Chapter 8

Beyond the North Sea: Leveraging the United Kingdom's Oil and Gas Expertise to Advance Geothermal

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By developing a robust geothermal industry, the United Kingdom can convert its oil and gas know-how into a world-class geothermal industry—lowering bills, strengthening energy security, and creating high-value jobs.

The United Kingdom's oil and gas industry is recognised globally for its expertise. Adding geothermal energy to the landscape may offer a powerful way to create jobs and spur economic growth by capitalising on the country's existing knowledge and oil and gas workforce.

The oil and gas sector currently supports close to 200,000 jobs in the UK and contributes £25 billion in economic value annually.[1] But a report from Robert Gordon University forecasts that direct and indirect jobs in the sector will fall to between 57,000 and 71,000 by the early 2030s.[2]

In that same period, geothermal energy production could grow, increasing demand for drilling engineers, geoscientists, plant operators, and complex project managers. Of all of the low-emission technologies available, geothermal and oil and gas have the most overlap in necessary skills and expertise.

The Robert Gordon University report underscores the urgent need for a coordinated transition strategy focused on recruitment, re-skilling, and maintenance of a balanced workforce. The transition must be handled in a way that ensures workers can transfer their knowledge into a thriving, sustainable energy sector. This is particularly true in Scotland, where expertise in exploration, engineering, fabrication, and financial services can apply to geothermal and help ensure the health of the country's economy.

According to the World Bank, geothermal "creates more jobs than natural gas and other utility-scale electricity generation technologies on a per megawatt basis at a comparable cost of electricity," and these jobs are of better quality and longer duration.[3] Multiple studies assume that somewhere between 5 and 10 jobs are created per megawatt of geothermal power, heat, or cooling generated.[4,5,6]

Currently, the most promising near-term opportunities to grow geothermal in the UK are for heat. This potential can be found in small-scale home heating and cooling systems; larger, district-wide heating networks like the Gateshead minewater heating scheme, which uses the water from underground mines to heat community buildings and hundreds of homes; and industrial process heat. These projects require many of the same technical skills and supply chain capacities that underpin the oil and gas sector, including drilling, reservoir characterisation, safety and environmental safeguarding, and project integration. The United Kingdom could adopt a geothermal goal of 15 gigawatts for heat and between 1.5 gigawatts and 2 gigawatts for electricity by 2050, which could yield between 80,000 and 170,000 jobs. This estimate is in line with other projections: The UK's National Geothermal Centre estimates that achieving its suggested goal of 10 gigawatts of geothermal heat and 1.5 gigawatts of electricity could create 50,000 direct jobs and 125,000 indirect jobs.[7] By leveraging its established industrial base, the United Kingdom could cultivate a domestic geothermal heat industry capable of supporting thousands of skilled jobs and contributing to regional economic renewal.

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Other European nations—including France, Germany, Belgium, and the Netherlands—have shown that geothermal energy projects offer both environmental and social benefits, from greenhouse gas reductions to economic stimulus and job creation. Since 2000, the German geothermal sector has generated €16.7 billion and created 35,000 jobs.[8] This chapter explores how the geothermal and oil and gas industries can work together to be productive partners in the United Kingdom.

OPPORTUNITIES FOR THE UK OIL AND GAS WORKFORCE

The United Kingdom has a range of potential applications for geothermal energy, including ground source heat pumps for residential properties, direct-use thermal networks for communities and businesses, and hot dry rock for electricity generation. While there is considerable overlap, the skill sets needed for each type of project are not identical.

Mines

One of the most obvious opportunities for partnerships between the oil and gas and mining industries and geothermal is the significant number of inactive and closed mines—and capped or decommissioned oil and gas wells—that can be ideal and cost-efficient to use for heat production.

The United Kingdom has about 23,000 deep coal mines and thousands of metal mines,[9] with water in them at temperatures between around 15°C and 25°C. The conditions offer promising opportunities for heat production. A study by the British Geological Survey showed that 25% of properties in the UK are located near or above flooded mines.[10] A number of projects designed to take advantage of this potential are currently in development, and some are already active: In 2023, for example, the Gateshead Energy Company began using a 6 megawatt water source heat pump to pull heat from 150 metres below the surface of abandoned coal mines within the UK's largest minewater network. The project supplies heat to a range of buildings in town, including 350 council buildings. It is projected to save 72,000 tonnes of carbon dioxide over its 40-year lifetime.[11]

Wells

The United Kingdom has about 2,100 onshore wells that were drilled for oil and gas, coal bed methane, or other purposes.[12] Depending on a few factors—such as heat at depth and location—a number of these wells could be repurposed to produce heat or electricity, which could reduce geothermal development costs by avoiding

high capital costs associated with drilling. In 2023, CeraPhi,[13] a UK geothermal development company, partnered with the Net Zero Technology Centre,[14] Third Energy, Weatherford, and Genius Energy Lab on the first successful attempt to produce geothermal energy from a repurposed hydrocarbon well in Kirby, Yorkshire. The project in Kirby could provide a model for using other wells in the future.

MOBILISING THE SKILLED OIL AND GAS WORKFORCE

The UK oil and gas industry has many skilled workers who would be crucial to developing geothermal energy projects, including project managers, well-site geologists, drillers, mud engineers, wireline loggers, rig crews, casing engineers, subsurface modelling experts, drilling professionals, corrosion mitigation specialists, and data analysts.[15]

TRANSFERABLE SKILL SETS FROM THE OIL AND GAS INDUSTRY

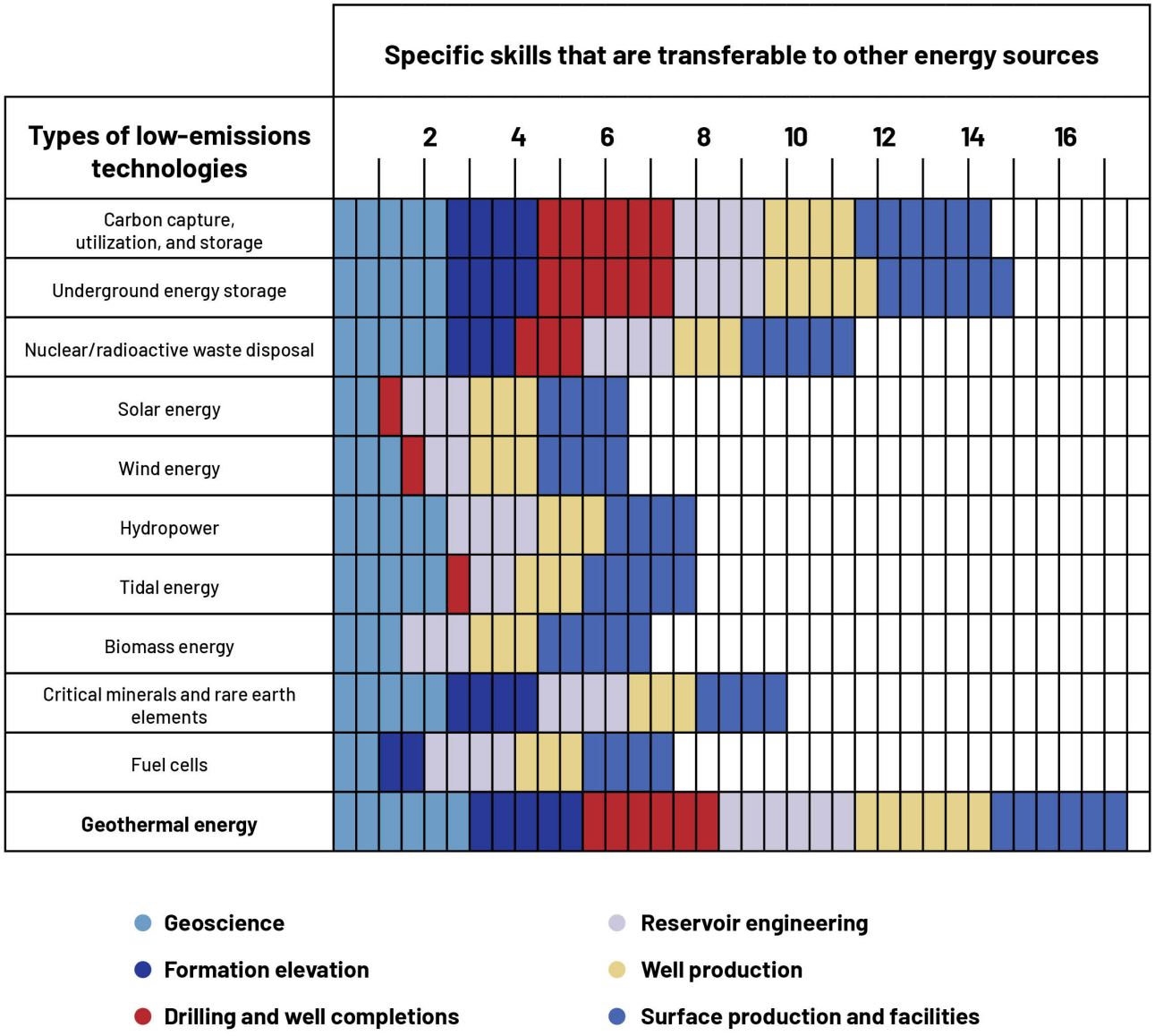


Figure 8.1: Geothermal requires the most skills from the oil and gas industry of all resilient energy production. Source: Tayyib, D., Ekeoma, P. I., Offor, C. P., Adetula, O., Okoroafor, J., Egbe, T. I., & Okoroafor, E. R. (2023). *Oil and gas skills for low-carbon energy technologies*. Society of Petroleum Engineers Annual Technical Conference and Exhibition. San Antonio, TX, United States.

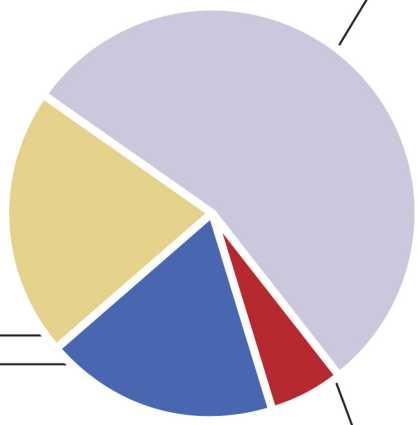
OIL AND GAS SKILLS OVERLAP WITH DEEP GEOTHERMAL PROJECTS

Exploration

- Desk-based surveys
- Remote sensing
- Structural geology field investigations
- Geophysics and geochemistry
- Hydrogeological/geothermal reservoir modelling
- Economics analysis
- Community engagement
- Slim-hole/gradient test drillings
- Seismic hazard assessment and monitoring

Well Field Development and Construction

- Site enabling works
- Drilling
- Hydraulic stimulation (if required)
- Pumping test
- Power and/or heat plant/ energy centre construction
- Steam gathering system and substations, connection to grid (if a power plant)
- Construct infrastructure
- Health and safety
- Community engagement



Planning

- Well design
- Power plant/energy centre
- Health and safety
- Planning application
- Environmental and regulatory approvals
- Community engagement
- Contractor procurement

Operation and Maintenance

- Start-up commissioning
- Operations and monitoring
- Maintenance, refurbishments, workovers, and makeup well drilling (if required)

Direct job for a typical deep geothermal project

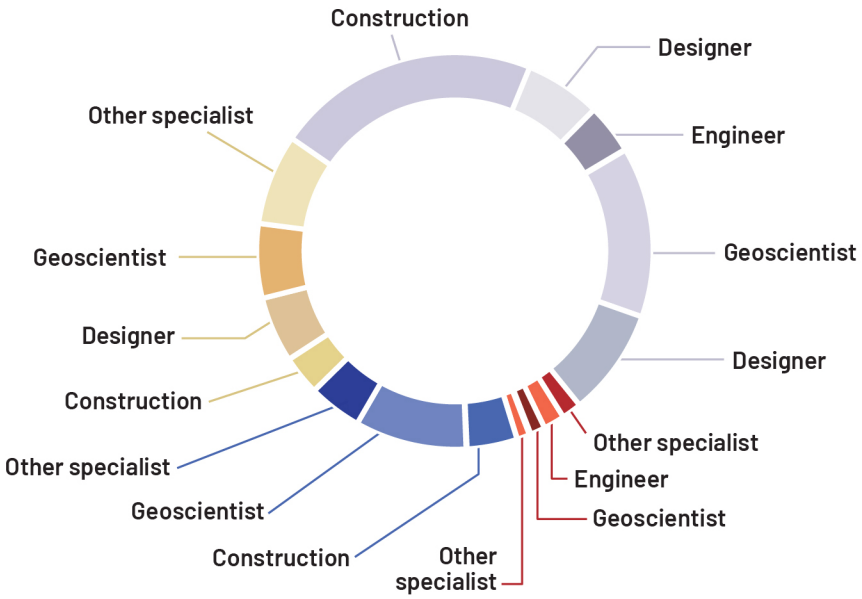


Figure 8.2: Supply chain activities for deep geothermal projects and the considerable overlap with oil and gas workforce skill sets and activities. Source: Adapted from ARUP. (2021). *Deep geothermal energy: Economic decarbonisation opportunities for the United Kingdom*.

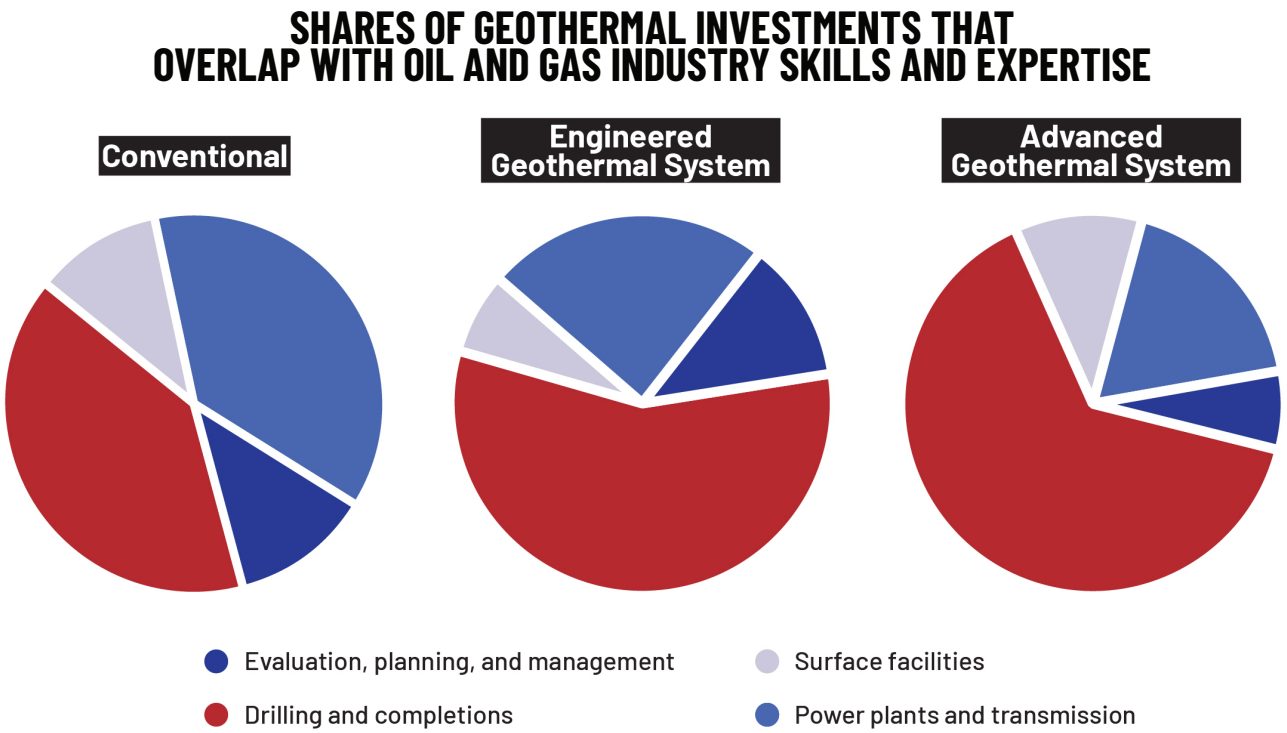


Figure 8.3: Each variation of geothermal requires pretty much the same skills as those found in the oil and gas industry. Source: International Energy Agency (IEA). (2024). *The future of geothermal energy*. IEA.

Given the high degree of skill overlap, it is no wonder that geothermal has one of the highest transferable skills bases across low-emission technologies, as shown in **Figure 8.1**.[16]

Oil and Gas Skills Overlap in Deep Geothermal Projects

Developing new geothermal projects requires subsurface evaluation, modelling, drilling, and surface operations—processes similar to those used in many upstream oil and gas projects. These tasks draw heavily on the expertise of geologists, geophysicists, petrophysicists, geochemists, drilling and reservoir engineers, data acquisition crews, and geographic information specialists.

Similarly, civil, mechanical, chemical, and electrical engineer designers are required for many phases of a geothermal project, including planning, construction and operation for well design, drilling, operation, monitoring, and maintenance. Both experienced and new petroleum engineering professionals' skills map well to the requirements of a geothermal reservoir engineer.[17]

Some of the biggest project overlaps between the oil and gas and geothermal industries are in the areas of project planning and management. Project management challenges such as permitting, Environmental Impact Assessments, and stakeholder engagement are similar in both sectors, as are demands around drilling and completion, surface facility construction and maintenance, and operations and production monitoring.

Oil and Gas Skills Overlap in Geothermal Heat Projects

The United Kingdom's shallow geothermal resources also offer opportunities for workers in the oil and gas industry. While volcanic deep systems dominate global attention, the UK approach focuses on accessible solutions such as heat pumps (with more than 40,000 installations supported by government programmes as of 2025[18,19]), district heating networks, and minewater systems. The Gateshead minewater heat network demonstrates the commercial viability of these systems, whereas newer projects in Wales and Seaham demonstrate the promise of geothermal heat across former coalfield regions.

Oil and gas professionals have directly transferable expertise that is relevant to geothermal development, particularly in subsurface geology modelling, fluid dynamics, and safety management. Their understanding of geological interpretation, structural analysis, and 3D modelling applies to geothermal resource assessment, whether in aquifers or flooded mine workings. The oil and gas sector's established health, safety, and environmental management provides useful foundations for geothermal operations. Existing frameworks for gas detection, blowout prevention, environmental compliance, and regulatory approval require adaptation for geothermal applications. The UK also has a supply of experienced drill rig operators who understand how to work efficiently and safely and would require minimum retraining and reskilling to drill the shallower wells required for district heating and cooling.

The oil and gas fabrication and manufacturing supply chain is positioned to support shallow geothermal deployment, bringing precision engineering expertise that is applicable to ground source heat exchangers, drilling infrastructure, and modular heat pump systems. Beyond domestic applications, the UK's North Sea drilling experience provides relevant capabilities for engineered geothermal systems in international markets with different geological conditions. By developing geothermal as a domestic opportunity and a potential technology export, the oil and gas sector can diversify operations, support the transition to low-carbon heating solutions, and contribute to decarbonisation efforts.

Training the Future Geothermal Workforce

As geothermal develops, there is likely to be significant competition for positions among workers transitioning from other sectors and new entrants to the field. A shared challenge across sectors is compensation. Currently, the renewables market does not offer salaries at the same level as oil and gas. An industry pay bechmarking report commissioned by Offshore Energies UK concluded that oil and gas remains the highest-paying sector, with salaries exceeding those in offshore wind, hydrogen, carbon capture, and other renewables by an average of between 15% and 50% and that emerging sectors (including geothermal) tend to pay lower on average.[20] Although the UK oil and gas industry is mature and the number of roles may decrease, this trend is not universal. Many oil and gas professionals are willing to work internationally, attracted by higher pay, which can contribute to skills shortages for renewable projects in the UK.

One opportunity for workforce development might be among the coal mining communities in areas like South Yorkshire, England, and Lanarkshire, Scotland. The UK's transition away from coal has resulted in economic hardship in those communities. The government provided £75 million in funding for training and retraining programmes in pit closure areas specifically to help former miners find new employment, but the regions still suffer from high levels of unemployment.[21] These workers would be good candidates for retraining and deployment in a newly burgeoning geothermal sector.

Where to Get Training

With engineering and design (mechanical, chemical, and civil), geoscience, and petroleum engineering as the core backgrounds required for geothermal, there is no shortage of training opportunities for those wanting to learn about the field. Several universities are pivoting from an oil and gas focus by offering dedicated modules within broader energy programmes or specialised short courses. The British Drilling Association provides information on the training and qualifications required to undertake geothermal drilling.[22] The following university programmes are a sample of what is available:

- The University of Manchester offers a Master of Science in subsurface energy engineering.[23]
- Robert Gordon University offers a short course on geothermal energy and applications.[24]
- The University of Aberdeen offers a master's-level online short course on geothermal and hydro energy.[25]
- The University of Edinburgh School of Geosciences GeoEnergy Master of Science program looks at research on established energy technology and developing areas such as geothermal.[26]
- Durham University has a leading UK geothermal research centre.[27]

Additionally, the London School of Business Administration offers a certificate programme in geothermal that covers areas such as energy systems,[28] plant design, and energy policies and practices.

In addition, joint research and development projects between public institutions and private companies can drive innovation in geothermal technology. These partnerships could focus on developing new drilling techniques, improving efficiency, and reducing costs while also providing training opportunities for researchers and engineers.

Today, the geothermal industry provides around 145,000 jobs globally.[29] The oil and gas industry employs about 12 million workers globally.[30] To narrow that gap, UK governments could expand partnerships with universities and private companies to develop specialised geothermal training programmes and include internships, apprenticeships, and hands-on training opportunities to ensure students gain practical experience alongside theoretical knowledge. These efforts would help geothermal grow into a thriving industry.

Existing Programs as Potential Models

A number of existing skills programmes could be expanded to include geothermal. For instance, the Offshore Petroleum Industry Training Organization (OPITO) developed an Integrated People and Skills Strategy[31] as part of the UK's North Sea Transition Deal, a partnership between the government and industry to transition the United Kingdom away from fossil fuels. Launched in May 2022, the program aims to train people on skills that translate to other energy sources. OPITO offers apprenticeships that provide training and qualification in the energy industry.[32] Many of the apprenticeships focus on opportunities in oil and gas, hydrogen, carbon capture and storage, and offshore wind. With some effort, these apprenticeships could also include geothermal-specific qualifications and skills.

Offshore Energies UK (OEUK), in partnership with RenewableUK, launched the Energy Skills Passport website in January 2025. The platform is currently designed to help workers identify the qualifications needed for specific roles within the oil and gas and offshore wind sectors. The tool also outlines potential career pathways within the broader energy industry. The program started as a pilot and will be released later this year. As the UK energy landscape continues to advance, the passport will be regularly updated to include new training opportunities and job availability, with plans to extend coverage beyond offshore skills to areas such as geothermal energy.

TECHNOLOGY DEVELOPMENT AND CHALLENGES AND WHERE THE OIL AND GAS INDUSTRY CAN HELP

Around the world, technical hurdles in both conventional and emerging geothermal operations represent opportunities for the UK oil and gas supply chain and workforce. This section provides an overview of the various geothermal systems, the challenges they face, and ways they could benefit from oil and gas experience.

Well Structure Stability

Well structure stability is an ongoing issue for the geothermal industry, particularly in mature conventional geothermal wells, which were designed according to oil and gas standards without taking into account geothermal's unique environment and operational stressors.[33] The dynamic conditions of injection and production and the high temperatures in geothermal wells can lead to an increase in stress, resulting in casing fatigue and failure. These issues can have a large impact on the productivity of a well and create ongoing maintenance costs.

These challenges present an opportunity for the oil and gas supply chain to develop innovative solutions for geothermal well stability and to extend the life of conventional wells. Opportunities could include new cements, new materials to strengthen casing, and flexible couplings. GeoWell and DEEPEGS are two European Union–funded projects already looking into solutions.[34]

Scaling and Corrosion

Geothermal fluids contain various substances that can cause scaling and corrosion of materials over time. Fluid composition is site specific, making this a complex problem, but the oil and gas industry has significant knowledge in this space that could be applied to geothermal projects. One oil and gas supply

chain company, Roemex, has begun developing a range of chemicals, monitoring, management, and reporting services for the deep geothermal market.[35] Its solutions include inhibitors for corrosion and scaling as well as remedial treatments designed to reduce injection pressures to improve or restore re-injectivity.

High Flow Rates

Geothermal operations require high flow rates to make projects economically viable, so wells tend to be larger in diameter than wells in other industries, requiring non-standard drilling techniques and tools. The oil and gas industry's knowledge of drilling in different environments is relevant for geothermal operations.

Pump Failure

Pumps are often required to lift the hot brine to the surface or increase fluid pressure. Electrical submersible pumps are useful and can be applied in the oil and gas industry, but they are not designed for geothermal conditions, leading to frequent failures and reduced life expectancy. Expertise from the oil and gas industry could help improve designs for geothermal operating conditions.

Next-Generation Geothermal

For electricity generation, geothermal systems need to tap into high subsurface temperatures, which often means drilling very deep. Depending on the temperature at depth, that could mean drilling to a depth of more than 7 kilometres. (See Chapter 3, "Where Is the Heat? Exploring the United Kingdom's Subsurface Geology," for the places in the UK that are best suited for power development.) The challenges and costs of drilling to that depth are significant. It is also difficult to ensure reliable instrumentation and sensing at the extreme temperatures at depth. A number of former oil and gas experts are working in this field in places around the world, but more oil and gas know-how can continue to benefit deep geothermal operations in a few areas.

New Drilling Techniques

Reduction in drilling time, whether for oil and gas or geothermal projects, has a significant impact on project costs. The need for new technologies that increase the rate of penetration (especially into hard rocks) offers a significant opportunity to innovate. Examples of technologies in this space include the following:

- GA Drilling, a drilling company based in Slovakia, is developing a plasma drill to evaporate hard rock.[36]
- Imperial College London is part of a project looking at the development of drilling systems that combine a high-pressure water jet and a high-powered advanced hammer action.[37]
- Quaise Energy,[38] fueled by research from Massachusetts Institute of Technology professor Paul Woskow, is developing techniques that use millimetre waves at high frequencies to melt rock and attempting to access "superhot" geothermal resources (around approximately 400 °C and higher).

New Drill Tools

Drilling into hard rock requires higher weight on drill bits, which can lead to cutting element damage and loss of performance. Tungsten carbide–based drill bits are commonly used, but the industry is seeking alternatives—especially affordable ones. New drive mechanisms also offer an opportunity. Systems that can more effectively and efficiently provide power to the drill bit can enhance penetration rates.

Modelling and Simulation

The oil and gas industry is a world leader in modelling the subsurface to understand rock and fluid interactions. Application of advanced modelling techniques for oil and gas could greatly enhance and de-risk deep geothermal projects. Companies such as tNavigator[39] and Seequent[40] specialise in providing reservoir modelling software.

Sensor Technology

As geothermal wells become more complex, more information on performance and the surrounding formations is needed. Tools such as measurement while drilling (MWD) that have been developed in the oil and gas industry can be used to provide real-time information on drilling performance—but these tools need to be rated for the potentially higher temperatures experienced in geothermal wells.

Distributed temperature sensing (DTS) and distributed acoustic sensing (DAS) are increasingly being used in the oil and gas industry,[41] but they could be improved to meet the needs of geothermal, where sensors must operate at high temperatures and pressures and be reliable over a long period of time.

If the geothermal industry in the United Kingdom were supported by clear policy signals and targeted financial mechanisms that de-risk the use of reservoir stimulation techniques such as hydraulic fracturing (read Chapter 5, "Clearing the Runway: Policies and Regulations to Scale the United Kingdom's Geothermal Potential," for more), long-term monitoring would be necessary to generate ongoing data on reservoir performance, temperature, deformation, fracture networks, and fluid flow.

Directional Drilling

As with sensing technology, existing directional drilling systems are typically only rated up to 175°C. An engineered geothermal system must be able to withstand higher temperatures (above 220°C). In the United States, some test sites–including Fervo Energy's site in Utah—have successfully drilled at temperatures above 250°C.[42]

Engineered and advanced geothermal systems—including closed-loop systems—require advanced drilling techniques such as directional and horizontal drilling. Companies with the capability of providing precise control of directional drilling, rotary steerable tools, and tools that can see ahead of the bit to measure and control position while drilling could provide valuable technology and skills to these projects.

There is considerable opportunity to transfer knowledge and expertise from shale gas operations to the development of engineered geothermal systems. Novel drilling rigs and well construction technologies developed for shale gas operations could be deployed for engineered geothermal systems, creating a substantial opportunity to leverage an existing skilled workforce and mature service supply chains in support of this resilient and secure energy source.

Figure 8.4: Potential job transitions from oil, gas, and mining to geothermal. Source: Bracke, R., & Huenges, E. (2022, February 2). *Shaping a successful energy transition* [Press release]. Fraunhofer IEG.

Geothermal Power Plants

The oil and gas industry also has expertise in the development of new turbines, which could help optimise operations to increase power conversion efficiency.

GEOTHERMAL ENERGY STORAGE

The oil and gas industry can also help create geothermal wells for energy storage. As mentioned in Chapter 1, "United Kingdom Underground: An Overview of Geothermal Technologies and Applications," underground thermal energy storage, also known as geothermal energy storage (GES), captures and stores waste heat or excess electricity by pumping fluids into natural and artificial subsurface storage spaces, from aquifers to boreholes to mines. GES can be primarily mechanical, with hydraulic fracturing techniques storing pressurised fluid in subsurface reservoirs.

There are plenty of examples of UK manufacturers or service providers with capabilities that could transfer to geothermal, including companies that manufacture drill bits, directional drilling tools, logging tools, power sections for pumps and drilling motors, and high-temperature blowout preventers, as well as services such as engineering, procurement, construction and installation management, and engineering consultancy. Start-ups in geothermal have also established engineering offices in the UK to leverage available skills and expertise in the country, including suppliers to many companies working in geothermal.

UK OIL AND GAS COMPANIES AT WORK IN GEOTHERMAL

Geothermal is rapidly being developed around the world. Germany[43] and the Netherlands[44] both have comprehensive road maps for the development of a geothermal sector, emphasising the benefits and contributions that geothermal can make to a nation's energy security. The United Kingdom should follow suit.

Many UK-based companies are already expanding their businesses in geothermal. Likewise, all of the major supply chain companies—including Expro, SLB, Halliburton, Baker Hughes, and Weatherford—are exploring and actively engaged in geothermal projects. With the lack of opportunities and projects in the United Kingdom, much of these companies' attention is international, but the lessons learned from those efforts can be applied to projects and help create jobs and secure heat and power at home as well.

CHANNELING THE SUPPLY CHAIN TO SUPPORT GEOTHERMAL INFRASTRUCTURE DEVELOPMENT

Today, a number of technologies are being developed for the design and operation of next-generation geothermal wells. Some, like engineered geothermal systems, require hydraulic fracturing of the surrounding formation, while technologies such as advanced geothermal systems do not. (See Chapter 1, "United Kingdom Underground: An Overview of Geothermal Technologies and Applications.") Most or even all of these new technologies will require the accurate placement of complex trajectories to get the wells in the right locations and the right distance from each other.

The features of next-generation wells mean new capabilities are needed for their development and operation. They will require fast drilling because of high drilling costs and will likely require monitoring to understand formation properties. The range of measurements will most likely be less involved than those in oil and gas because geothermal does not try to characterise reservoirs, but rather to make new ones. Next-generation wells will also need more maintenance because of the longer lifespan of the wells compared with oil and gas. Many of the technologies required have been developed and manufactured in the UK. The skill base that created them is still around, although without new opportunities, that may change. By developing a robust geothermal industry, the UK can convert oil and gas know-how into a world-class geothermal industry, lowering bills, strengthening energy security, and creating high-value jobs. That said, more training will be needed as skilled workers may retire or move.

Some experts believe parts of the UK oil and gas supply chain can also be adapted to support shallower, low-temperature geothermal applications, including minewater systems, sedimentary aquifers, and district heat networks. Many of the technologies and assets developed for hydrocarbons—such as drilling services, casing and cementing systems, pumps, and precision manufacturing—can be combined with existing technologies for shallower boreholes and heat exchange systems. Smaller, medium-depth drilling and workover rigs can be retooled for smaller-

diameter geothermal wells, while pipeline and fabrication firms experienced in subsea or onshore gas networks can design and install insulated heat distribution systems and energy centres. Subsurface data and instrumentation companies can redirect their expertise in reservoir monitoring, automation, and control systems toward geothermal heat networks, providing real-time monitoring and performance optimisation. By strategically mobilising these existing capabilities, the UK can create a domestic geothermal supply chain that underpins large-scale deployment of low-carbon heat, reduces dependence on imported equipment, and drives resilient industrial growth.

A BIT OF OIL AND GAS (AND DRILLING) HISTORY

By John Clegg

The UK oil and gas industry grew significantly in 1934, when Parliament passed the Petroleum Act, making it clear that the Crown owned all oil and gas resources in Great Britain. More oil was discovered during the Second World War and over the next two decades, when oil was found in the East Midlands, Scotland, and Southern England, including at Wytch Farm and Kimmeridge, where the K1 well has been continuously pumping oil since 1961.[45]

The second big acceleration for the industry was the discovery of the Groningen gas field in the Netherlands in the late 1950s and early 1960s, which stimulated exploration of the North Sea. After the UK Continental Shelf Act was passed in 1964, exploration began. In 1969, Phillips Petroleum discovered the Ekofisk field in the Norwegian sector and Amoco discovered the Montrose field in the UK sector. Both contained a wealth of oil, and a major industry in the North Sea was born.

To extract this oil, technology was initially imported from the United States, where the first offshore platform had been installed in the Gulf of Mexico in 1955. But the harsher environment of the North Sea, combined with more difficult reservoirs to drill and produce from, meant that new technologies had to be developed to fully exploit these fields. Drilling is expensive, especially from platforms located in hostile environments, and reliability is key to success. The result was an industry based on integrity, reliability, and the understanding of a high potential cost of failure.

Although a number of ports on the east coast of England and Scotland were used to service the growing North Sea industry, Aberdeen became the prime location and much of the supply chain began to gravitate there.[46]

At the same time, other areas began to develop their own supply chains, including in the Newcastle area and East Anglia, on the east coast, and Gloucestershire and Somerset in the southwest. This part of England became, and remains, a global centre of excellence for electronics and electromechanical systems (effectively, robotics) used in harsh, demanding environments. Products including MWD systems, rotary steerable systems, polycrystalline diamond compact drill bits, subsea valves, and subsea wellhead control systems were produced along a line stretching from Tewkesbury to Nailsea, south of Bristol. They leveraged capabilities found in aerospace, including high-integrity materials, precision machining, advanced manufacturing, rugged and reliable sensors, and reliability electronics. Some of these suppliers have since moved to other countries as the market shifted away from the North Sea, but many remain, along with local supply chains. For example, Schlumberger develops the directional drilling technology it uses in its global operations in the small town of Stonehouse in Gloucestershire.[47]

The policies enacted in 1934, and again in 1964, have had major benefits for the United Kingdom's economy, workforce, health, and emissions. Chapter 5, "Clearing the Runway: Policies and Regulations to Scale the United Kingdom's Geothermal Potential," outlines suggested policies that could spur the next major energy industry in the United Kingdom.

CONCLUSION

To help geothermal energy emerge as a critical way to lower costs and enable workforce development, the UK can look to its oil and gas and mining sectors. With their deep expertise in technology, infrastructure, subsurface exploration, drilling, and resource management, these industries are well positioned to play a catalytic role and help significantly lower project costs and de-risk early-stage development.

This transition from legacy energy to geothermal also offers a powerful way to create jobs. If supported with appropriate incentives, infrastructure, and workforce development, these industries can play a transformative role in positioning the United Kingdom as a global leader in geothermal innovation.

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