UK Geoenergy Observatories

David Manning
Newcastle University
UKGEOS Senior Science User
Earth Resources sustain development

- Water
- Food
- Fertilizers
- Energy minerals
- Construction materials
- Raw materials for industry/consumer goods
- Metals
- Raw materials for new technologies
Mining addresses/affects all SDGs:
Mining through time

- Porphyry copper deposits
- Haber process
- Ammonium fertilizers made from methane
- London Lead Company (UK Pennines)
Mining through time

Porphyry copper deposits
Haber process
Ammonium fertilizers made from methane
London Lead Company (UK Pennines)
The Haber-Bosch Process

• Has enabled the world’s population to rise from 3 billion to 7 billion in the last 50 years
• Uses 5% of the world’s methane production – but as a raw material
• And 1% of the world’s energy production
• Everything you eat, from a conventional farm, contains elements that came out of a gas well
Is there an alternative to the Haber-Bosch Process?

- In a post fossil-fuels world, what is the alternative to:

  - Nitrogen (air) 125 million tonnes/yr
  - Methane (natural gas) 100 million tonnes/yr
  - Hydrogen 25 million tonnes/yr
  - Ammonia 150 million tonnes/yr

  400 – 450°C
  200 atm
  iron catalyst
Methane to make fertilizer

• 100 million tonnes a year is needed as a raw material

• Over 1500 of these ships:
Mining: vital to the UK economy

- World’s 2nd largest tungsten mine outside China – Plymouth, producing from 2015-2018 (£123m)
- World’s largest single mine for potash fertilizer being built in North York Moors National Park, to produce from 2021 (£2.5bn)
- Commercial geothermal drilling led by Geon/Arup/Geothermal Engineering Ltd:
  - HALO Kilmarnock – 2km well to feed district heating (£1.8m)
  - Jubilee Pool (Penzance) – 1.4km well, leisure/tourism (£1.4m)
  - United Downs – 2.5 & 4.5 km wells, power generation (£18m)
- Onshore: 120 sites with 250 operating wells producing between 20,000 and 25,000 barrels of oil equivalent a day
- 210m tonnes of raw material mined annually in the UK that goes into the supply chain; £5bn GVA -> £235bn GVA products (12% of UK GDP; 2xNHS; 6xdefence)
Society’s mineral use differs

- Extraction of metal ores rising
- Industrial mineral extraction rising more rapidly

Global Material Flows Database
Public licence

• We can only extract raw materials from the Earth with public consent (provided society has good governance)

• Decision makers, those who grant permission for extraction or regulate it, need good science

• The UK GeoEnergy Observatories are designed to provide this
Times change

- Potash in north-east Yorkshire

Boulby Mine; built in 1969
Sirius Minerals

- Near Whitby, the world’s biggest underground fertilizer mine is being built
Sirius Minerals

- Near Whitby, the world’s biggest underground fertilizer mine is being built
Sirius Minerals

- Near Whitby, the world’s biggest underground fertilizer mine is being built
Woodsmith Mine

- Planning permission granted – although in a National Park
- Designed to produce up to 20 million tonnes of polyhalite per year for 100 years
- No waste
- No industrial surface activities within the National Park, once operational
- 37 km tunnel to take ore to Teesside
Demand

• The need for geological resources is growing
• Society’s expectations are growing

Which is why we need the GeoEnergy Observatories
The UK GeoEnergy Observatories

- A £31 million investment, financed by BEIS through NERC
- Delivered and operated by BGS
- A national facility within an international context
  - Part of a community of underground laboratories/observatories
- Designed to provide publicly-accessible data concerning phenomena in the subsurface
- Designed to inform a range of stakeholders
The UK GeoEnergy Observatories

- Designed following consultation with the academic community
- Designed to enable research outlined in the resulting Science Plan
- Glasgow observatory now being built (coal mine geothermal)
- Planning application in for second observatory near Chester (deep energy resources)
Research at UKGEOS

- Open to all members of the UKRI community – NERC and EPSRC likely to be most interested
- BGS operates UKGEOS
- BGS provides baseline data
- Research funded through normal research council routes
- Open competition with full peer review and normal decision-making process
- Oversight by independent Geoenergy Observatories Science Advisory Group (GSAG); chaired by Zoe Shipton (Strathclyde)
Research at UKGEOS

• Open to all members of the UKRI community – NERC and EPSRC likely to be most interested
• BGS operates UKGEOS
• BGS provides baseline data
• Research funded through normal research council routes
• Open competition with full peer review and normal decision-making process
• Oversight by independent Geoenergy Observatories Science Advisory Group (GSAG); chaired by Zoe Shipton (Strathclyde)

And that is where you come in…