Change Act (Northern Ireland) 2022[2] requires total emissions from all sectors in Northern Ireland to be net zero by 2050.

Decarbonising how we heat our homes and businesses is particularly challenging for many reasons including the impact it has on our lives and the limited number of alternatives to fossil fuels.

Geothermal energy can play a significant role by providing an environmentally sustainable alternative to fossil fuels for heating individual buildings or multiple buildings via a district heating system.

1 The Path to Net Zero Energy. Safe. Affordable. Clean.
2 Climate Change Act (Northern Ireland) 2022

Geothermal energy is a secure source of heat that is always available, and because it is available locally it is less impacted by "price spikes" in the global energy market. This heat can be accessed across all of our region and can provide renewable heating to both urban and rural areas.

The proposals contained in this consultation represent the first steps in providing value for money geothermal heat. The geothermal sector here is nascent and lack of competition, capacity and experience mean that it is likely that, initially individuals investing in a secure, stable cost heat supply will lead the way in growing the market and reducing costs for everyone.

The proposed licensing system will set standards for installation and operation of systems so that they are built to a good standard, operate as efficiently and for as long as possible – providing secure and value for money heat so that the user will always have heat at a stable cost. Ultimately, if that heat then comes to be sold on then we know it is value for money and reliable.

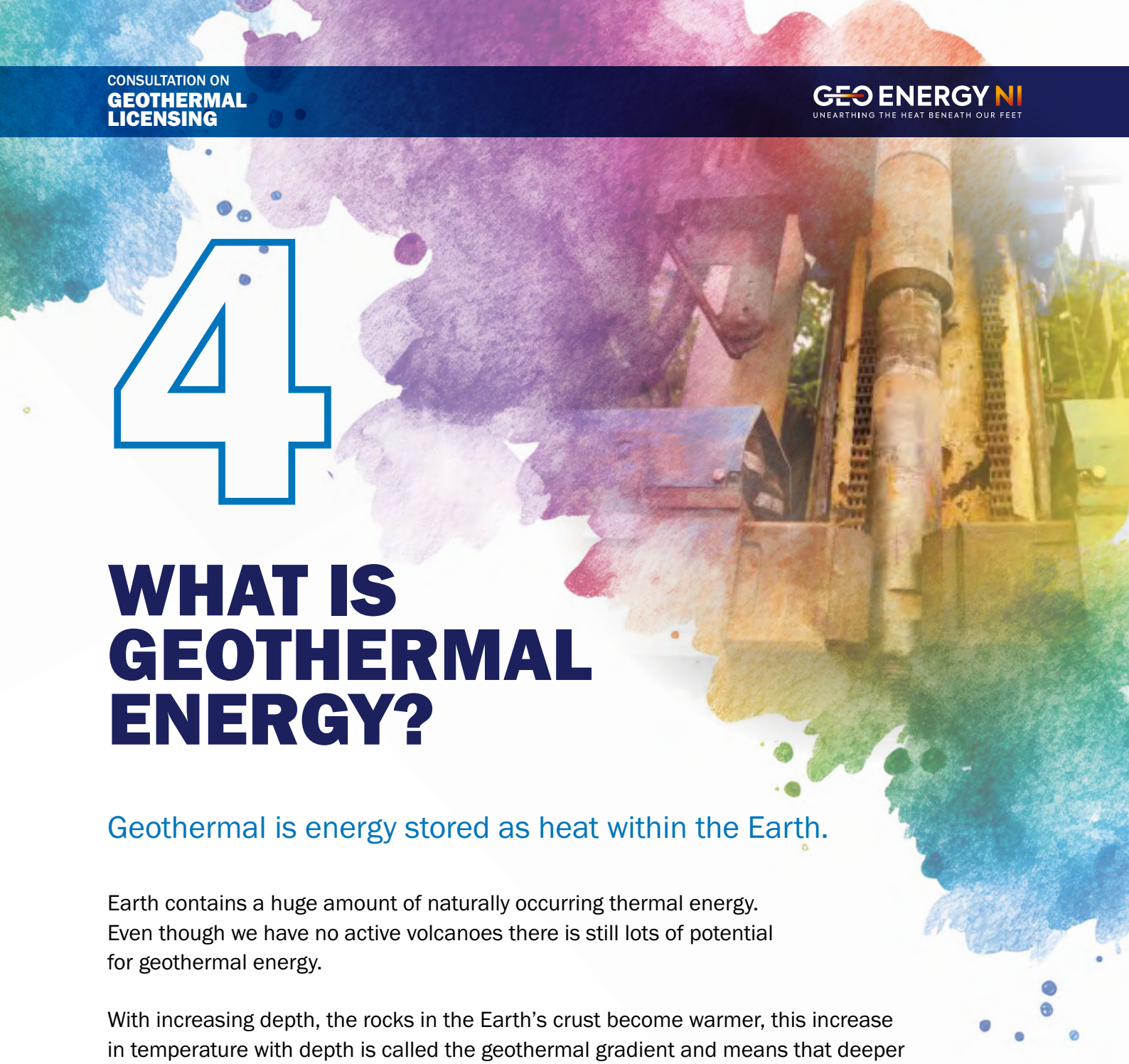
Growing the geothermal sector can also provide local, well-paid, skilled, 'green' jobs.

Despite being a proven technology that is in use across Europe, our local geothermal sector remains very small. Data from March 2023, held by the Microgeneration Certification Scheme suggests 386 geothermal systems are currently installed in Northern Ireland. Significant growth is needed to ensure that geothermal energy can play a role in meeting our future heating needs.

For a number of years DfE has been actively engaging with geothermal experts to consider what actions could be taken to grow the geothermal sector. Research commissioned by DfE[3] has indicated that a clear, streamlined process for regulating geothermal development is essential to accelerate growth and provide investor confidence.

Alongside geothermal regulation DfE is planning to bring forward a more rigorous process for heat networks which will ensure the cost of any geothermal or other heat sold to customers on those networks will be calculated transparently and fairly.

3 Research into the geothermal energy sector in Northern Ireland



4

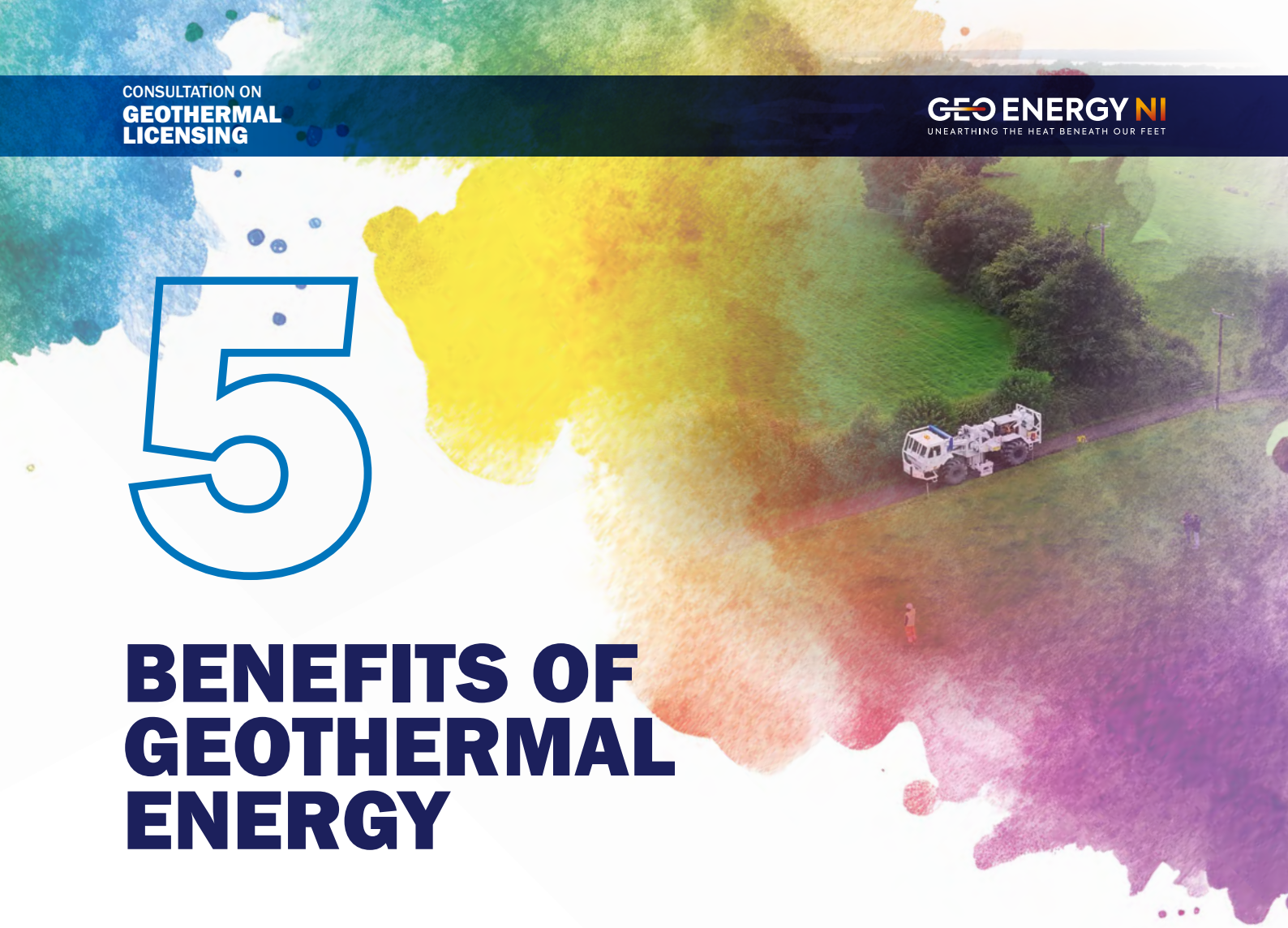
WHAT IS GEOTHERMAL ENERGY?

Geothermal is energy stored as heat within the Earth.

Earth contains a huge amount of naturally occurring thermal energy. Even though we have no active volcanoes there is still lots of potential for geothermal energy.

With increasing depth, the rocks in the Earth's crust become warmer, this increase in temperature with depth is called the geothermal gradient and means that deeper systems can access hotter water. At shallower depths (100 m) the temperatures are around 10-12°C; this lower temperature heat can still provide useful energy, though a heat pump is needed to raise the temperature to a level suitable for heating buildings. Higher temperature geothermal systems are suitable for large scale direct heating.

Other countries such as the Netherlands, France and Germany where the geology and geothermal gradient is similar to ours are already using this lower temperature geothermal resource.



5 BENEFITS OF GEOTHERMAL ENERGY

Geothermal energy is a sustainable and continuous source of low carbon, renewable heat that is unaffected by the weather; it has a small footprint and once installed, has minimal visual impact.

Geothermal energy is an alternative to fossil fuels and because it is available everywhere it can provide our local communities with a reliable source of heating and cooling.

Geothermal can deliver particular benefits for rural areas by providing a sustainable option where the choices for decarbonised heat are more limited.

Increased use of this technology can create new skilled local jobs, across a range of professions from environmental management, construction to ongoing maintenance; many of which are likely to be well paid[4].

4 Economic Impact of the Geoscience Sector

6

GEOTHERMAL DEMONSTRATOR PROJECT

In 2021 the Department launched its Geothermal Demonstrator Project, GeoEnergy NI, to explore our geothermal potential.

The College of Agriculture, Food and Rural Enterprise (CAFRE) Greenmount Campus near Antrim and the Stormont Estate in Belfast were chosen as they have suitable geology to demonstrate our deep and shallow geothermal potential respectively.

A key objective of the project is to increase awareness of geothermal energy through public engagement and interactive tools including virtual reality headsets.

Information gathered from the demonstrator project has been used to inform the proposals contained within this document. The GeoEnergy NI website provides comprehensive information as well as links to our virtual reality and other media outputs.

7

ACCESSING GEOTHERMAL ENERGY

Heat from deep within the Earth and from the Sun is stored within the rocks, sediments and waters in the Earth's crust. Water stored below ground is known as groundwater and the rocks and sediments that contain significant amounts of water are called aquifers.

The stored heat is accessed using different technologies, depending on temperature, depth and the amount of groundwater there is.

At shallow depths, the subsurface maintains a relatively constant temperature throughout the year. The process of extracting geothermal heat does not create heat; it simply moves it from the subsurface into the building which means the process can also be reversed to provide cooling in warmer months.

When a higher temperature is needed, this lower temperature heat is transferred to buildings using a ground source heat pump, which collects heat and raises it to a suitable temperature.

More information on heat pumps and how they operate can be found at Annex E.

At greater depths higher temperature heat can be brought to the surface through boreholes and used directly for heating.

Geothermal systems rely on the natural flow of heat from the Earth and the relatively stable temperatures underground.

The type of system varies depending on the geology, heat requirement and its use. Technological developments continue to improve how we access and use geothermal energy which means that licensing proposals need to be flexible enough to deal with future systems.

8

MANAGING COSTS

Our geothermal sector is still at an early stage and project costs remain highly variable and site-specific; reflecting differences in geology, depth, drilling conditions, and system design. DfE intends to use benchmark cost ranges to guide oversight while allowing the market to mature. This will focus on requiring operators to submit detailed cost data at licensing and periodically thereafter, enabling DfE to monitor affordability and identify outliers.

9 GEOTHERMAL HEAT AND HEAT NETWORKS

It is anticipated that most early installers and operators of geothermal systems will be businesses and public sector organisations seeking to avail of a local, low carbon and secure source of heat and or cooling for their own use.

Where geothermal heat is supplied to more than one customer through a shared system, this heat may, in future, be delivered through a heat network. The Department is progressing separate policy and engagement to develop a proportionate regulatory framework for heat networks in Northern Ireland. This work is focused on establishing baseline consumer protections, including transparent billing, fair treatment and access to appropriate redress.

Subject to evidence and further consultation, this framework could, over time, help improve transparency and fairness in how charges for heat supplied through shared systems are structured, while recognising the need for such systems to be financially viable. Any future arrangements would be introduced incrementally and would be developed separately from, and would not affect, the geothermal licensing proposals set out in this consultation.

Types of Geothermal System

There are two main types of geothermal systems; one uses groundwater and the other uses coolant in sealed.

Open Loop Geothermal Systems

An open loop system uses two boreholes drilled into underground layers of rock, sand or gravel called aquifers. Groundwater is pumped up through the first borehole and passes through a ground-source heat pump, which transfers heat to or from the water. The clean water is then returned to the aquifer through a second borehole, placed far enough away so the water has time to warm up again naturally. This spacing stops the system from recycling the same cooled water too quickly.

Shallow open loop systems serving a single house are not likely to require a licence.

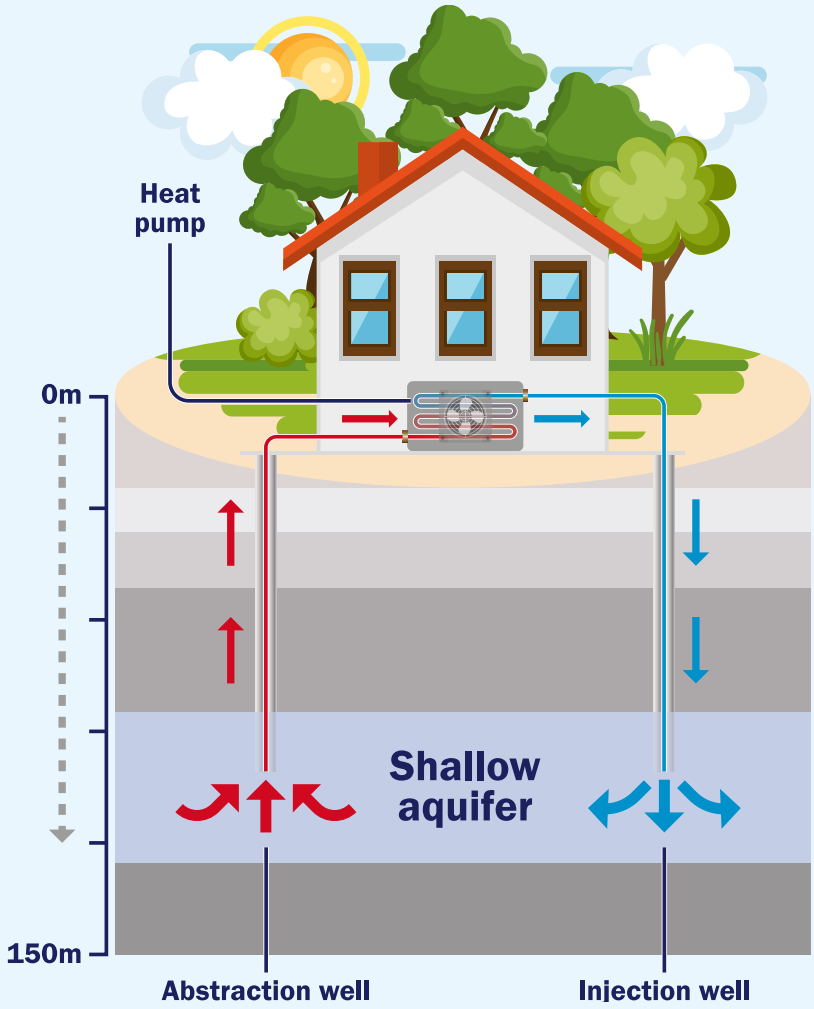


Fig. 1: Ground source heating and cooling using an open loop system. Diagram showing an open-loop geothermal system where groundwater is pumped from an aquifer through a heat pump and then returned underground through a second borehole.

Closed Loop Geothermal Systems

A closed loop system uses sealed pipes buried in the ground to move a fluid around in a continuous cycle. This fluid absorbs or releases heat as it passes through the pipes and a connected heat pump uses this process to provide heating or cooling. Because the fluid is recycled repeatedly, only a small amount is needed. These systems can be installed either horizontally, by digging shallow trenches a few metres under the surface or vertically, by drilling a borehole.

Closed loop systems serving a single house are not likely to require a licence.

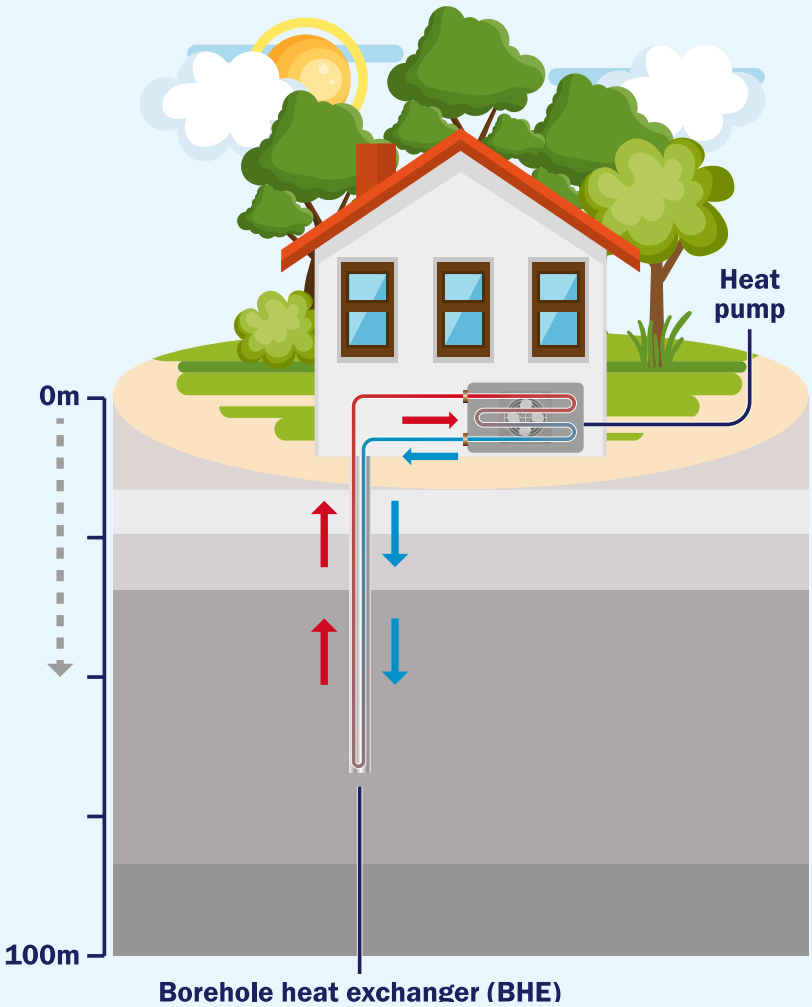


Fig. 2: Ground source heating and cooling using a closed loop system. Diagram showing a closed loop geothermal system using sealed underground pipes to circulate fluid that transfers heat between the ground and a building.

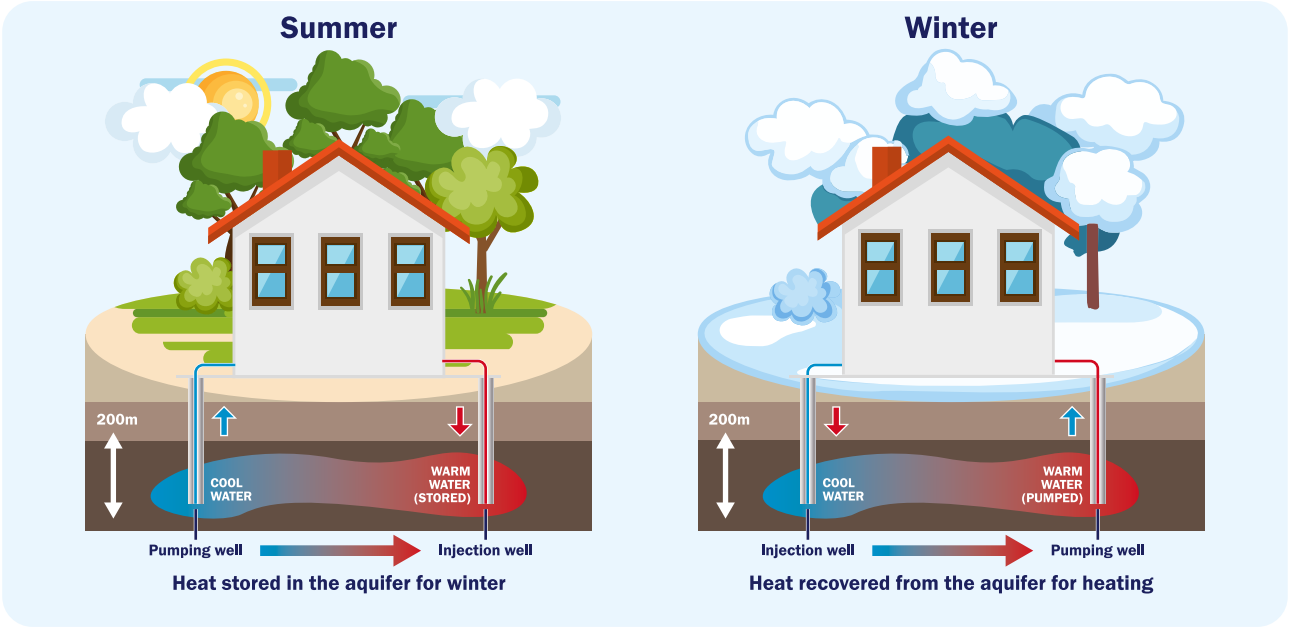


Fig. 3: Diagram showing a geothermal system storing heat underground, with arrows illustrating how heat spreads within a defined three dimensional thermal envelope in the subsurface.

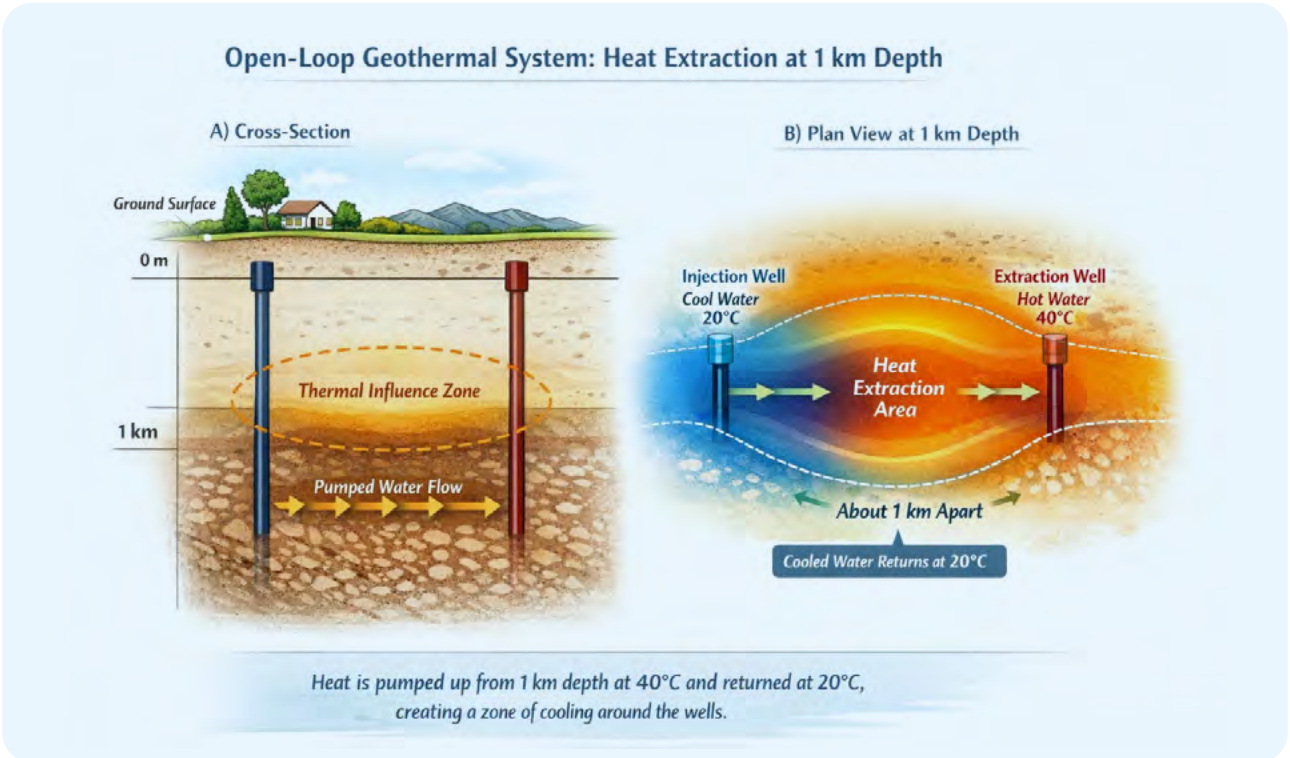


Fig. 4: Cross-section diagram illustrating the thermal envelope of a geothermal system, showing the area underground where temperatures are intentionally increased or decreased during operation.

Fig. 5: Photograph showing plastic pipes laid in shallow trenches underground for a horizontal closed loop geothermal heating system alongside a three dimensional representation of the system.

Horizontal systems are generally the simplest and cheapest geothermal systems to install and can be used for domestic heating. It is not proposed that these will require a licence.

Want to find out more?

More detailed information on the different types of geothermal system can be found at Geothermal technologies-BGS geothermal energy research

10

POLICY OBJECTIVE

Geothermal energy has a role to play in delivering self-sufficiency in affordable renewable energy. It can provide a source of low carbon heating for homes and businesses. The British Geological Survey (BGS) has identified Northern Ireland as a 'super region' where the geology is well suited for uptake of geothermal energy[5].

However, the local sector is small and underdeveloped, with only a very small number of installed geothermal systems.

DfE is proposing to introduce new geothermal policy aimed at encouraging growth in the number and scale of geothermal systems by setting standards for the design, building and operation of these systems we will ensure a secure and value for money supply of heat. As the market grows costs will reduce and, alongside heat networks regulation, we will ultimately create an energy environment that ensures that consumers pay a fair price for the energy we produce locally, insulating us from volatile global fossil fuel commodity costs.

Recent research by Queen's University Belfast (QUB) highlighted the critical role of regulatory reform in unlocking the potential of geothermal energy in Northern Ireland[6]. Currently, there are no specific planning rules, environmental regulation or licensing regime for geothermal energy. This creates uncertainty for potential developers and acts as a barrier to geothermal developments.

5 BGS - geological super regions
6 Net zero pathways - building the geothermal energy sector in Northern Ireland

The proposals contained in this consultation are intended to support and promote a vibrant geothermal sector in Northern Ireland ensuring geothermal systems are operated in an economically and environmentally sustainable manner.

The proposal to licence geothermal systems is aimed at ensuring that all new geothermal systems meet robust environmental and operating standards. It will also protect the developers' investment by ensuring geothermal energy is not overexploited and that systems do not take heat from each other.

New legislation will be required to give effect to the proposals.

Question 1

Do you agree that licensing and regulation can encourage growth in the geothermal sector in an economically viable way?
Please provide reasons to support your answer.

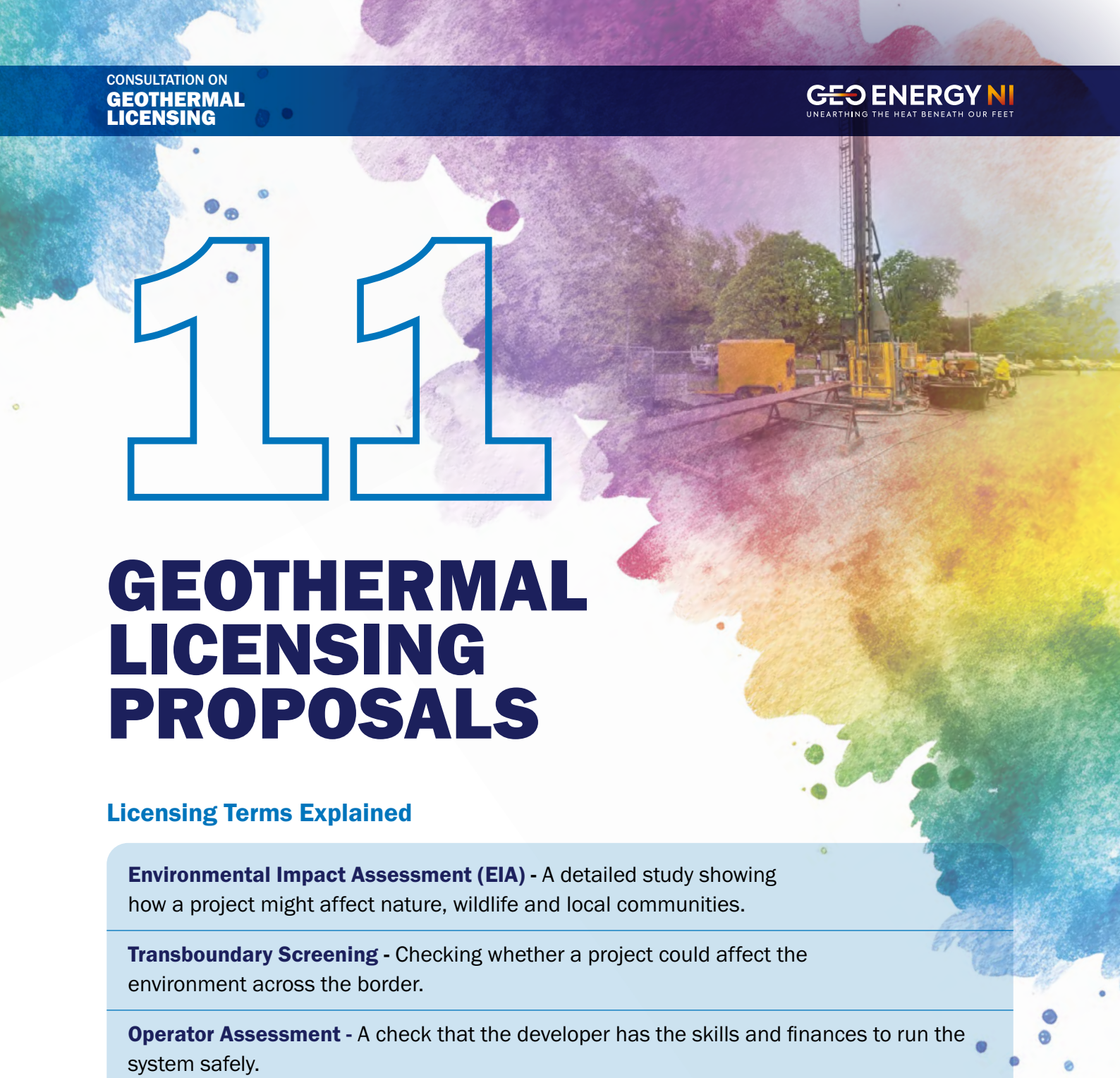
Existing regulatory framework

There are currently no regulations in place that protect our geothermal resource or regulate the way geothermal systems operate, however, there is some overlap with the regulatory powers of the Northern Ireland Environmental Agency (NIEA) when groundwater is used to transfer the heat to the surface for example in an open loop system. Anyone wanting to install an open loop geothermal system would also need to apply for a water abstraction licence and discharge consent from NIEA. A typical geothermal system will also require planning permission from the local council to ensure the surface infrastructure is suitable.

These regulatory processes (planning permission, NIEA abstraction/discharge consents) will continue to operate completely independently of the DfE geothermal licensing system as they are regulating water and surface matters.

A DfE licence will not require prior approval from NIEA or planning authorities, and vice-versa but all legal requirements will have to be met before a geothermal system can be installed.

The proposals for a new geothermal licensing system will not change or vary the existing statutory requirements, however, DfE will work closely with the other regulators to make sure that we do not make it more difficult to install and operate a geothermal system.



11

GEOTHERMAL LICENSING PROPOSALS

Licensing Terms Explained

Environmental Impact Assessment (EIA) - A detailed study showing how a project might affect nature, wildlife and local communities.

Transboundary Screening - Checking whether a project could affect the environment across the border.

Operator Assessment - A check that the developer has the skills and finances to run the system safely.

Monitoring Data - Regular information (like temperatures or water flow) to show the system is safe.

Licence Variation - Permission required when an operator wants to change how the system works.

Decommissioning - Safely shutting down a geothermal system when it reaches the end of its life.

This section provides an overview of the proposed geothermal licensing process. A more detailed technical description of the proposed licensing regime is provided in Annex B.

Financial Support

We are not proposing to introduce any grants or subsidies at this time. Instead, we plan to support the geothermal sector by creating clear rules to help it grow. However, DfE is proposing to take powers that would allow us to provide financial support in the future.

Licensing Body

DfE will be responsible for issuing geothermal licences for individual geothermal systems. Technical experts from the Geological Survey of Northern Ireland (GSNI) will assess the feasibility and suitability of each application before a licence is issued.

Licensing Criteria

The proposed licensing framework distinguishes between geothermal developments based on their size, depth and potential risk, so that small scale systems may not need a licence, while larger or deeper developments are subject to proportionate regulation.

Most small domestic geothermal installations will not need a licence. This includes horizontal ground source systems, where pipes are laid in shallow trenches close to the surface, and small geothermal installations providing up to 60 kilowatts of heat, typically used to heat a single home or building. These installations generally operate within the first 100 metres underground and are considered lower risk. While a geothermal licence would not be required, existing planning and environmental requirements would still apply where relevant.

Licensing is proposed for larger or more complex geothermal developments, particularly where there is greater interaction with groundwater or the wider subsurface. This includes shallow vertical geothermal systems, which can extend down to 500 metres, such as vertical boreholes and open loop groundwater systems. These are more commonly used for large buildings, commercial sites or shared heating arrangements and require closer technical and environmental oversight.

Deep geothermal developments, defined as operating at depths greater than 500 metres, would also require a licence. These systems are generally more complex and may supply heat to multiple buildings, campuses or industrial users. Because of their depth and scale, they would be subject to a more detailed assessment process.

Where geothermal developments include the intentional storage of heat or cold underground, additional controls are proposed based on the scale and risk of the storage activity. Small-scale, low-risk storage schemes of up to 200 megawatt hours would be subject to basic application requirements and standard monitoring. Medium-scale schemes storing between 200 and 2,000 megawatt hours or operating at higher temperatures or closer to sensitive environments, would require more detailed modelling and monitoring. Large scale or higher-risk schemes storing more than 2,000 megawatt hours would be subject to the highest level of regulation.

In addition, large-scale groundwater abstraction, defined as abstraction above 20 cubic metres per day, would be subject to a registration requirement with DfE. This aligns with existing water abstraction controls and would not apply to private domestic wells or typical agricultural use.

In practice, this means that small, shallow systems serving individual buildings will remain unlicensed, while deeper, higher-output or heat-storage schemes will require a licence, with regulatory requirements increasing in line with scale and risk. This proportionate approach is intended to support growth in geothermal energy while protecting the environment and the long-term availability of the resource.

Exemptions

Not all new geothermal systems will require a licence. Horizontal closed loop and open loop systems providing less than 60kW total i.e., typically individual homes or buildings will not need to be licensed.

Question 2

Do you agree with the proposed exemptions from geothermal licensing?
If not, please suggest an alternative and provide supporting evidence.
(Please refer to Annex B for further details on exemptions).

Licence holder requirements

The applicant and therefore the licence holder will be required to prove that they have sufficient qualifications/expertise and finances to continuously operate the geothermal system as set out in the licence conditions. Operational conditions will vary depending on the type and complexity of the system being proposed.

Licensing Process

DfE will follow a defined structured sequence to assess each geothermal system to ensure it complies with all requirements, that it is designed to industry best practice and that the proposed system will be built and operated in an environmentally sustainable manner. The process and assessment criteria may vary depending on the type and depth of the geothermal system, but will generally include the following steps:

1. **Geothermal Licence Application to DfE**
   The developer must apply to the Department for the Economy (DfE) for a geothermal licence, providing detailed operator, financial, geological, technical, and operational data.

2. **Operator Assessment by DfE**
   DfE will assess the technical capability and financial capacity of the operator.

3. **Technical Assessment by GSNI**
   The Geological Survey of Northern Ireland (GSNI) will assess the technical feasibility and sustainability of the proposed geothermal system, including geological risks and potential interactions with other subsurface activities.

4. **Public Consultation**
   To ensure full transparency and accountability, all details of all geothermal applications, including geological, technical and environmental information, will be published on DfE's geothermal website. A 28 day consultation process will allow the public to have input into the decision-making process. All consultation outcomes and responses will be published.

5. **Environmental Assessment**
   The applicant may be required to submit an Environmental Impact Assessment (EIA) if this has been produced in support of an application for planning approval. Where an EIA is not available the applicant will be required to provide appropriate evidence that they have considered and mitigated the environmental impacts of the system they are proposing.

6. **Transboundary Screening**
   As part of the assessment process DfE will screen each application to determine if there is any cross border environmental impact.

7. **Issue Licence**
   If the application is deemed to meet DfE requirements, then we will issue a geothermal licence. A geothermal licence is a standalone permission issued by DfE. It does not replace or subsume planning permission or NIEA approvals. Developers are responsible for securing all other regulatory permissions separately before installation or operation. DfE will not refuse or delay a geothermal licence on the basis that planning or NIEA permissions have not yet been secured.

Thermal Storage

Geothermal systems are often designed to store heat. The licensing process will also regulate any thermal storage process within the system. Thermal storage refers to storing heat underground so that it can be used at a later time. This allows heat collected during warmer periods to be saved for use in winter. In warmer climates, these systems can also be used to store cold in the same way. In simple terms, geothermal heat or cold storage works like a rechargeable battery, but instead of storing electricity, it stores thermal energy within the rocks and groundwater beneath our feet.

Thermal storage can support the efficient use of geothermal systems. However, because different thermal storage systems vary in size, temperature and location, the potential risks to the environment also vary. To ensure appropriate oversight, the proposed licensing regime includes a three tier, risk based approach:

- **Tier 1 – Small scale / Low risk systems:** These store up to 200 MWh of heat, at relatively low temperatures (generally between 5°C and 25°C), and are located away from sources of drinking water or other sensitive environments. It is anticipated that a basic application and standard annual monitoring would apply.
- **Tier 2 – Medium risk systems:** These include systems storing between 200 and 2,000 MWh of heat, systems operating at higher temperatures (up to around 40°C), or systems located closer to environmentally sensitive areas. It is anticipated that these would require detailed thermal and groundwater modelling and, potentially, more frequent monitoring.
- **Tier 3 – Large scale / High risk systems:** These include systems storing more than 2,000 MWh of heat, operating at higher temperatures (above 40°C), or systems located in urban areas or near drinking water supplies. These would require a full Environmental Impact Assessment, comprehensive thermal and groundwater modelling, financial guarantees, and real-time monitoring.

Licence conditions and monitoring data

It is proposed that all geothermal licences issued by DfE will include conditions tailored to the scale, design and environmental risk of the proposed system. These conditions will form the basis for ongoing monitoring and compliance activities.

Geothermal operators will be required to provide operating and environmental data to DfE on a regular basis to show that they are complying with the conditions of their licence.

DfE, with technical support from GSNI, will monitor the systems to ensure they are operating properly and do not pose risks to the subsurface.

Where monitoring or inspection identifies non-compliance with licensing conditions, DfE may issue formal notices requiring the operator to take action to address the non-compliance. Where the breach is serious this could include suspension, modification or withdrawal of the licence.

A geothermal licence would authorise activity only for the purpose of accessing, using or storing geothermal heat. It would not grant any rights to explore for, test, or extract petroleum, gas, minerals, or any other subsurface resources.

Licence conditions would limit permitted activities to those necessary for geothermal development, such as heat extraction, reinjection, thermal storage and temperature monitoring. Activities associated with petroleum or mineral exploration, including geological sampling for mineral content, hydrocarbon testing, or drilling designs suited to mineral or petroleum extraction, would be expressly prohibited.

Appeals

It is proposed that applicants and operators will have a right of appeal against certain regulatory decisions, including licence refusal, suspension, modification or withdrawal. Appeals will be heard by either the Lands Tribunal or the Planning Appeals Commission, subject to agreement with the Department of Justice.

Transparency and Record-Keeping

To support public confidence and compliance with environmental information obligations, DfE proposes to publish information, about licensing decisions, inspections and enforcement actions, on a new geothermal data portal. More information about the proposed portal and how it would operate can be found at Annex D.

Fees

DfE will charge a fee for each application to cover the costs of processing, assessing and issuing the licence. There will also be a modest annual fee to cover monitoring costs. In line with government policy all fees and charges will be determined on the basis of full cost recovery.

Decommissioning

The proposal is that all licensed geothermal systems should be decommissioned safely to prevent contamination of groundwater or other adverse environmental impacts. At application stage applicants will be required to provide evidence that appropriate finances are in place to cover the cost of decommissioning. When the system has reached the end of its operational life or is to be closed, a decommissioning plan must be agreed with DfE before it is implemented.

Geothermal expert or want to find out more?

More detailed information on the licensing system can be found at Annex B.

QUESTIONS

Annex B provides more detailed information on the licensing process which geothermal experts may want to consider before answering these questions.

Question 3

Do you agree with the proposed licence requirements for geothermal systems?
Please comment on whether the level of regulation seems appropriate, proportionate and understandable. You may wish to refer to the technical details set out in Annex B when providing your views on the specific requirements. Please provide reasons to support your answer and any alternative suggestions.

Question 4

Do you agree with the three-tiered approach to the licensing and regulation of thermal storage systems?
Please comment on whether you support a risk-based approach. You may wish to review the detailed criteria in Annex B when forming your response. Please provide reasons to support your answer and any alternative suggestions.

Question 5

Do you agree that DfE will use installation and operation cost data to benchmark system costs?
Please provide reasons to support your answer.

Question 6

Should existing geothermal systems providing more than 60kW of heat be required to obtain a geothermal licence?
Please provide reasons to support your answer.

Question 7

Do you agree with the proposed initial 25 year duration of a geothermal licence?
Please provide reasons to support your answer.

Question 8

Do you agree with the proposals on public consultation as part of the licensing process?
Please provide reasons to support your answer and any alternative suggestions.

Question 9

Do you agree with the proposed enforcement measures?
Please provide reasons to support your answer and any alternative suggestions.

Question 10

Do you agree with the plan to establish a public NI geothermal data portal?
Please provide reasons to support your answer and any alternative suggestions.
Further information on the geothermal data portal can be found in Annex D

12

OWNERSHIP OF GEOTHERMAL ENERGY

What does "ownership of heat" mean?

It means the heat underground belongs to the public, not individual landowners. It does not change who owns the land itself.

These proposals are concerned with the regulation of geothermal heat at depth; ownership and use of heat within the first 100 metres for typical domestic systems would continue as now.

Establishing public ownership of geothermal heat does not change ownership of the land itself. Landowners would still own their own land as they do now. Ownership would only apply to the heat not to the land, buildings or property rights.

The proposal is that DfE's regulation would apply to geothermal heat below 100 metres in depth, while heat within the first 100 metres underground would be unregulated. This reflects the fact that the vast majority of existing underground activity takes place at shallow depths. Assessment of the OpenNI database indicates that around 98% of boreholes, mines and quarries are located within the first 100 metres, and this is also where most householders install small-scale shallow geothermal systems.

DfE recognises, however, that heat underground does not sit neatly within fixed depth boundaries and that geothermal activity above and below 100 metres can interact. For this reason, while licensing would relate to the use of geothermal heat below 100 metres, the proposed framework also includes wider monitoring and information-gathering, including understanding the locations and characteristics of significant shallower systems. This is intended to support sustainable management of the resource, help prevent interference between developments, and protect both existing and future users of geothermal heat.

DfE's role would be to license systems to access and use geothermal heat below 100 metres, subject to clear conditions set out in legislation and individual licences. These conditions would ensure that geothermal developments operate safely, sustainably and in the public interest, while providing confidence and clarity for developers, landowners and communities.

Addressing the ownership of geothermal heat would help make licensing clearer and fairer. If the heat belongs to everyone and geothermal activities are regulated by DfE, it will be certain exactly who is responsible for giving permission to use that heat. This approach follows what other countries with successful geothermal industries already do.

Geothermal heat is renewable, but it can still be overused if it is not managed properly. Establishing public ownership would allow DfE to steward how much heat can be taken from the ground, so the resource will be available for future generations.

If many systems are built in the same area, one system could affect another (for example by reducing the heat available). DfE would ensure that systems do not interfere with each other and that everyone has fair access.

Clear and consistent rules give licence holders more confidence to invest in geothermal systems. Countries like the Netherlands and France use public ownership of geothermal energy to help attract investment because developers know exactly who grants the rights to the heat and what rules will apply.

Alongside the ownership matter DfE would propose that licensed geothermal developers may be granted statutory access rights, subject to safeguards and compensation where appropriate, as set out in legislation. DfE is in the process of obtaining expert legal opinion on ownership and access rights, including what compensation or mitigating measures would be necessary to ensure property rights are respected.

What does this mean for landowners?

Even though geothermal energy will belong to everyone, landowners will keep their normal rights to use and enjoy their land; including farming, building or selling it. Developers will still require a landowner's permission to access their land at the surface but a licensed geothermal developer will be able to access the heat below 100m. Any geothermal work will have to avoid unnecessary disruption and provide compensation if damage occurs.

What does this mean for communities?

Public ownership of geothermal energy allows it to be developed and co-ordinated to provide communities with clean, reliable heat while respecting existing land uses and property rights

Want to find out more?

More detailed information on vesting can be found at Annex C.

QUESTIONS

Annex C has further information on ownership and access which you may want to consider before answering this question.

Question 11

Do you agree with the proposals for public ownership of heat and access to geothermal energy, with DfE responsible for the regulation of the resource?
Please provide reasons to support comments or alternative suggestions.

Question 12

Do you agree that clarifying ownership and access will contribute positively to the geothermal sector?
Please provide reasons to support comments or alternative suggestions.

13

POLICY MONITORING EVALUATION AND REVIEW

DfE will continuously monitor geothermal policy and regulation to ensure that it continuously supports the geothermal sector. It is proposed that a full review of the policy will take place five years after the introduction of the new geothermal legislation.

14

DRAFT IMPACT ASSESSMENTS

This policy has been assessed against Section 75 equality requirements, and has been screened out, as no Section 75 groups are deemed to be adversely affected. A full Equality Impact Assessment is not required. This assessment is available on the DfE **website**.

An initial assessment for the Rural Needs Impact Assessment (RNIA) has indicated no adverse impact on those in rural areas. Geothermal can deliver benefits for rural areas by providing a sustainable option in rural areas where the choices for decarbonised heating are more limited, to the benefit of agri-businesses and other rural consumers. A more detailed assessment will be completed once the policy has become more developed.

A Strategic Environmental Assessment (SEA) and Habitat Regulations Assessment (HRA) on the policy are planned. These will be published alongside the final policy proposals.

A Regulatory Impact Assessment (RIA) will be completed on the final policy proposals and will accompany the consultation on those proposals.

These impact assessments relate only to the proposals to introduce geothermal regulations. The requirements for Planning and NIEA approvals will continue to apply and be unchanged by these proposals.

QUESTIONS

Question 13

Do you agree with DfE's assessment of the equality and rural impacts of licensing geothermal systems?
Please provide reasons and evidence to support your comments.

15

NEXT STEPS

Once this consultation has closed, DfE will analyse all responses and publish a summary of the responses on the department's website. Responses and evidence will be used to inform further consideration of the policy proposals.

A Strategic Environmental Assessment and Habitat Regulations Assessment on the policy proposals will be undertaken to ensure that the final policy properly protects the environment.

Once the assessments are complete a further consultation on the final policy will take place allowing further public consideration of the proposals.

New legislation will be required to give effect to the policy proposals and once public consultation and environmental assessments are complete the Minister will bring the proposals to the NI Assembly as new Primary legislation is needed to introduce the new licensing process.

ANNEX A

FAQS

A more comprehensive list of FAQs can be found on the **GeoEnergy NI** website

Will accessing geothermal energy cause earth tremors?

Unlike 'fracking' geothermal systems do not pump water into the ground at high pressure with a view to creating fractures. The types of geothermal system that are suitable to local geology are unlikely to cause any induced seismicity (earth tremors). However, as part of the licensing process, GSNI will assess the potential risk of induced seismicity for each proposal, especially deep geothermal systems. They will ensure that any developments are appropriate and include mitigation measures in line with international best practice.

What environmental impact will geothermal have?

Geothermal systems have negligible greenhouse gas emissions and can replace fossil fuel heating, so helping to combat climate change. There is a risk that inappropriate or poorly operated geothermal systems may cause contamination of groundwater. However, the licensing and monitoring process, which includes assessments from experts in GSNI, will ensure only systems which would be installed and operated in an environmentally sensitive manner will be approved.

What impact will the new geothermal policy have on property rights?

While recognising the benefits to developing the sector and preventing overexploitation of geothermal resources, it must be balanced against the property rights of landowners affected by geothermal developments. DfE is currently engaging expert legal advice on the implications of public ownership and access rights for geothermal energy and any mitigation measures (such as compensation) that may be necessary.

Will DfE consider financial support for the geothermal sector?

DfE is already funding two major geothermal demonstration projects at Stormont and CAFRE Greenmount Campus. As mentioned previously, these will showcase the potential of geothermal and help grow public support and understanding of this form of renewable energy. On a technical level, they help de-risk future developments by increasing knowledge and providing valuable lessons learned.

Though there are no specific plans for further financial support from DfE at this stage, legislation should allow for it in future. Rather than offering grants, instead DfE may choose to underwrite risk for geothermal developers. This would support developers during the exploration phase, often a time of maximum uncertainty in the system and so reduce their cost of capital.

Will a geothermal licence allow anyone to also extract petroleum or minerals?

No. A geothermal licence would only authorise the development and operation of a geothermal system. It would not grant rights to explore for or extract petroleum or other minerals.

What happens if petroleum or minerals are discovered during geothermal drilling?

It is unlikely that any petroleum or minerals will be found during geothermal drilling, but if it does happen there are clear steps to follow to keep everyone safe and to meet legal requirements.

Work would stop straight away, and the team would make sure the site is safe and poses no risk to public safety or the environment. This could include controlling any gas that has been released and securing the borehole.

After the site is safe and the right people have been notified, the authorities will decide the safest and most appropriate next steps. This could mean sealing the borehole or adjusting the drilling plan.

ANNEX B

GEOTHERMAL LICENSING AND PERMITTING

This section should be read in conjunction with the main consultation. This Annex is intended for technical and industry stakeholders, including geothermal developers, engineers, geoscientists, environmental consultants and other interested parties.

It provides detailed technical, geological and regulatory proposals that underpin the proposed geothermal licensing system. These requirements go beyond the high-level descriptions in the main consultation document and are included to allow specialists to understand and comment meaningfully on the technical standards, assessment frameworks and compliance expectations associated with geothermal licensing.

For ease of navigation, this Annex is structured into defined sub-sections covering definitions, eligibility, licensing processes, data submission, environmental protection requirements, monitoring, enforcement and decommissioning.

Definitions

The following proposed definitions underpin the licensing proposals and these will be incorporated into new legislation:

Geothermal Energy Source

The thermal energy contained in rocks, sediments and/or soils, including any fluid contained in the underground, or naturally discharging at the ground surface, which is available for extraction and/or conversion into energy products.

The Geothermal Energy Source might change over time due to influx to, outflux from, or internal generation of energy within the underground. In geothermal systems, the Geothermal Energy Source may be the thermal energy output (wholly or in part) from an upstream system drawing on the same original Geothermal Energy Source. (“United Nations - UNECE”)

Geothermal System

A geothermal system is a controlled underground heat exchange setup, which includes the extraction, injection and storage of thermal energy, which uses one or more wells drilled into suitable rock layers to access the natural and injected thermal energy contained in the subsurface and which operate together within a single thermal envelope. This includes deep and shallow geothermal systems.

Thermal Envelope

The thermal envelope is the three-dimensional subsurface volume within which temperatures are intentionally altered by a geothermal system through the extraction, injection, or storage of thermal energy. It includes the area of thermal influence created by heat being drawn from, added to, or stored in geological formations as well as the temperature changes occurring in surrounding groundwater and rock due to system operation.

Deep Geothermal

Deep geothermal refers to the extraction of heat from geological formations located at depths greater than 500 metres.

Shallow geothermal

Shallow geothermal refers to the extraction or use of heat from the subsurface at depths from ground level down to approximately 500 metres.

Exempt geothermal systems

DfE does not intend to licence horizontal ground source systems.

Small geothermal systems providing up to 60kW of heating will also be exempt from the licensing requirements. However, these systems would still be subject to the usual existing planning requirements from the local council.

However, it would be useful for DfE to hold information on all geothermal systems, including basic details such as location, type and heating load. Whilst there is no plan to collect this information, it is proposed that powers will be taken so that this information can be obtained should there be a future need.

Proposal for Existing Geothermal Systems

Geothermal systems (apart from those that are exempt) that have been installed prior to the commencement of the licensing regime will, initially, be issued a deemed licence and will be eligible for a full licence, provided that they demonstrate that they are operating in accordance with their original design and are not causing any adverse environmental impact.

DfE will operate a light touch regime in these cases, requiring only limited information on type, location and heat extraction rates.

Licensing existing systems will provide a safeguard against any detrimental effects arising from the installation of new geothermal systems nearby, ensuring continued protection of both the resource and the environment.

Proposal for Exploration Licences

An exploration licence will be available to give certainty and protect a potential developer's right to the heat while testing and design take place. It is anticipated that this type of licence will only be required for very large shallow or deep geothermal systems. The licence will be valid for a period of five years and will only be renewable in instances where reasons for delays are clearly demonstrated, with a maximum duration not exceeding 7 ½ years. The applicant will be required to submit an exploration plan setting out the activities that will take place during the period of the licence. Should DfE determine that the applicant has not complied with the proposed plan the licence may be revoked.

The exploration licence will grant exclusive rights to the surface and estimated subsurface envelope to conduct geological surveys, geophysical studies, and exploratory drilling for geothermal development within the licensed area. This will allow the exploration licence holder to conduct testing to assess the viability of the system.

Applicants must demonstrate their technical capability and financial backing to successfully complete their stated work programme. Exploration licence holders will be required to submit annual progress reports to DfE for the duration of exploration licence.

Once the exploration programme is complete the exploration licence holder can then apply for a full geothermal licence to cover the full extent of the exploration area or a lesser area. If a geothermal licence is issued for a lesser area the remaining area will be available for future licensing.

Conditions of an exploration licence will explicitly prohibit exploration for minerals or petroleum.

As part of the licence conditions, applicants must agree all subsurface data submitted to DfE will be deposited into the NI geothermal database once a full geothermal licence has been issued or the developer makes the decision not to proceed to a full licence or after a period of 3 years from the cessation of the exploration licence, whichever is the shortest.

Shallow Geothermal (Vertical)

Operators intending to develop shallow vertical geothermal systems; defined as installations down to 500 metres in depth; will be required to apply to DfE for a geothermal licence. This licence will cover the use of the system to provide heating, cooling and heat storage as part of the system design.

Applicants will be required to submit comprehensive system details to DfE, including:

- Location of the proposed system, particularly borehole coordinates.
- Maximum target borehole depth and, for open loop systems, the subsurface location of extraction and discharge points. Final systems cannot exceed this depth.
- Heat extraction and or heat storage parameters, including expected temperature and flow rates and predicted subsurface temperature changes. Final systems cannot exceed these parameters.
- A sufficiently detailed geological model, identifying aquifers and subsurface conditions.
- Heat plume modelling, to assess thermal impact and potential interference with nearby geothermal sites and sensitive environmental receptors.
- Proof of landowner permission.
- Proof of compliance with recognised industry standards in the design, drilling, construction, and operation of their systems.
- Proof of appropriate environmental screening or assessment to ensure that potential impacts are identified and mitigated in line with regulatory and environmental obligations, or a formal Environmental Impact Assessment (EIA) as required by the planning authorities.
- Proof of technical and financial capacity to ensure the systems will be operated and maintained to industry standards.
- Proof of financial guarantees for decommissioning and environmental liabilities proportionate to the scale of the system, depth of the drilling and or the amount of heat being extracted.

DfE will obtain expert advice from GSNI, who will assess the suitability and sustainability of the proposed heat extraction and or storage system.

DfE will issue a full operating licence once its assessment of the application is complete and the geothermal system proposed will be carried out in a safe, sustainable, and environmentally responsible manner, which protects the integrity of subsurface resources.

Following the installation of the system the licence holder will be required to provide details of the final design. DfE may issue a geothermal licence independently of planning or NIEA approvals. However, the developer must ensure that all other required consents (e.g. planning, NIEA abstraction/discharge) are in place before physical installation or operation begins.

If an application is unsuccessful, DfE will provide clear reasons and identify deficiencies. Applicants may submit additional information for reconsideration to DfE within a defined timescale.

Deep Geothermal

Deep geothermal systems will undergo a broadly similar licensing process to shallow systems. However, due to greater depth, the assessment process will be more technically complex and involve greater scrutiny of the potential geological and environmental impacts.

In addition to the shallow system requirements listed above, deep geothermal applications will require details on:

- Geological and geophysical data that supports the model development.
- Well design and drilling plans.

As with shallow systems, DfE will issue a licence once its assessment is complete and the system meets the required standards. Following the installation of the system the licence holder will be required to provide details of the final design. Should geological uncertainty result in a significant change to the subsurface location of the boreholes a new application will be required to ensure that the system is suitable.

Planning and NIEA approvals are separate regulatory processes and are not prerequisites for DfE licensing. However, operators must hold all relevant permissions from other authorities before installing or operating the geothermal system.

Thermal Storage

The licensing regime will include thermal storage systems. Where heat is stored as part of a geothermal system the storage element will be assessed as part of the larger system design.

This will apply to all new installations and significant expansions of existing systems involving the subsurface storage of heat or cold. As a minimum thermal storage systems must be situated a minimum safe distance from sources of drinking water to prevent thermal or hydrological interference and comply with industry standards for well construction and pressure.

The proposed licensing system will take a three-tiered approach to thermal storage based on risk.

Tier 1: Small scale / Low risk

This applies to systems storing up to 200MWh of heat between 25°C and 5°C outside critical groundwater zones (e.g. close to sources of drinking water). This would require only a basic application covering a site description and a basic hydrogeological survey. The system would be subject to standard annual monitoring and reporting requirements.

Tier 2: Medium Risk

This applies to systems storing between 200 to 2000 MWh of heat up to 40°C or Tier 1 systems near sensitive sites. The application would require full thermal and groundwater modelling and stakeholder consultation. These sites would be subject to more regular water quality monitoring and reporting than Tier 1.

Tier 3: Large Scale / High Risk

This applies to systems storing over 2000 MWh of heat over 40°C in urban or confined aquifers or near sources of drinking water or Tier 2 systems near sensitive sites. The application would require an Environmental Impact Assessment, comprehensive modelling of thermal and groundwater impacts and guarantees of financial security. These sites would require real-time monitoring with automatic safety triggers.

All applications must include decommissioning plans, including well sealing procedures and post closure monitoring, to prevent contamination of groundwater systems.

Large Scale Water Abstraction

All existing large scale water abstraction systems should be registered with DfE as by abstracting large volumes they impact the local thermal characteristics of the aquifer. This is proposed to be a registration process with only limited information required, such as location, depth and water abstraction rate.

Large scale would be defined as extraction rates over 20m^3 per day[7], i.e. requiring a water abstraction licence. It would not apply to wells for private or typical agricultural use.

Duration of Licence

DfE is proposing to issue licences for up to 25 years with a review every 5 years to reevaluate the performance and operation of a system and to confirm that the licence and its conditions are still appropriate. Two licence extensions will be available to compliant licence holders; each extension will be for up to 12 ½ years. Licences for inactive geothermal systems may also be withdrawn after a period of inactivity. At the end of the extension periods the licence holder can apply for a new geothermal licence; assessment of which will be expedited to ensure continuity and certainty for the applicant.

7 Abstraction and impoundment licensing requirements | Department of Agriculture, Environment and Rural Affairs

Variation of a Licence

Where an operator proposes to change the way a licensed geothermal system functions; such as increasing heat storage, adjusting heat extraction or injection rates, or adding new boreholes within the same thermal envelope an application for a variation of the licence will be required. This is to ensure continued safe and sustainable operation. A formal licence variation allows the Department to assess these impacts, ensure they remain within acceptable limits, confirm that the expanded system maintains thermal balance and environmental protection, and verify that it continues to comply with industry best practice and the monitoring requirements set out in geothermal policy and guidance

DfE may also seek to vary a licence if ongoing monitoring identifies issues with system design or operation that adversely impact or have the potential to adversely impact the thermal and hydraulic behaviour of the subsurface. This could include the extent of thermal interference and the interaction between wells.

Public Consultation

It is proposed that all geothermal licence applications, including geological, operational and environmental data will be published on the DfE geothermal website. Commercially sensitive or personal data will not be shared.

The proposed format of the public consultation will be as follows:

- The applicant will be required to advertise the application in newspapers which serve the community in which the system is to be installed.
- DfE will publish a notice in the Belfast Gazette.
- There will be a 28 day period for responses. In certain cases, the consultation period may be extended beyond 28 days. This may occur when the proposed geothermal activity is of significant scale or complexity, the development is near environmentally sensitive areas or there is substantial public interest. Any extension will be communicated clearly through public notices and relevant platforms.

The advertisement and notice will direct people to the DfE website where they will be able to view details of the application and take part in an online consultation process. There will also be the option to write to DfE with comments. The consultation process will take place following with the DfE / GSNI assessment of the project as being technically feasible and include details of the assessment process. This consultation relates solely to the DfE geothermal licensing decision and will run independently of any planning or NIEA processes.

Responses from the consultation will be considered in making the final decision on the suitability of the proposed geothermal system.

DfE will also consult with other statutory bodies. These may include:

- Local councils
- Department for Infrastructure (DfI)

The consultation responses, the decision and rationale behind it will be published on the DfE website.

Transboundary Obligations

This relates to cross border environmental issues, as per the Espoo convention[8]. As part of the assessment process DfE will screen each application to determine if there is any cross border environmental impact.

Right of Appeal

There will be a right of appeal for the geothermal system operator to decisions made by DfE. This will either be heard by the Lands Tribunal or the Planning Appeals Commission, subject to agreement with DOJ.

Operator Requirements

Operators will be required to provide evidence that they have the technical and financial capacity to ensure that the systems will be maintained. Operators will be required to provide financial guarantees for decommissioning and environmental liabilities proportionate to the scale of the system, depth of the drilling and or the amount of heat being extracted.

Operators will be required to monitor system operation in line with licence conditions, and it is anticipated that will include flow rates, heat extraction rate, water chemistry, air emissions, and monitoring seismicity, where appropriate.

Cost transparency and financial reporting

To support a fair, transparent and investable regulatory framework for geothermal development, licence applicants will be required to provide cost information sufficient to allow the DfE to understand the economic characteristics of proposed geothermal systems.

8 Espoo Convention | UNECE

DfE recognises that the geothermal sector in Northern Ireland is at an early stage and that project costs are currently highly variable and site-specific, reflecting differences in geology, depth, drilling conditions and system design. DfE does not therefore propose to set heat prices or impose rigid cost controls at this stage. Instead, proportionate cost transparency will be used to support market development, inform benchmarking and monitor affordability as the sector matures.

As part of a geothermal licence application, it is proposed that applicants will be required to submit information on:

- capital costs associated with drilling, borehole construction and surface infrastructure;
- anticipated operating and maintenance costs;
- key system performance assumptions, including heat output and expected annual energy production; and
- the high-level financial assumptions used to assess project viability.

The level of detail required will be proportionate to the scale, complexity and risk profile of the system being proposed.

Where geothermal heat is supplied beyond a single owner or occupier, applicants may also be required to provide a transparent cost assessment demonstrating how heat charges relate to underlying capital and operating costs.

Licence holders will be required to update relevant cost and performance information during the licence period. This will enable DfE to monitor cost trends, identify material deviations from expected performance, and support evidence-based policy review.

DfE will use this information to develop benchmark cost ranges, understand market development, and identify outliers. Intervention on cost grounds will take place only where there is evidence that costs are excessive, unjustified, or inconsistent with efficient system design, consumer protection or the sustainable management of publicly owned geothermal heat.

Construction and Operating Standards

DfE will work with industry experts to understand the construction and operating standards of geothermal systems, and how they could be included as criteria in the assessment process. DfE will require that all systems are designed to appropriate industry best practice in design, operation, performance, safety and environmental security as part of the licensing process. All applicants must demonstrate that their system is compliant with best practice. For new or novel systems applicants will be required to provide sufficient data for GSNI to assess the suitability of the system.

Enforcement

DfE's proposed geothermal legislation will allow for the regulation and enforcement of geothermal licence conditions. This will include:

- Right of entry on to the geothermal site to inspect the operation or decommissioning of the geothermal system and carry out relevant tests.
- The right of access to monitoring data in relation to the operation of the geothermal system, including temperature and pump rate data, to allow DfE to ensure the system is performing in accordance with licence conditions
- Penalties, including prosecution, for operating an unlicensed geothermal site, or operating a geothermal site in contravention of licence conditions, or obstructing DfE or mandated personnel from inspecting or testing a geothermal site, or failing to decommission a geothermal site appropriately.

Proposed Fees

The legislation will allow DfE to charge fees for the licensing process and provide the ability to update the charges over time to allow for cost increases.

Fees will be set on a full cost recovery basis.

A licence application fee will be payable in full on application. Fees will not be refunded if the application is ultimately unsuccessful.

It is anticipated that a small annual fee will be charged to cover the cost of monitoring and enforcement by DfE.

Consideration will be given to including provision for levying a small charge to cover the cost of activities that would contribute to the growth of the local geothermal sector or provide other benefit to local communities. This could take several forms, such as:

- Funding local geothermal research
- Funding local training courses in geothermal related subjects
- Outreach programmes to promote geothermal energy to the public

Proposed Decommissioning

At the end of their operational lives, geothermal systems must be decommissioned safely to prevent contaminants from entering groundwater systems. Before proceeding with any decommissioning work, operators must first lodge a detailed plan with DfE. This will include:

- Timeline
- Safety procedures
- Risk assessment
- Removal of infrastructure
- Removal of polluting chemicals
- Sealing boreholes
- Waste management
- Site restoration

This plan will be reviewed by DfE and GSNI. Decommissioning can only proceed once approval has been granted by DfE. DfE will monitor the decommissioning process, including site visits.

If DfE identifies issues at any time during the decommissioning process, the operator will be required to address them. Failure to inform DfE, agree a decommissioning plan or comply with recommendations will result in enforcement action being taken by DfE.

Once DfE and the operator agree that the decommissioning process is complete, the licence will be revoked and recorded on the public geothermal data portal.

Proposed Transfer of Ownership Requirements

The geothermal licence relates to the system not the operator. However, if at any time during its operation the geothermal system is sold, the owner must inform DfE of the change in ownership. The new owners will be expected to have appropriate expertise and financial capability to operate the system and to adhere to the terms of the licence.

ANNEX C

OWNERSHIP AND ACCESS TO GEOTHERMAL ENERGY

As part of the introduction of a new regulatory regime, DfE is proposing to take powers to provide that the public owns all geothermal energy in NI, with the exception of the first 100 metres in depth which is where most individuals would seek to install their own shallow systems and where around 98% of boreholes, quarries and mining activities currently take place.

DfE commissioned a report from Arup to evaluate the local geothermal sector. It highlighted that clear ownership of geothermal heat and secure access to that heat are essential for the successful development and regulation to the geothermal sector in Northern Ireland. It recommended that the ownership of and access to geothermal heat should be clearly set out in legislation to provide legal certainty for developers and investors, ensuring sustainable management of the resource, enabling effective licensing and regulation.

Legislating for ownership of and access to geothermal energy would allow DfE to more effectively manage geothermal developments preventing over-exploitation and maintaining the valuable heat resource. It would ensure each geothermal system is managed sustainably, protecting the environment and preventing developers from over extracting heat and potentially adversely impacting an otherwise renewable source of zero carbon energy. It would also allow DfE to ensure that new geothermal systems would not be able to take or reduce the heat available to existing systems and, where heat is stored in the subsurface the owner of the heat will have confidence that it is secure.

International examples of ownership of geothermal energy

Netherlands: Geothermal heat is owned by the state, and a dedicated licensing regime governs its exploration and use. This has provided clarity and encouraged investment in geothermal systems.

France: The state owns subsurface resources, including geothermal heat, and issues licences for their use, ensuring both public benefit and private sector participation.

Ireland: In the 2023 policy statement "Geothermal Energy for a Circular Economy", the Irish government has stated its intention to vest control of geothermal energy with the Minister for Climate, Energy and the Environment.

Balancing Public Interest and Property Rights

DfE recognises that legislating to provide for ownership of and access to geothermal energy necessarily interacts with private property rights. Any interference must pursue a legitimate public interest (such as climate action, energy security, and economic development) and strike a fair balance between the general interest of the community and the protection of individual rights.

In this context, the public interest in decarbonising energy, ensuring sustainable management of a renewable resource, and supporting economic growth provides a strong justification for vesting. However, to comply with human rights obligations, the legislation may need to include safeguards such as:

- Provisions for compensation where property rights are adversely affected.
- Transparent and fair procedures for licensing and oversight.
- Mechanisms for stakeholder engagement and dispute resolution.

DfE has commissioned expert legal advice on the matters of ownership of and access to geothermal and any mitigating measures that may be needed. This advice will inform further policy development and any resulting legislation.

Compensation

Depending on the outcome of the legal advice, DfE may take powers to obtain monies from geothermal system operators, potentially based on the amount of heat extracted. These payments would be retained by DfE to be used towards compensation payments to landowners affected by geothermal developments. Any surplus may also be used in projects to support the local geothermal sector or community benefit proposals.

ANNEX D

NI GEOTHERMAL DATA PORTAL

DfE proposes developing a geothermal data portal. This would incorporate web-based Geographical Information Systems (GIS) and map viewers, which provide information and maps of geothermal resources to help developers and policy makers to identify opportunities for deployment of geothermal technologies.

Benchmarking with France and Germany suggests that the portal should incorporate interactive GIS tools and standardised data formats to support developers and planners in identifying viable geothermal sites.

As part of the licensing conditions all applicants will be required to share the geological data arising from their investigations and test drilling. The nature of this data and the timeframe for publication have yet to be decided. DfE recognises that some data may be commercially sensitive and may have the potential to adversely impact the economic viability of a project and where the licence holder can clearly demonstrate that this is the case provision of data will be deferred.

GSNI will be responsible for collating this data on the portal and maintaining the database. The operational costs of the database will be covered by a portion of the geothermal licence fees.

ANNEX E

HEAT PUMPS

Many geothermal systems will require a heat pump to raise temperatures to level suitable for heating buildings.

A heat pump absorbs heat from the ground or air and upgrades the heat to temperatures suitable for heating buildings. It acts in a comparable way to a fridge, only in reverse. An Air Source Heat Pump (ASHP) absorbs energy from the air, while a Ground Source Heat Pump (GSHP) absorbs energy from the ground via water or coolant circulating in underground pipes or from a borehole.

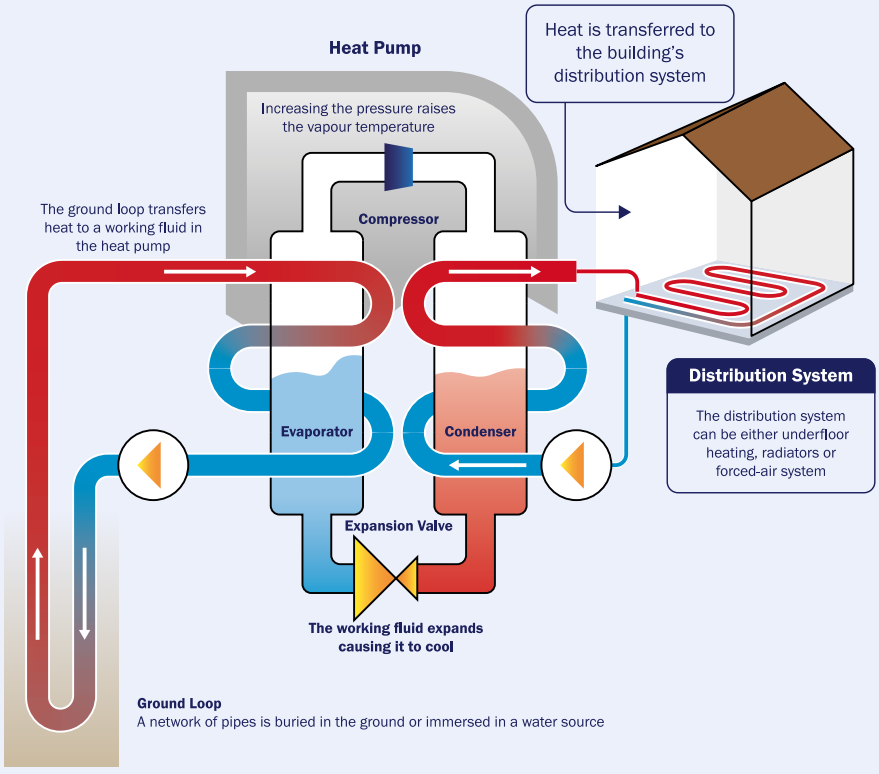


Fig. 6 Simplified diagram of a heat pump showing how heat is absorbed from the ground, compressed to raise its temperature, and released to heat a building.

The operation of a heat pump can be explained as follows:

1. A heat exchanger absorbs background heat, which is used to evaporate a refrigerant.
2. This is passed into an electric compressor which increases the pressure and temperature of the gas.
3. It then passes through a second heat exchanger, where the energy of the higher temperature gas is transferred to the heating circuit of a building. This causes the refrigerant to cool down and become a liquid.
4. It then flows through an expansion valve to reduce the pressure and temperature further to below the background temperature, allowing the cycle to begin again.

Heat pumps are very efficient because they can produce more heat than the electrical energy they use. This efficiency is shown by a number called the Coefficient of Performance (CoP). For example, if a heat pump has a CoP of 3, it means that the heat pump is producing three times more heat energy than the electrical energy it uses.

GSHPs are usually more efficient than ASHPs because the temperature underground stays warmer and more steady throughout the year compared to the air. This makes it easier for GSHPs to collect heat and they do not have to work as hard.