OR/19/052 Project overview

From Earthwise
Jump to navigation Jump to search

Kingdon, A, Fellgett, M W, and Spence, M J. 2019. UKGEOS Cheshire Energy Research Field Site - Science infrastructure. *British Geological Survey Internal Report*, OR/19/052. *Contributors:* Midgley, J, Elsome, J W, Dearden, R A, Chapman, C, Burke, S P, Hough, E, Luckett, R R, and Bianchi, M.

Overview

The aim of the UK Geoenergy Observatories project is to establish new centres for world-leading research into the subsurface environment. The knowledge generated will contribute to the responsible development of new subsurface technologies, both in the UK and internationally.

The project, commissioned by the Natural Environment Research Council (NERC) and UKRI on behalf of BEIS, follows the 2014 decision that the Government would spend £31 million to create world-class, subsurface energy-research test centres. The British Geological Survey (BGS) has the responsibility for delivering the research infrastructure and managing access to these facilities over their anticipated 15-year lifetime.

The BGS consulted with a range of stakeholders to identify two preferred geological locations. The first research field site will be in Cheshire south of the River Mersey near the villages of Thornton and Elton, and will provide data to underpin research into a number of new energy technologies that will directly help reduce atmospheric carbon emissions, for example CO_2 storage, shallow geothermal, and aquifer storage of heat and compressed air. The second research field site (Monaghan, 2018[1]) will be in Glasgow, close to the Cuningar Loop in the River Clyde and will focus on shallow geothermal energy. The Science Plan, developed through a consultation process, ensures that UKGEOS provides for the current and future needs of the scientific user community.

Figure 1 View over Ince Marshes towards Runcorn including Frodsham windfarm. Image © Peter Cocoran

Geological overview & research potential of this location

The Cheshire site was chosen for its scientific potential, as the geology underlying the location presents opportunities for both academic and industrial research:

Quaternary deposits — At the surface are Quaternary sediments that are representative of surface 'ice age' sediments across the UK. They provide opportunities for research relating to engineering problems, natural shallow gas migration, the potential for shallow geothermal technologies, anthropogenic influences as well as groundwater flow and transport.

Permo-Triassic sandstones — Beneath the Quaternary sediments are sandstones of the Permian-Triassic Sherwood Sandstone and the Collyhurst Sandstone. The Sherwood Sandstone, is the UK's second most important aquifer and so research is envisaged to characterise controls on groundwater flow and the factors that affect its quality. The Sherwood Sandstone and Collyhurst Sandstone will also be investigated and described as they are potential targets for carbon capture and storage (CCS) in the North Sea and east Irish Sea. The Sherwood Sandstone and Collyhurst Sandstone also suitable rocks for geothermal energy research, specifically low enthalpy heat.

Caprock sedimentary layers — The Manchester Marl is a low permeability Permian age sedimentary rock that is, in some UK locations, the caprock envisaged for proposed exploitation of unconventional hydrocarbon resources. This strata is relatively close to the surface at Ince Marshes, allowing research into the flow characteristics of low permeability layers. The Permo-Triassic overlies mudstone beds of the Carboniferous Halesowen Formation and also the mudstone and siltstone and scattered sandstone beds of the Pennine Coal Measures Group and Millstone Grit Formation, which offer similar research opportunities.

Prospective shale — Beneath the Pennine Coal Measures Group and Millstone Grit Formation are the shales and limestones of the Craven Group, which are a target for shale gas exploration in the north of England. The Cheshire observatory would be used to independently monitor and observe any industrial shale gas exploration activities that took place in the Ince Marches area by observing groundwater quality (temperature, pH, gas content, water level), seismicity, and other possible ground movements. Such data could also provide insights into the response of the subsurface to shale gas extraction, which would be of benefit to planners, local authorities, policy makers, regulators, researchers and the public.

Structural and basin complexity — The Ince Marshes site has an almost geologically unique structural position on a geological structural 'high' between the large East Irish Sea and Cheshire basins (Figure 2). The area is structurally complex, with faults on each side that offer excellent opportunities to study whether these faults are seals, or whether they allow transmission of fluids and gases. In addition, there is the potential for research to investigate the processes that led to fault formation and seismicity. Such structural highs are important when considering buoyant fluids such as CO_2, and the management of fluid flow and geomechanics in basins.

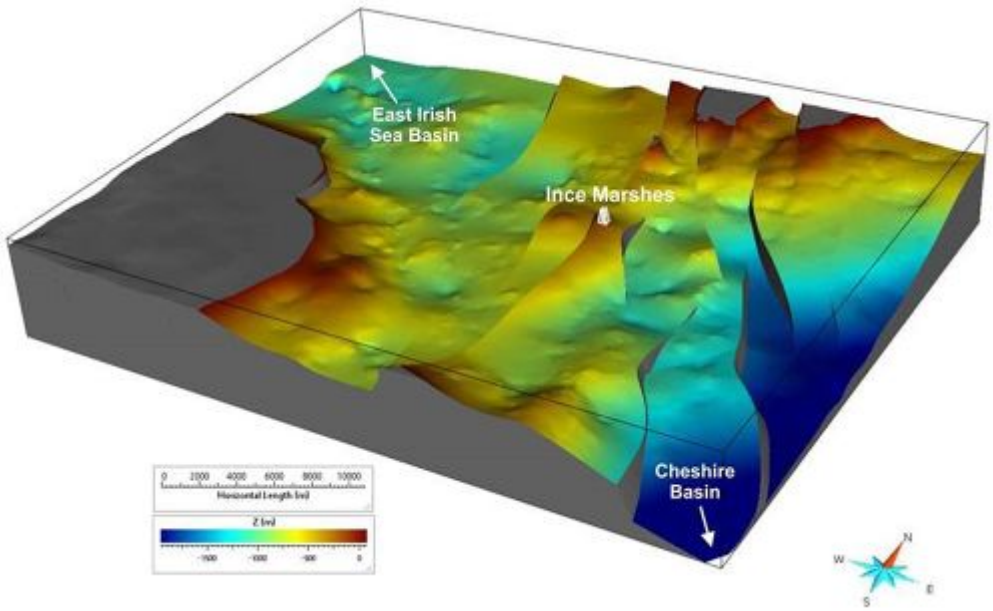

Figure 2 Ince Marshes, the East Irish Sea and Cheshire basins modelled on the top of the Variscan unconformity. Colour coding indicates depth below surface: yellow is shallow; blue is deep.

Availability of high quality geoscience data

A key rationale for developing the Cheshire Energy Research Field Site (CERFS) is that there is extensive geological data already available for this area. This includes good quality 3D seismic survey data and extensive 2D seismic from the oil and coal industries (available from UKOGL). The geology has been directly sampled by exploration and appraisal wells for coal, coal bed methane, conventional oil and gas, and unconventional gas, including some high quality geophysical log suites. Much of this data is available to view, and some for download, on the BGS website. Such a quality, variety and density of data is available in only a few locations in northern England and this provides an excellent basis for further research at Ince Marshes.

Scope of the facility

The Cheshire Energy Research Field Site spans over 20 square kilometres of Cheshire. Its main focus is around 50 purpose-drilled boreholes of between 50 and 1200 metres depth — the total drilled length of all boreholes will exceed 8000 metres. Over 1800 state-of-the-art sensors will be installed that will track seismicity, changes to groundwater flow and quality, temperature and hydraulic properties. These will provide data from the surface to 1200 metres depth and this will be streamed online in real-time allowing wide public observation of Cheshire's subsurface.

Almost 3000 metres of rock core will be sampled from these boreholes and scanned with state-of-the-art core scanners (recently installed at BGS's headquarters in Keyworth) to characterise its physical and geochemical properties. Rock core and scan data will then be made available to the research community for sampling and analysis. In addition, researchers will be able to request samples of core material that have been preserved immediately after recovery for biological, physical and geochemical analyses. All project data will made available online free of charge after any required quality checks have been completed.

From 2020 the Cheshire Energy Research Field Site will be open to researchers for field experiments. Researchers will have access to both the borehole arrays and data from £2 m worth of installed instrumentation. They will also be able to deploy their own equipment. The vision is to

encourage international scientists to focus their research efforts in this area by creating a volume of rock characterised to the highest standards. This will support world-leading science, creating a step-change in geological and process understanding.

BGS will provide access to scientific facilities at the Cheshire observatory. It is also envisaged that laboratory and welfare facilities, including a restaurant, will be available as workspaces at the nearby Thornton Science Park. At BGS Keyworth there will be the opportunity to sample and analyse core material and work with the new core scanning laboratory.

Finally, an innovative web portal is being developed to meet the needs of the public and the research community. This will include a state-of-the-art interactive 3D geological model to visualise the research facility and showcase the power of the data being generated to support scientific understanding. The portal will also provide access to an extensive archive of data from the installation and operational phases.

Figure 3 View over Ince Marshes. Image © Peter Cocoran

References

1. ↑ Monaghan, A A, Starcher, V, O Dochartaigh, B, Shorter, K, Burkin, J. 2018. UK Geoenergy Observatories: Glasgow Geothermal Energy Research Field Site: science infrastructure. Nottingham, UK, British Geological Survey, 46pp. (OR/18/037) (Unpublished)

Navigation menu

Personal tools

- Not logged in
- Talk
- Contributions
- Log in
- Request account

Namespaces

- Page
- Discussion

□

Variants

Views

- Read
- Edit
- View history
- PDF Export

□

More

Search

Search Go

Navigation

- Main page
- Recent changes
- Random page
- Help about MediaWiki

Tools

- What links here
- Related changes
- Special pages
- Permanent link
- Page information
- Cite this page
- Browse properties

- This page was last modified on 17 December 2019, at 16:23.

- Privacy policy
- About Earthwise
- Disclaimers
- British Geological Survey NATURAL ENVIRONMENT RESEARCH COUNCIL
- Powered By MediaWiki Semantic MediaWiki