

CDT scholarship (2018 start)

Project Title: Critically evaluating the geological case for shale gas extraction in the UK
Host institution: Institute of Petroleum Engineering, Heriot-Watt University
Supervisor 1: Professor John Underhill
Supervisor 2:

Project description: Gas is hugely important to the UK. The country uses more than 65 billion cubic metres to heat most of its 25m homes and generate around a quarter of its electricity each year. Despite efforts to move to renewable energy sources such as wind and solar, demand for gas is likely to remain high for the foreseeable future since it heats 80% of UK homes and supplies 25% of its electricity. Until 2004 all the gas the country needed was sourced from the UK, primarily from the North Sea and East Irish Sea. Since then, production has declined to the point where imports count for more than half of the needs with supply from European pipelines (38%), particularly from Norway and Russia; and liquid natural gas (LNG) deliveries (17%), primarily from Qatar. This dependency on foreign gas is precarious to say the least and in March 2013, an unseasonal cold snap almost left the country short of supplies. It was averted by an LNG delivery docking at Milford Haven in Wales in the nick of time. This late in its lifespan, conventional new gas exploration in the North Sea is unlikely to reverse this situation and many argue that the UK should consider all options, including onshore shale gas. When making the case for shale gas, they not only point to the success in the US but also to the decommissioning of Centrica's main gas storage site in the southern North Sea, making the country even more reliant on imports to meet the demand.

For a shale gas "sweet spot" suitable for commercial production, a number of geological criteria need to be met. The source rock needs a relatively high organic content, a good thickness, sufficient porosity and the right mineralogy. The organic matter must have been buried and heated in such a way as to produce large amounts of gas. There must also be a relatively simple geological structure. The most successful US shale areas, such as the Marcellus, Barnett, Haynesville and Bakken, all lie at depths, temperatures and pressures that mean they are ready to expel their oil and gas when hydraulically fractured. The basins in which these occur are primarily in relatively stable, undeformed "intracratonic basin" areas away from the edges of active tectonic plates. These are characterised by continuous layers of rock with only gentle dips and few fractures or major faults, all of which aid subsurface imaging, gas/oil detection and the directional drilling needed for shale exploration.

Research Theme: Unconventional Hydrocarbons / NPIF eligible

Research Context: The aim of this project is to use subsurface (seismic and well) data accessed through the UK Onshore Geophysical Library (UKOGL) together with surface geological mapping to evaluate the structure and stratigraphy of the sedimentary basins that are purported to contain shale gas resources. The student will undertake a systematic interpretation of 2D and 3D datasets from the Bowland, Cleveland, Weald and Midland Valley basins to determine whether their structure, temperature and pressures support the case for shale gas or not. Comparisons will be drawn to US basins where shale gas and oil extraction has been successful. The outcomes will help inform the debate about the UK's options for energy supply.

Research costs: All the key budget costs including fees, stipend, hardware, data storage, and lab costs are covered by the £5k p.a RTSG element in the scholarship.

Career routes: The project will be ideal for a candidate seeking future employment in the oil and gas sector as an exploration geologists or geophysicist be it with an oil company or in the service sector. The project also lends itself to a career in academia, the BGS or government departments such as OGA & BEIS.