IEA GEOTHERMAL

United Kingdom Country Report

2013

IEA Geothermal

Implementing Agreement

National Activities
Chapter 21 of 2013 GIA Annual Report
United Kingdom

Figure 1. *Drilling into old mine workings at Crynant, South Wales. (Photo courtesy of WDS Green Energy Ltd)*

1 Introduction and Overview

During 2013 there has been no additional capacity for either geothermal power generation or direct use from deep sedimentary aquifers in the UK. Two combined heat and power (CHP) engineered geothermal system (EGS) projects are still in development in the southwest of England at the Eden Project, St Austell, Cornwall and at the United Downs Industrial Estate near Redruth also in Cornwall. The only geothermal district heating scheme is in the City of Southampton where a 2 MW capacity installation can extract brine at 76 °C from a Triassic sandstone aquifer at a depth of 1.8 km, although the scheme has not been operating for a number of years while a new electric pump is fitted. Proposals for exploiting deep geothermal heat for district heating are still active in the city of Manchester and at Shiremoor, located to the north of Newcastle upon Tyne in the northeast of England. A new initiative has also been launched to exploit the geothermal potential of the Cheshire Basin deep sedimentary aquifer beneath Crewe in central England.

Two important government-sponsored reports were published in 2013. The first was commissioned by the UK Department of Energy and Climate Change (DECC) and was undertaken by Atkins Ltd. The report focussed solely on the UK potential for geothermal electricity power generation, although the direct use by-product was taken into account as it was concluded that a viable business case was only possible from a CHP development. The key conclusions were that there was a development potential of 170 MWe, a figure considerably lower than previous estimates; the risk profile of project development is too high and is therefore unattractive to private investors; and that to kick start a geothermal power sector, the government would need to fund a programme of deep drilling to prove reserves and develop a power generation demonstrator project. DECC responded to the report by stating that it was not considered value for money for the taxpayer to invest in deep geothermal drilling or to establish a demonstrator project. It would continue to support direct use through the improvement in the feed-in-tariff for deep geothermal heat.

The second report was commissioned by the Scottish Government to look into the potential for deep geothermal energy in Scotland and was undertaken by Aecom Ltd and the British Geological Survey. The comprehensive report considered power generation, direct use from deep sedimentary aquifers and the thermal potential of the waters in disused mines. The report was favourably received by the Scottish Government and through the process of consultation the establishment of demonstrator projects for deep geothermal heat and heat from disused mines is being actively considered.

Table 1. Status of geothermal energy use in the UK for 2013.

Electricity	
New capacity installed in 2013 (MW_e)	0
Total Installed Capacity (MW_e)	0

Direct Use	
New capacity installed in 2013 (MW_{th})	0
Total Installed Direct Use (MW_{th})	2.6
Total Heat Used (TJ/yr) [GWh/yr]	44.3 [12.3]+
Ground source heat pumps	
New capacity installed in 2013 (MW)	67
Total Installed Capacity for Heat Pumps (MW)	422
Total Net Heat Pump Use [GWh/yr]	681*

+ Note this is lower than previous years due to maintenance of the plant at Southampton.

* in calculating the net heat pump use it has been assumed that the hrs/year heating equivalent full load is 1800 hrs/year for domestic systems and 1500 hrs/year for commercial systems.

2 National Programme

The UK Renewable Energy Strategy was launched in 2009 with a target of 15% of energy from renewables by 2020. It also aims to reduce the UK's carbon dioxide emissions by over 750 million tonnes by 2030. The lead scenario envisages more than 30% of electricity generated, 12% of heat generated and 10% of transport energy are from renewables. Most of this will be wind, biomass, biofuels and electric vehicles, but with a significant input to domestic heating from ground source heat pumps (GSHP). Geothermal electricity is expected to have a minor role.

The UK Renewable Energy Roadmap was published in 2011 and identified 8 technologies that have the greatest potential for the UK to meet its renewable energy targets. One of those identified was ground source and air source heat pumps. Incentives introduced included the Renewable Heat Incentive that, after consultation in 2013, covers domestic and non-domestic ground source heat pumps and deep geothermal heat (see below for the tariff rates). Prior to March 2014, domestic GSHP was not eligible for the feed-in-tariff, but received a one off grant known as the Renewable Heat Premium Payment to assist with installation costs.

2.1 Legislation and regulation

The UK Government's Electricity Market Reform programme is replacing the Renewables Obligation incentives for large-scale renewable electricity generation with a new mechanism known as Contract for Difference. Each renewable technology has a 'strike price' in £/MWh of renewable electricity generated. When the market price of the electricity is below the strike price, the generator receives a payment equivalent to the difference between the strike price and the market price. However, if the market price is above the strike price the generator has to pay back the difference between the two prices. This variable top-up is designed to reduce the risk and increase the level of certainty for renewable generation. In December 2013 the strike price for geothermal for 2014/15 was set at £145/MWh.

The Feed-in Tariffs (FITs) scheme was introduced on 1 April 2010. Through the use of FITs, the DECC hopes to encourage deployment of additional small-scale (less than 5MW) low-carbon electricity generation. There was no geothermal electricity generation in 2013.

The Renewable Heat Incentive (RHI) was introduced in July 2011 and pays a tariff for renewable heat. After consultation in 2013 the scheme covers domestic and non-domestic GSHP and deep geothermal heat (from April 2014). The rates are as follows;

- Non-domestic GSHP has a 2-tiered tariff comprising 8.7 p/kWh for the first 1314 hours of use (tier 1) and 2.9 p/kWh thereafter (tier 2).
- Domestic GSHP tariff is 18.8 p/kWh payable for 7 years, but note that new build properties other than self-build are not eligible.
- Deep geothermal (defined as from a minimum depth of 500 m) tariff of 5.0 p/kWh.

2.2 Progress towards national targets

- By the end of 2013 there were 100 accredited ground source heat pump installations receiving the RHI with a combined installed capacity of 4.0 MW_{th}. Eligible heat generated was 7559 MWh_{th}.
- Between August 2011 and December 2013, 1949 ground source heat pump installations (22.1 MW_{th}) received the Renewable Heat Premium Payment.

2.3 Government support/Incentives for R&D

- Geothermal Engineering Ltd was awarded a grant of £800,000 by DECC in November 2013 to trial an updated single borehole heat exchanger in a deep borehole. The project will utilise a borehole drilled for the UK hot dry rock project in the 1980s at Rosemanowes quarry in Cornwall, SW England.
- The British Geological Survey received £42,000 in 2013 from the Natural Environment Research Council to conduct geothermal research.

3 Industry Status and Market Development

In 2013 the UK moved closer to breaking ground on its first deep geothermal project since the 1980s. Auckland Castle Trust, advised by Cluff Geothermal, announced that they would allocate funding of £3.5 million to create a direct use project in Bishop Auckland, County Durham. This project is now seeking planning permission and the Trust hopes to start drilling in early 2015.

Other direct use projects were in an advanced stage in Manchester (led by GT energy) and North Tyneside (led by Cluff Geothermal). Both companies have obtained, or are in the process of obtaining, environmental and planning consents for these projects and hope to move to the drilling stage in 2015.

In Cornwall, EGS Energy Ltd and Geothermal Engineering Ltd continue to work towards developing EGS combined heat and power projects. With the necessary planning permission and environmental consents in place these companies are now concentrating on fundraising, building on strong support from Cornwall Council.

4 Research, Development and Demonstration/Deployment

Geothermal research in the UK is at a low level when compared to research into other renewable technologies. The government has been supporting technologies such as wave and tide where it sees the UK can develop a commercial advantage that can be exported. The majority of UK geothermal research is largely related to resource estimations and utilisation of the resource.

4.1 Government funded

Government funding for early stage research is distributed through the Research Councils. Additional funding may also be available from the European Commission and is included here. The projects in Table 2 were funded in 2013, but this is not an exhaustive list.

Table 2. Projects funded in 2013.

Institute	Industrial partner	Project title	Subject area	Funder
Cambridge University	Arup	Numerical modelling of EGS reservoir development	Deep geomechanics	EPSRC
Glasgow University	Cluff Geothermal Ltd	A conceptual hydrogeological model for fault-related geothermal energy resources in northern England	Geothermal potential of northeast England	NERC
Southampton University		Foundations as an energy source	Energy piles performance	EPSRC/ RAERF
Cardiff University		SEREN – Ground Source Heat	Improve the performance and uptake of GSHP	WEFO
Durham University	BP	Assessing the UK's low enthalpy geothermal resources with specific focus on deep sedimentary basins	Hot sedimentary aquifers	

Durham University		Multiphysics simulation of geothermal engineering	Fracture systems in crystalline rocks	
Durham University		The geological characterisation and permeability measurements of surface and subsurface fractures in the southern Negros geothermal production field, Negros Oriental, Philippines	Hydrogeothermal	

EPSRC – Engineering and Physical Sciences Research Council
NERC – Natural Environment Research Council
RAERF – Royal Academy of Engineering Research Fellowship
WEFO – Welsh European Funding Office

5 Geothermal Education

There are no specific higher education courses devoted to the exploration and exploitation of geothermal energy in the UK. However, earth science and renewable energy university courses will often have modules on aspects of geothermal energy.

6 Future Outlook

During 2013 the tariffs that will apply to geothermally sourced heat and power were announced. This has now created a stable business environment where new projects can be planned and costed. There is increasing interest in developing direct use from deep sedimentary aquifers. Cheshire East Council announced an initiative to attract private investors to work with the council in utilising the heat resource of the Cheshire Basin for the town of Crewe in central England. In early 2014 Stoke-on-Trent City Council and Staffordshire County Council were awarded £20M in funding to develop a district heat network supplied with deep geothermal heat.

The thermal potential of the water in disused mines is also receiving greater attention. Those regions undermined by coal workings do not usually have access to deep sedimentary aquifers and hence large networks of coal workings have the potential, via heat pump technology, to be a heat source for district heating. The Aecom report for the Scottish Government included an estimate of the disused coal mine thermal resource in the Central Belt of Scotland as 12 GWth. To date there are only 4, small mine-water schemes in the UK. These comprise two in Scotland at Shettleton and Lumphinnans that heat single apartment blocks, a scheme at Dawdon in NE England that heats a small industrial unit, and a scheme at Crynant in S Wales that heats a farm business. Several local councils have commissioned scoping studies into the mine-water potential in their regions.

7 References and Websites

Aecom Ltd & the British Geological Survey, 2013. Study into the potential for deep geothermal energy in Scotland. Report for the Scottish Government. http://www.scotland.gov.uk/Publications/2013/11/6383

Atkins Ltd. Deep Geothermal Review Study, 2013. Report for the Department of Energy and Climate Change. https://www.gov.uk/government/policies/maintaining-uk-energy-security--2/supporting-pages/electricity-market-reform

Curtis, R, Ledingham P, Law R and Bennett T., 2013. Geothermal Energy Use, Country Update for the United Kingdom, European Geothermal Congress 2013, Pisa, Italy, 3-7 June 2013.

Contracts for Difference:
https://www.gov.uk/government/policies/maintaining-uk-energy-security--2/supporting-pages/electricity-market-reform

Renewable Heat Incentive:
www.decc.gov.uk/en/content/cms/meeting_energy/renewable_ener/incentive/incentive.aspx
http://www.energysavingtrust.org.uk/scotland/Generating-energy/Getting-money-back/Renewable-Heat-Incentive-RHI2

Renewable Energy Association Deep Geothermal Group:
www.r-e-a.net/member/deep-geothermal

Ground Source Heat Pump Association:
www.gshp.org.uk/

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