BritGeothermal
Plumbing the Depths

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Sustainable Exploitation of the Subsurface 21-21st May 2015
Geothermal Energy

• Sourced from Earth’s Core
• Volcanic High T >150°C
• UK Low T <150°C

• Harnessed at surface or by drilling into target formation
• Used for direct heat and for power generation
# Why Geothermal?

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
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<tbody>
<tr>
<td>Predictability</td>
<td>Drilling Costs</td>
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<td>Energy Security</td>
<td>Economics</td>
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<td>Offset heat demands</td>
<td>Infrastructure</td>
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<td>Low Carbon Resource</td>
<td>Social change</td>
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<td>Proven</td>
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**Brit Geothermal**
How is it exploited?
Key Message 1: You don’t need volcanoes

Potential UK Geothermal Targets
Key Message 2: Heat is as important as electricity

- Half of the energy consumed in the UK is used for the production of heat
- Two thirds of this can be assigned to the domestic sector
- 83% is used for space and water heating
- Deep geothermal resources could provide over 100GW of heat

Source: DECC
Key Message 3: Geothermal energy technology is not new

- Geothermal energy has been used for millennia
- Globally China and the USA are the largest producers of geothermal heat and power respectively
- Less than 1% of the Earth’s geothermal potential is currently exploited
- Technology advancements mean that most regions of the globe could access geothermal resources
- Several geothermal plants have been operational on the scale of decades
Objectives

Centre for Deep Geothermal Energy Research

- Formally launched at the 4th London Geothermal Symposium Oct 2014
- Expertise gained from drilling 3 most recent deep boreholes in the UK

Objectives

- Create a virtual geothermal research centre
- Actively collaborate and cooperate in geothermal research
- Share experiences and expertise and promote knowledge exchange
- Seek out new sources of funding for geothermal research
- Promote geothermal energy to government and commerce
Key Skills

• Microseismicity
• Hydrogeochemistry
• Minerals geothermometry
• Hydrogeology
• Petroleum geology
• Structural geology

Research

• Research on projects identified by the consortium or in response to industry needs. Supervision by both academic and industry staff

Outputs

• Journal Papers and Geothermal Book
•Visited DECC to discuss UK geothermal - Feb 2014
• Responded to DECC Consultation on underground access - Aug 2014
• Invited to brief Lord Jenkin on geothermal - Oct 2014
**UK Geothermal Interests**

BritGeothermal research themes within the UK:

- Hot sedimentary aquifers  
  e.g. Cheshire and Wessex Basins
- Radiothermal granites and fault systems  
  e.g. NE England and Cornwall
- Oilfields  
  e.g. E Midlands, Wytch Farm and North Sea
- Abandoned flooded mineworkings  
  e.g. UK coalfields
- Colonising abandoned/planned wells  
  e.g. Abandoned exploration and shale gas wells

Potential UK Geothermal Targets
Radiothermal Granites

Fig. 1. Map showing the heat flow determinations in County Durham and north Yorkshire and the deep geological structure of the region. Lower Carboniferous hinge-belts are marked by arrows which indicate the direction of thickening. A-A' is line of section shown in Fig. 2. RB—Rookhope boring, WB—Woodland boring, SH—South Hetton boring, KB—Kirkleatham boring, TB—Tockets boring.
Eastgate - Granite

- Drilled in 2004 to a depth of 998m
- Drilled into Weardale Granite to intercept fractures associated with Slitt Vein
- Temperature 46°C at bottom of well
- Well doublet created
- Plans for testing
Science Central - Faults

• Drilled 2011 in central Newcastle upon Tyne

• Drilled to connect with 90 fathom fault which feeds thermal fluids from the Weardale Granite

• 73°C measured at 1,821m gradient >35°C/km

• Intercepts Fell Sandstone aquifer

• Well tests planned
Hot Aquifer Systems

• Buried thick sedimentary basin sequences
• Aquifer Depths 2-5km – convective flow
• Heat only
• Temperature typically 60°C or above
UK Warm Water Deep Basin Potential

- Southampton District Energy Scheme
  - Single borehole to 2km into Triassic Sherwood Sandstone
  - Start-up 1986
  - Rate 15-20 lsec⁻¹ (≡ 39,500-52,600 m³month⁻¹)
  - Temp ~75ºC
  - Heat ~ 1.7MW
Geothermal Basins in England
Wytch Farm Oilfield

- Potential to reduce CO$_2$ emissions in the Poole area by 85,000 tonnes
- Potential heat and power output of 35MW and 1.3MW
- Opportunities for replication at other sites
Abandoned Mines

- 15bn tonnes of coal from deep mines
- 2bn m³ of water within flooded workings in the UK
- 38,500TJ of heat*
- Good underlap with population centres

* At ΔT 4°C
Single Well Systems

- Colonise existing wells
- Independent of geology
- Lower heat outputs suitable for clusters of dwellings or larger single buildings
- Reduces project risk and cost when using existing wells

Adapted from schematic by Geothermal Engineering Ltd
Looking to the Future...

- Offsetting gas consumption for heat production
- Lowering minimum temperatures for power production
- Reducing risk by enhancing survey techniques
- Increase in heat network uptake
To conclude...

• The UK has a wide variety of geothermal resources
• There are opportunities to reuse existing subsurface infrastructure
• Need to know more about the deep subsurface to reduce risk and increase investor confidence
BritGeothermal
Research Partnership

Thank you

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