

“Renewed Unconventional Reservoir Exploration in the UK: The Carboniferous Bowland-Hodder Shale” by Chad Hartman, Weatherford Labs

This presentation was given at the monthly DIPS (Denver International Petroleum Society) meeting on March 14 at the Wynkoop Brewing Company. Chad Hartman is the Chief Technology Advisor at Weatherford Labs in Golden, Colorado, where he has worked for the past 13 years. He holds a BSc. in chemistry from Ft. Lewis College in Durango.

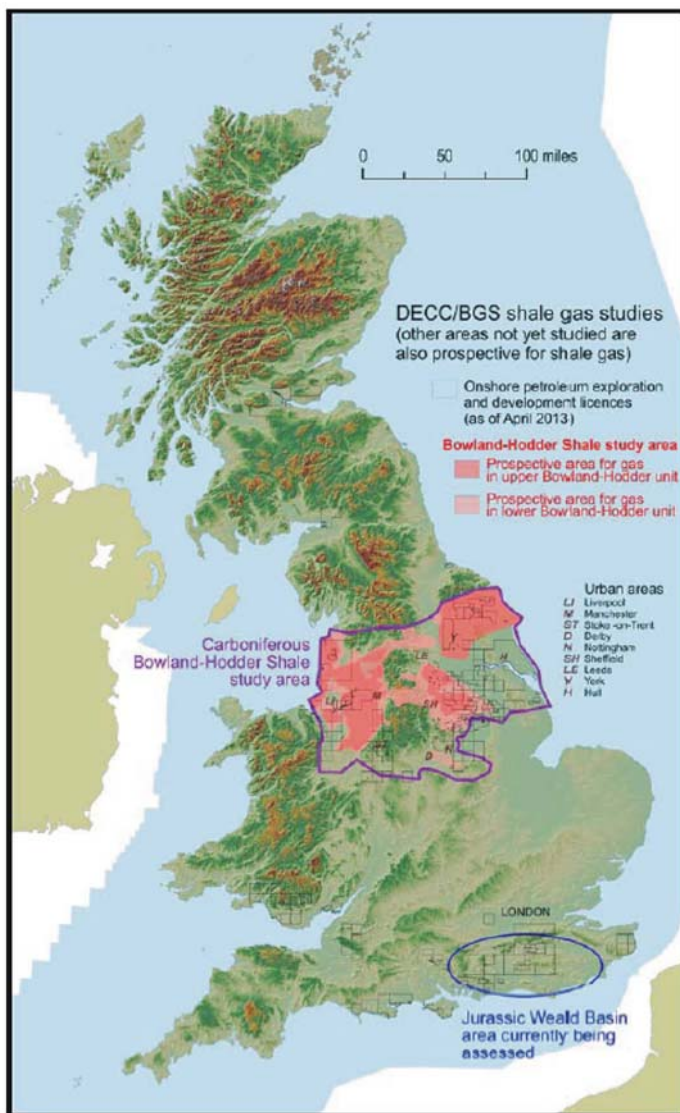
The UK had large conventional gas fields in the southern North Sea, but has used and exported most of this supply. They now import gas, chiefly from Norway, and are hoping to emulate the US in hydraulic fracturing in order to revive domestic production. Hydraulic fracturing was banned in the UK after this technique resulted in some minor earth tremors. However, in May 2013 the parliamentary ban was lifted, allowing companies to pursue their exploration of unconventional reservoirs. Although the UK Energy and Climate Change Select Committee has concluded that shale gas reservoirs are unlikely to be a “game changer” in the UK as they have been in the US, the British government seeks to increase security of gas supply and has provided community incentives alongside new planning guidance for shale gas production as part of their energy portfolio.

Mr. Hartman described the geology of the potential reservoirs based on material published by the UK House of Commons Library and the [British Geological Survey \(BGS\)](#), which is part of the Department of Energy and Climate Change. The shale gas units that indicate sufficient potential for exploration include the Kimmeridge Clay and Lias in the Weald Basin (which are major source rocks for the North Sea fields) and the Bowland-Hodder unit located in central Britain. The Bowland-Hodder shale, of Carboniferous age, is the source rock for gas fields in the Irish Sea. Operators exploring for shale gas in the UK include Cuadrilla, Centrica, IGas, and Dart. An indication that shale gas exploration is gaining traction in the UK is evident with the January 2014 announcement by IGas that they have completed a farm-out agreement with Total E&P UK Limited. Total has contributed \$1.6 million to offset existing costs and may provide up to \$46.5 million in future funding with a minimum of \$19.8 million.

Sixty-four conventional wells have been drilled into the Bowland-Hodder unit, which is found in six onshore basins. Most of these wells only penetrated the upper Bowland-Hodder unit, and only three advanced into the deeper lower Bowland-Hodder unit. The area of interest is densely populated and much of the geologic information was obtained from seismic surveys.

IGas is currently drilling an exploratory stratigraphic test at their Barton Moss site, which lies directly west of Manchester (near highway M62 and Barton Moss Road) and will reach a TD of approximately 10,000 feet. The primary objective is to evaluate the

economic potential of the upper and lower Bowland-Hodder shale. Weatherford Laboratories has been contracted by IGas to provide analytical and prospect appraisal services of the core and open-hole geophysical logs that will be obtained from this drill hole. The test hole is very high profile as it is one of the first attempts to target unconventional reservoirs since the lifting of the fracking ban. There is a sector of the public that is aggressively opposed to any drilling activities, much less those with hydraulic fracture stimulation. The presentation included photos of people demonstrating against the drilling. All of IGas activities are legal and protesters are arrested by police if they interfere. There is interest in using existing North Sea platforms as pads for shale gas exploration before they are decommissioned, to avoid land use problems and local opposition.



The Bowland-Hodder unit is estimated to range in subsea depth between 2,000 and 16,000 ft. The TOC content is between 0.2 and 8% with an average of 1-2%. Vitrinite reflectance studies indicate that the window for dry gas production is at depths greater than 9,000 ft. Mr. Hartman considers this conservative and thinks a cut-off of 6,000 ft. could be used.

With regard to the expense of shale gas exploitation, Mr. Hartman mentioned that an Eagle Ford well can cost about \$8.5 million with 67% of this cost in completion. He stressed the importance of obtaining cores in order to optimize completion techniques and for use in the calibration of well logs. A logging suite might include porosity, induction, micro-resistivity and NMR logs.

An audience member asked about the licencing and taxation system in the UK. All the subsurface minerals rights are owned by the Crown (hence the need for the government

to provide community incentives). There is a minimal charge for permits, which require detailed plans of operation. There is no severance tax. The government's revenue is obtained from taxation of the profits from oil and gas exploration activities.

In answer to another question, Mr. Hartman said that the upper Bowland-Hodder unit, which averaged about 500 ft in thickness, was about 50% clay, which could present difficulties for fracking. The lower Bowland-Hodder unit was up to 10,000 ft. in thickness and was composed of approximately 50% carbonate and 10% clay, the rest being silicates. There is evidence that the lower Bowland-Hodder unit has a higher organic content. Also, the units are slightly overpressured.