



UK Shale Developments

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The Global Warming Policy Foundation

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Cover image: Preece Hall drill site
Cuadrilla

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About the author

Harry Wilkinson is a researcher at the Global Warming Policy Foundation.

1 Introduction

There have been significant developments in the UK shale oil and gas sector in the past year, but the industry remains in an exploratory phase.

Flow-rate appraisals Important new planning permissions have been granted at the Kirby Misperton site in North Yorkshire, and at Preston New Road in Lancashire. These will allow the appraisal of flow rates at multiple shale gas wells, the first time this has been permitted since 2011.

Hybrid plays There is also great potential for the development of 'light tight oil', which is oil trapped in shale layers that can also migrate through naturally induced fractures into adjoining limestone and sandstone layers. This allows for the use of both conventional and unconventional methods of extraction.

New resource Interest is focused on the south of England, where the Upper Jurassic Kimmeridge (the source rock of the North Sea) is hosted within the Weald Basin. On Friday 23rd June 2017, UK Oil and Gas plc revealed a major new discovery at their Broadford Bridge site that suggests the presence of a significant oil resource. Initial flow-rate testing, using conventional methods of extraction, is scheduled to begin in the second half of July.

2 The future of shale gas in the UK

UK Onshore Oil and Gas (UKOOG), the representative body for the industry, has estimated that approximately 400 well pads developed across the UK between 2020 and 2035 could reduce our gas import dependency by at least 50% (see Figure 1).¹ This estimate is based on a typical 10 wells per pad, with between 7 and 11 production pads required to develop a typical 10 × 10 km licence area. UKOOG estimates that 140 production pads across the UK by 2025 could reduce import dependency by around 40%. A further 260 pads would reduce total import dependency by 50% by 2035, and a further 100 pads would maintain that contribution through to 2050. Consultants EY have projected that this would generate £33bn of investment in supply-chain activities and has the potential to create over 64,000 jobs.² The alternative to investing in shale gas will be for import dependency to rise to 80% by 2035, which is the current Oil and Gas Authority projection for where we are headed.³ Today, the UK imports approximately half of its gas, at a cost of over £18m per day.

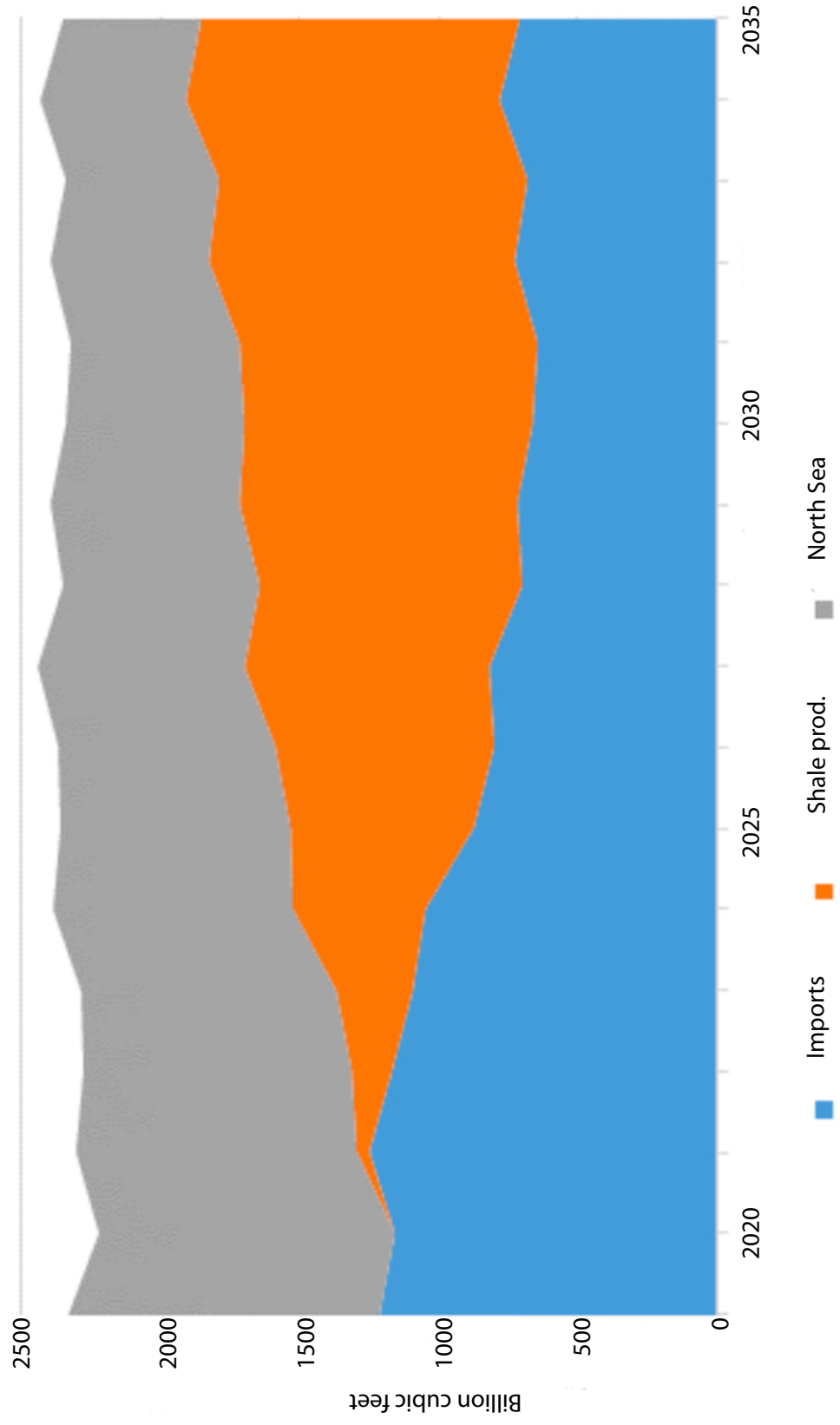
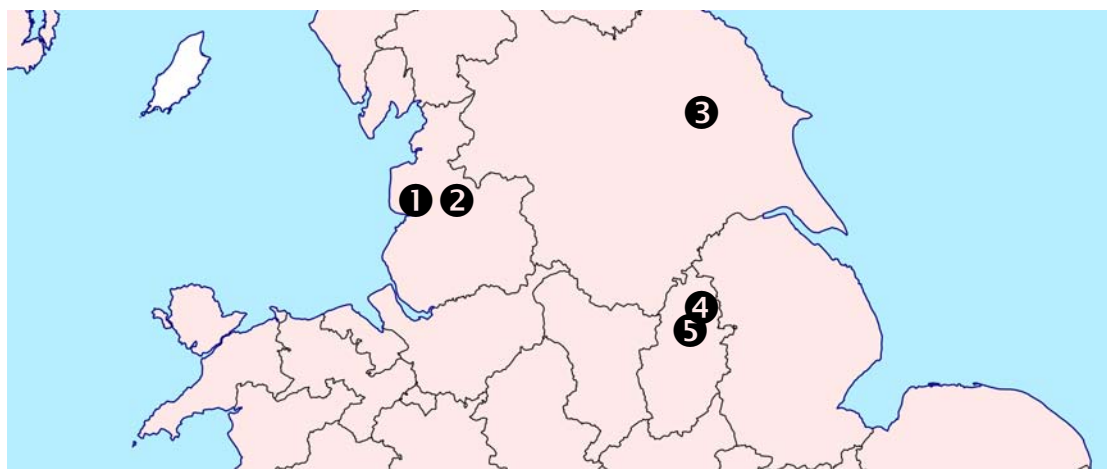


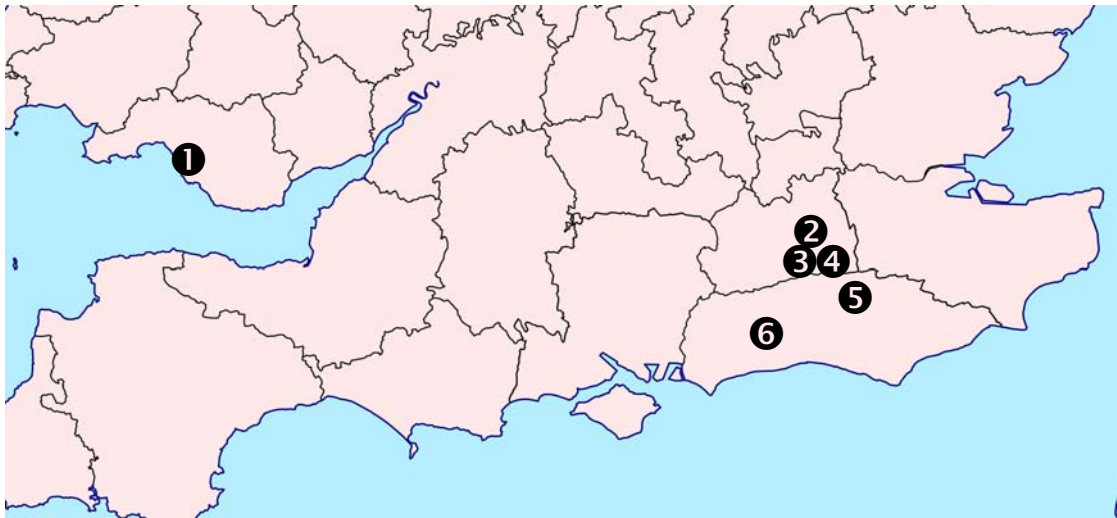
Figure 1: UK projected gas supply

Source: UKOOG

3 Active shale gas and oil sites



1. Preston New Rd, Lancashire (Cuadrilla)	Planning permission approved for up to four new shale gas exploration wells, with further permission for hydrocarbon appraisal (flow testing) if these sites are viable. Site construction began in January 2017. ⁴
2. Roseacre Wood, Lancashire (Cuadrilla)	Planning application for drilling and testing four new horizontal shale gas wells. In October 2016, the government overturned the local council's decision to reject the application, but final approval is dependent on a further consultation on highway conditions. ⁵
3. Kirby Misperton, North Yorkshire (Third Energy)	Planning permission for a shale gas appraisal well, to allow the testing of flow rates of gas from the site. In December 2016, legal challenge by residents rejected at the High Court. ⁶
4. Misson, Nottinghamshire (iGas)	Permission granted for two exploratory wells to assess the potential for shale gas, one vertical and one horizontal well. ⁷
5. Tinker Lane, Nottinghamshire (iGas)	Planning permission approval for exploratory (shale gas) borehole, with an addition of three sets of monitoring boreholes. In 2017, council granted approval for drilling. ⁸



1. Pontrhydyfen, South Wales (UK Methane)	Temporary permission (five years from 2015) for the drilling of an exploratory borehole to test for coal bed methane and shale gas. ⁹
2. Brockham, Surrey (Angus Energy)	Conventional oil well drilled at the site in 1987. Three new wells and a side-track to last well (Brockham-X4) now drilled, allowing assessment of the viability of tight oil extraction in the Weald. New environmental permit issued in 2016. ¹⁰ The old well was permitted for production and Angus claim that this also permits production from the side-track well, but this is disputed by the council. ¹¹
3. Bury Hill Wood, Leith Hill, Surrey (Europa)	Planning permission granted for exploratory oil and gas well in 2015, seven years after applying. Currently applying for environmental permits for handling mining waste and to put up a fence. Primarily a conventional well but seen as 'proof of concept' for tight oil extraction. ¹²
4. Horse Hill, Surrey (UK Oil and Gas)	Hybrid conventional/shale site. Planning application for new flow rate testing for oil at existing exploratory well site, including drilling a side-track well, and drilling and appraisal of a new bore-hole, also with side-track well. Decision on the application is expected in July 2017. ¹³
5. Balcombe, West Sussex (Cuadrilla)	Temporary planning permission given for flow rate testing for shale oil at existing exploratory well site (now expired). In 2017, Cuadrilla applied for variation of its environmental permit to allow further appraisal to begin. ¹⁴
6. Broadford Bridge, W. Sussex (UK Oil and Gas)	Planning permission for drilling and flow testing of a temporary borehole, to assess the prospect of oil. Recent drilling revealed the presence of oil-bearing Kimmeridge shales and limestones. ¹⁵

4 Prospective shale gas and oil sites

Figure 2 shows the areas that received petroleum exploration and development licences under the 14th licensing round, awarded in December 2015, as well as in previous licensing rounds. Several sites within this expanded licensed area are now under consideration as prospective shale gas and oil sites.

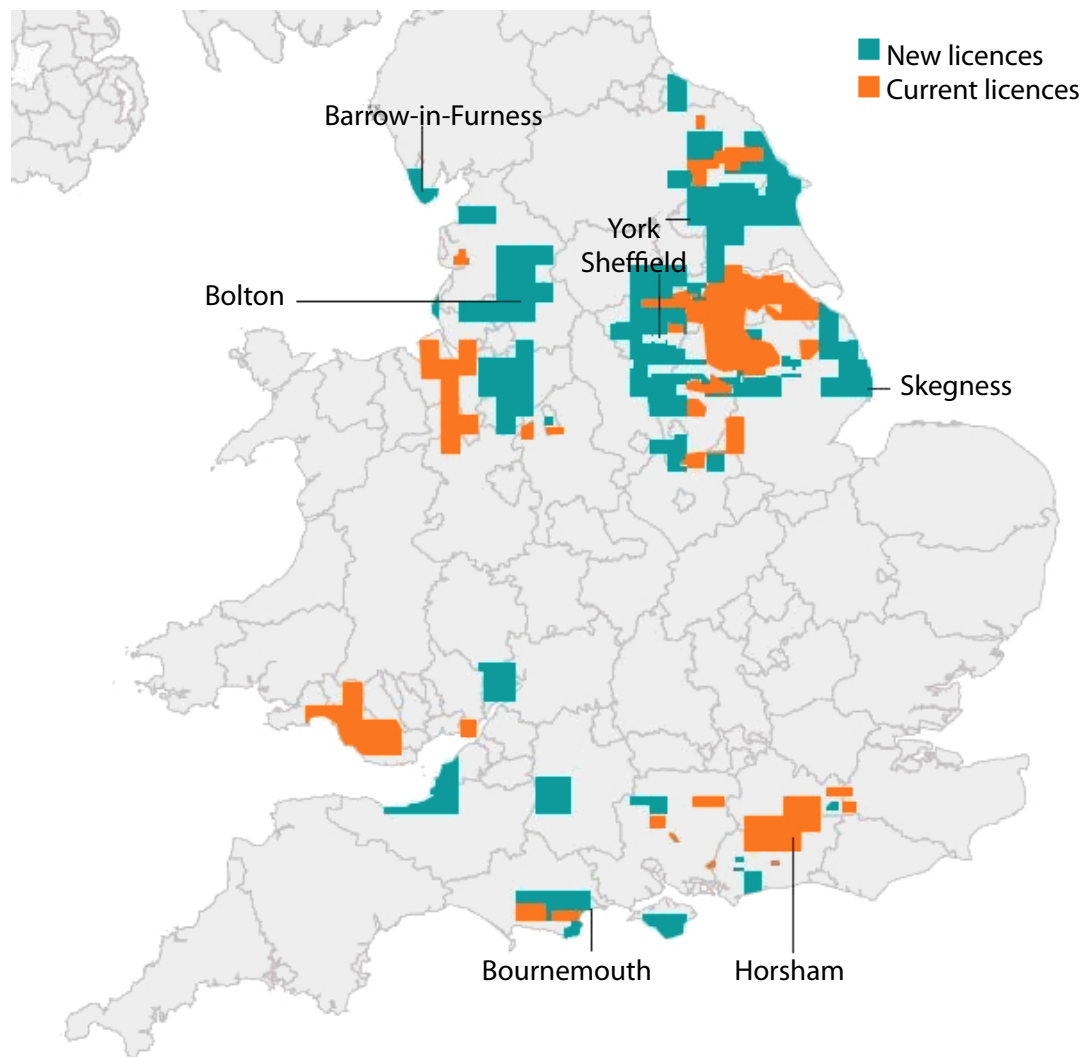


Figure 2: UK oil and gas exploration licences

Source: Oil and Gas Authority/BBC

Mickle Trafford, Cheshire Two potential drilling sites for shale gas have been acquired by IGas. Further progress is dependent on the results of seismic testing.¹⁶

Dutton's Lane, Cheshire Unsuccessfully drilled for coal bed methane. Now has the potential to be developed for shale gas, according to the owners, INEOS.¹⁷

Marsh Lane, Derbyshire Owners INEOS have submitted a planning application for a vertical exploratory core well for shale gas. Would be Derbyshire's first shale gas well if approved.¹⁸

Formby, Lancashire Site owned by Aurora Energy Resources. Seismic testing carried out in July and August 2016. In February 2017, Aurora confirmed its intentions to submit a planning application for shale gas drilling later this year. The site is on a former oilfield that yielded 72,000 barrels of oil between 1939 and 1965. Aurora hope to be able extract further conventional oil resources from the site, but also may look for unconventional resources, as the area is thought to contain shale oil.^{19,20}

Harthill, South Yorkshire INEOS have submitted a planning application for a vertical exploratory well at the site, which is in an area of interest based on existing seismic data.²¹

Thieves Wood, Nottinghamshire INEOS has been negotiating with the Forestry Commission for access to a site for a potential shale gas well.²²

5 Barriers to development

Misinformation campaigns

Opposition from local groups and green NGOs is proving to be a significant barrier to further development. Much of this opposition is fuelled by misinformation campaigns, which repeat discredited claims about the hydraulic fracturing process. These campaigns have even been linked to Russia, where lower gas and oil prices are having a big impact. The former Secretary General of NATO, Anders Fogh Rasmussen, told Chatham House in 2014 that mounting evidence showed that Russia was behind attempts to discredit fracking.²³ Since then, several green activists have appeared on *Russia Today* to condemn the process, including Tina Rotheray, a prominent anti-fracking campaigner in Lancashire. The scaremongering has led to pressure on local councillors to object to drilling for hydrocarbons. Many local councils have tried to issue so-called 'fracking bans'. Earlier this year, Friends of the Earth were forced to withdraw a leaflet by the Advertising Standards Agency, as it contained unsubstantiated claims about fracking.²⁴

Planning system

The choice to explore and extract shale gas and oil resources in the United States is largely based on a private transaction between a landowner and an energy company. This transaction, while governed by federal and state law, is a contractual agreement between two parties that does not provide an entry point for public consideration of the proposed activity. Public engagement is limited to participation in the development and implementation of the regulatory process that governs the subsequent activity. The process of allocating environmental permits varies from state to state.²⁵

In Britain, separate planning applications are required for the exploration, appraisal and production of onshore hydrocarbon resources. This is on top of a variety of environmental and health and safety permits. Furthermore, since mineral resources belong to the state rather than the landowner, energy companies must also apply for exploration and development licences. Planning applications are the responsibility of local councils, but the Secretary of State does have the power to 'call in' an application if it is regarded as 'nationally significant'. The length of time that it takes to process these applications, often many months, and sometimes over a year, has significantly hindered the sector.

In their 2017 manifesto, the Conservative Party pledged to make some significant changes to the planning process, in particular that drilling that does not involve the hydraulic fracturing process will now be classed as 'permitted development', and that 'expert planning functions' will be established to advise local councils, with major shale planning decisions being made the responsibility of the National Planning Regime. The manifesto also contained the promise to set up a new 'Shale Environmental Regulator', which will assume the relevant functions of the Health and Safety Executive, the Environment Agency and BEIS, with the intention of speeding up permit applications.²⁶ Following the hung parliament, there was no mention of these policies in the Queen's Speech, which will make it all the more important to keep the pressure up on the Government in this area. An approach is needed that can bring about swift but considered planning decisions, and that also provides necessary reassurances for local communities. The Labour Party policy remains that fracking should be banned, on the grounds that 'it would lock us into an energy infrastructure based on fossil fuels'.²⁷

Policy barriers

The Scottish and Welsh Governments have both imposed moratoriums on the hydraulic fracturing process. In Scotland, it has been estimated in a report by KPMG for the Scottish Government that unconventional oil and gas development in Scotland could create up to 3100 jobs and add £4.6bn to the value of the Scottish economy.²⁸ The Scottish Government has said that it hopes to decide on whether to allow the

technique in the second half of 2017.²⁹ INEOS boss Jim Ratcliffe has in the past stated his belief that the Scottish Government is 'not against' fracking³⁰. However, more recently he has expressed his frustration with the moratorium, accusing it of denying Scotland income and investment.³¹

It is estimated that there are over 15 EU regulations and directives that apply to the fracking industry.³² Some of the most significant to the industry are:

- the Groundwater Directive, which requires the Environment Agency to enforce groundwater quality standards
- the Mining Waste Directive, which covers the handling and disposal of water used in the process
- the Environmental Impact Assessment Directive, which forces firms to consistently consult with the authorities and the public on each new project
- the Habitats Directive, which prevents drilling near the homes of certain species
- the Industrial Emissions Directive, which requires shale drillers to get an additional licence before flaring.

Following Britain's exit from the European Union, the Government should re-assess these regulations, removing any that are unnecessary or inappropriate.

6 Resource estimates

The most comprehensive UK estimates for shale gas resources come from the British Geological Survey's 2013 study of the Bowland shale formation in northern England. There are other areas in the UK with shale gas resources, such as central Scotland, but they are not thought to be as significant as the Bowland formation.

The central gas-in-place projection, which is an estimate of the total volume of gas contained in the rock, is 37,600 billion cubic meters (bcm), with a range of 23,000–65,000 bcm. This would translate to a potentially recoverable resource of between 1,800–13,000 bcm, assuming similar recovery factors to the US, of around 8–20%. Given annual UK gas consumption of 77 bcm, this would be enough to supply the UK market for between 23 and 169 years.

Estimates for shale *oil* resources have been more contested. In 2014, the British Geological Survey produced a central resource estimate of 4.4 bn bbl of oil in place for the Jurassic shale of the Weald Basin.³³ This is a significant resource but lower than some in the industry predict. In October 2016, the BGS made a western extension to the previous Weald study, to include the Jurassic shale of the Wessex area. It made a central estimate of an additional 1.1 bn bbl³⁴, bringing the total resource estimate to 5.5 bn bbl for the South of England. An earlier US Energy Information Administration (EIA) report estimated there were 700 million barrels of technically recoverable shale

oil in the United Kingdom, with a total 'risky' estimate of 17.1 bn bbl of shale oil in place, and an 'unrisky' (meaning best-case scenario) estimate of 54 bn bbl.³⁵

However, recent commercial findings have suggested that the oil resource may be of a greater size. For example, an assessment by US petroleum consultants Nutech, made a best estimate of 124.3 bn bbl of Jurassic tight oil within the Weald Basin.³⁶ One note of caution is that this estimate includes interbedded conventional plays as well as Kimmeridge shale oil that is not included in the US EIA report, as prior to tests at Horse Hill this was not thought to be mature enough to generate oil.³⁷

To put these estimates into context, annual UK oil consumption is approximately 550 m bbl, and the total resource extracted from the UK's continental shelf in the North Sea is 45 bn bbl. So, if the BGS's assessment is correct, the shale oil in the Weald and Wessex basins may be enough to supply the entire UK market for perhaps 4–9 months at the current rate of consumption, and at typical shale oil recovery factors of 3–7%. At the other end of the spectrum, if the higher commercial findings are validated, the resource may be large enough to supply the entire UK market for between 7 and 16 years.

7 Latest news

UKOG shares rise after significant new oil find 23 June 2017: A significant new oil discovery at the Broadford Bridge oil well in West Sussex sent UKOG shares rising by 60%. This discovery suggests that there could be a continuous oil deposit which extends 30 km to the company's Horse Hill well near Gatwick airport.³⁸ 'The presence of light mobile oil in fractured Kimmeridge shales is highly significant,' the oil and gas explorer said. It observed mobile light oil seeping from multiple sections of fractured shales and limestones at the well.

Flow rate testing is now expected to take place in the second half of July, to determine the commercial viability of the site.³⁹

Scottish councils put £400m into fracking companies 20 June 2017: Pension funds run by ten Scottish local authorities invest more than £400 million in 23 fracking companies, according to a new report.⁴⁰

Study finds fracking doesn't harm drinking water in Texas 19 June 2017: A report by the Academy of Medicine, Engineering and Science of Texas, found that 'direct migration of contaminants from targeted injection zones is highly unlikely to lead to contamination of potential drinking water aquifers.' The study also found that fracking adds \$473 billion to the Texas economy and has created 3.8 million jobs.⁴¹

INEOS submit plans for exploratory test well at Harthill, South Yorkshire 16 June 2017: Shale operations director Tom Pickering said: 'This well is another important step in helping us understand the local geology.'⁴²

GMB union votes to reaffirm its support for fracking 9 June 2017: GMB members have backed their leadership in favour of fracking for UK shale gas, supporting a statement that read: 'If there is a plentiful supply of UK shale gas is it not a moral duty for Britain to provide for our own gas needs.'⁴³

Court of Appeal to hear legal challenge against Lancashire fracking plans 9 June 2017 - Earlier this year the High Court dismissed a judicial review challenge by the Preston New Road Action Group. They have now been granted to challenge this verdict at the Court of Appeal.⁴⁴

Notes

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