POLICY BRIEFING

Update on Fracking

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Summary

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- On 13 January 2014, David Cameron announced that councils would be able to keep 100 per cent of business rates they collect from shale gas sites. This adds to community benefits already agreed with the extraction industry of £100,000 when a test well is fracked and a further one per cent of revenues if shale gas is discovered.
- The Government has offered considerable support for the exploration and possible development of shale gas, despite the controversy surrounding the associated technique of fracking. Water contamination and seismic disturbances are among the associated environmental risks.
- This briefing deals with what is known so far about shale and oil and gas deposits in the UK, the associated risks and possible benefits, and the regulatory regime governing onshore exploration and development.
- It will be of interest to members and officers in all tiers of local government with an interest in environmental sustainability, local economic development, and planning.

Background

Shale gas is found within certain types of shale beds containing organic material that sometimes breaks down to form natural gas or oil. Unlike conventional sources of gas that are contained in reservoirs trapped between layers of impermeable rock, shale gas is trapped within tiny pore spaces or adsorbed into clay mineral particles. Advances in technology, and increases in the wholesale prices of hydrocarbons have made the production of gas directly from shale beds commercially viable.

Methods for extracting gas and oil trapped in shale advanced in the late 1990s, allowing the permeability of shale to be increased by pumping a mix of water, sand, and chemicals at high pressure down a well in order to fracture the shale. The fractures thus created liberate some of the gas from the pore spaces, allowing it to

flow to a well. This technique is known as hydraulic fracturing, or hydrofracing, or more popularly, as fracking. Horizontal drilling produces wells with very long pay zones, and allows both access to harder-to-reach deposits and drilling in several directions from a single vertical bore. Hydraulic fracturing is not a new technology, and horizontal drilling and fracking are also used in conventional exploration and development.

However, advances in these techniques have unlocked some of the largest natural gas deposits in the world. The Barnett Shale of Texas was the first major natural gas field developed in a shale reservoir rock. Others include the Marcellus Shale in the Appalachians, the Haynesville Shale in Louisiana and the Fayetteville Shale in Arkansas. The extraction of gas from American shale deposits has transformed the USA's energy market. According to some sources, the USA's enormous shale reservoirs hold enough natural gas to serve all of the USA's needs for several decades. Import terminals, built before the shale boom, are now being converted intro export facilities for Liquid Natural Gas (LNG).

Shale gas and oil deposits are present in all continents, although exploration and development of shale gas and oil outside of North America is still in the early stages. Energy extraction companies are acquiring shale acreage in a number of countries, including Argentina, Canada, China, Lithuania, Poland, Romania, the Ukraine, and Australia.

Similarly, drilling for shale gas in the UK is still in the exploration stage. However, the Government has offered considerable support for the further exploration and eventual extraction of gas from shale. In Budget 2013, it promised a new shale gas field allowance and to extend the ring-fence expenditure supplement from six to ten years for shale gas projects. It has established a new **Office of Unconventional Gas and Oil** covering the development of shale gas and oil and coal bed methane. In the 2013 Autumn Statement it was announced that the tax rate on a portion of a company's profits would be reduced from 62 to 30 per cent and that companies would receive a tax allowance equal to 75 per cent of capital spent on projects.

On 13 January 2014, David Cameron announced that councils would be able to keep 100 per cent of business rates they collect from shale gas sites. According to the Government, this could be worth up to £1.7 million a year for a typical site. This adds to community benefits already agreed with the extraction industry of £100,000 when a test well is fracked and a further 1 per cent of revenues if shale gas is discovered which, it is claimed, could be worth between £5m-£10m for a typical site over its lifetime.

All of this is in the face of considerable opposition and controversy surrounding fracking. In August 2013, the extraction company Cuadrilla started test drilling for oil at Balcombe in West Sussex, but had to scale back operations after a series of protests in which Caroline Lucas, the Green MP, was arrested. No fracking had yet taken place and more recently the company has announced that extraction can proceed without fracking. Up to date news on sites where shale gas or oil exploration is, or is planned to take place, is available on the site **Frack Off**, together with lists of local protest groups. A number of countries and state or local jurisdictions, where

they have the requisite powers, have announced bans, or moratoriums of various durations on fracking, including France, South Africa, Bulgaria, Northern Ireland, New York, Pennsylvania, Quebec, Fribourg (Switzerland) and New South Wales.

Opposition to fracking arises from its suspected environmental and health risks, the small, if any, contribution of shale gas to the mitigation of greenhouse gas emissions in comparison with renewable sources of energy or nuclear power, and from the disruption it causes for local residents. Among the environmental and health concerns are the risks of water contamination and earthquakes. In the American documentary **Gasland** (YouTube trailer link) local residents demonstrate the contamination of drinking water from gases caused by nearby fracking operations by setting fire to the water running from their kitchen taps. In another Caudrilla incident near Blackpool in 2011, earth tremors attributed to fracking in a report commissioned by the company following the incident led to an 18-month ban on further fracking operations. An American study reported in **New Scientist** concluded that over 100 small earthquakes were triggered in a single year of fracking-related activities in one region of Ohio. The study was among others that concluded that seismic events were triggered by the way waste water was dealt with in the fracking process.

Geological features that make shale wells more costly to drill is one factor among others that mean the industry will develop more slowly in the UK than in the USA, despite the effect of higher natural gas prices. Unlike in the USA, landowners in the UK do not own mineral rights, so there is less incentive to support development. Local authorities must grant planning consent. The USA has relatively permissive environmental regulations, lower population densities, better tax incentives, infrastructure supply chains and technology. Despite the Government's enthusiasm for shale gas, it could be as long as a decade before production on a significant scale will take place. Exploration and development could take another two years.

Where it is and how much there is

A report for DECC by the British Geological Survey (BGS) on the **Unconventional Hydrocarbon Resources of Britain's Onshore Basins – Shale Gas** (pdf file) shows the British shale formations with most gas potential. The diagrams are based on geological maps, where one relevant formation (the Jurassic Lias Subcrop) runs roughly in a forward-leaning 'L' shape from the north east of England down to the south and south west coasts. It includes the Weald Basin, covering parts of East and West Sussex, Kent, and Hampshire. Another is the Bowland Shale, in the Pennine Basin, covering much of Lancashire and Yorkshire. In England, the Weald and Pennine basins are thought to offer the best bets for shale gas recovery. The Central Belt in Scotland is another likely target.

Exploration and development for any oil and gas in the UK can only proceed on the basis of a Petroleum Exploration and Development Licence (PEDL) issued by DECC (see below). A **DECC map** shows the onshore licences as of January 2014. It includes areas currently under licence, the PEDL number and the company to which it was awarded. Upper-tier local authority areas are distinguishable in the map under

the grids and coloured patterns showing areas currently under licence. According to DECC, there is not a firm distinction between exploration for shale gas and exploration for other energy resources and it could be the case that for some sites drilled originally for conventional oil and gas there are plans for deeper drills for shale exploration. The company websites listed with the PEDL numbers can yield more information on what the companies are doing. Some more information can be sought through the PEDL numbers on DECC's website. The **Frack Off** site also has maps of drilling activity, with the skull-and-crossbone insignia in various colours intended to indicate how dangerous the activity is thought to be.

In estimating reserves, the following terms are commonly used:

- Total Resource, or the estimated total volume of gas physically contained in the rock; one measure of total resources used commonly, including by the British Geological Survey (BGS), is Gas in Place (GIP) which is an estimate of the total amount of gas that is trapped within the shale rock.
- Reserves, or the amount deemed to be technically and commercially recoverable.
- Technically Recoverable Resource (TRR), or the estimated volume of gas possible to extract from the total resource if not constrained by economic considerations (and therefore larger than the reserves estimates).

There is very little certainty about the total amount of shale gas potentially extractable from British sites. In June 2013 the BGS and DECC published a **Bowland Shale Gas Study**, including a gas-in-place (GIP) resource assessment for the Bowland shale formation. The central estimate of GIP is 37.6 trillion cubic meters (tcm). Warnings are given on the difficulties of estimating how much of this is recoverable, but extrapolations can be made of recoverable resources of 1.8-13.0 tcm by assuming similar recovery rates to those achieved in the USA. However, Cuadrilla has estimated that 5.7 tcm of gas is in the Bowland Shale under Lancashire, and another company, IGas, has estimated 2.9 tcm in the North West, including the Bowland Shale. Both of these estimates are for total resources. It is expected that further exploratory drilling will yield more accurate estimates.

For perspective, DECC's **published figures** of a current annual UK gas consumption is 77 billion cubic metres (bcm) and potentially recoverable conventional gas resources of about 1.5 tcm.

In its **April 2013 report** (pdf file), the Energy and Climate Change Committee (ECCC) inquiry noted the considerable uncertainty surrounding estimates of shale gas reserves, and the lack of clarity ensuing from inconsistent terminology despite the presence of departmental definitions. In its **response** (pdf file) in July 2013, the Government noted that the industry had estimated that it would have to drill 20 to 40 wells over the next 2 years in order to establish the commercial viability of extracting shale gas. ECCC also concluded that it was too early to say whether domestic production of shale gas could result in cheaper gas prices in the UK, and that it would be wrong to assume that prices would come down as a result of domestic or foreign shale gas. Nonetheless, the ECCC agreed with the Government that shale

gas exploration should be encouraged, subject to rigorous regulatory arrangements. .

Shale gas exploration and local communities

There are a number of assessments purporting to demonstrate the economic benefits of shale gas, some, perhaps predictably, produced by the industry itself. In 2011 Cuadrilla published **Regeneris Consulting's economic assessment** (pdf file) of the impact of shale gas exploration and production in Lancashire and the UK. This estimated that a single test well operation in Lancashire, in 2011 prices, costs about £10.5 million, about 18 per cent of which flows to Lancashire workers or suppliers. It is estimated that test well activity can support some 250 full time equivalent (FTE) jobs across the UK over a 12 month period, of about 15 per cent of which is taken by Lancashire residents. In the early stages, very few of the specialist supply chain contractors make extensive use of local labour although this would change under a full commercial extraction scenario. At the UK Level, the estimated FTE employment impact peaks at some 5,600 jobs in the period 2016 through to 2019, with a build up in the years from 2013 onwards, if there is a move to commercial extraction. In a bullish report from the **Institute of Directors**, also sponsored by Cuadrilla, it is indicated that the industry could support up to 74,000 jobs, many in regions with currently high unemployment.

A short paper published by DECC: **Developing Onshore Shale Gas and Oil: Facts about 'Fracking'** (pdf file) details the development sequence for shale gas and oil. During the first phase, normally lasting for between 2-6 months, there is exploratory drilling to see if oil or gas can be extracted profitably. This stage might involve seismic surveys, test samples of the shale rock, one or more fracks and flow testing. A pad will be built and a 30m high drilling rig installed. Stage 2, preparing for production, lasts between six months and two years, during which water, chemicals, equipment, and materials will be bought on to the site and waste water carried away for disposal. This appears to be the busiest stage, during which additional wells will be constructed. Production could last for another 20 years. Decommissioning, the final stage, and which includes site restoration, could take place at any time if the site doesn't develop into the next one.

Local Environmental Impacts

It appears to be generally accepted that unconventional gas is an intensive industrial process, generally imposing a larger environmental footprint than conventional gas development. More wells are often needed, and the scale of development can have major implications for local communities, land use and water resources. There are serious hazards including the potential for contamination of surface and groundwater. On the other hand, the Institute of Directors report contains case studies of environmentally successful onshore drilling operations of which **Wytch Farm** in Dorset is among the more widely reported.

A 2011 report by the **Tyndall Centre** (pdf file) report set out concerns about ground and surface water contamination, possibly affecting the quality of drinking water and wetland habitats. The severity will depend on the importance of the aquifer, the extent and nature of contamination, the concentration of hazardous substances and the connection between groundwater and surface waters.

Groundwaters can become exposed to contamination from shale wells through failures in the wellbore, or through the migration of contaminants from the target fracture formations through subsurface pathways. It is noted that because wellbores are likely to be drilled through several aquifers, the wellbore probably provides the single most likely route for contamination of groundwater – the actual fracking itself takes place deep underground far below aquifers. Much discussion tends to focus on the casing, or protective sheath, around the wellbore, and it is noted that in the USA, standards on casings varies between states. The instances of water contamination in the USA noted above (the flammable tap-water) have been attributed to unsatisfactory well casing construction or cementing. In the USA, an investigation by the Environmental Protection Agency (EPA) on the **impact of fracking on local drinking water** is ongoing and due to report in 2014.

Induced seismicity can occur in previously aseismic areas following oil and gas activities. Natural or mining-induced earthquakes in the UK are not uncommon. Following the resumption of fracking activities in December 2012 after the investigation of the Blackpool incident, the Secretary of State announced a new set of requirements for operators. Henceforth, they would have to review the available information on faults in the area and to monitor background seismicity before operations commenced. Seismic monitoring would continue during operations, with these subject to a 'traffic-light' regime. The 'red light' would be applied to Cuadrilla's programme in Lancashire if a seismic event at magnitude 0.5 occurred, which is considered far below a perceptible surface event. Operators would also be required to monitor the growth in the height of the frack away from the borehole, in part to ensure that the fracture would be contained and far away from any aquifers.

Finally, the large water requirement of fracking has been noted by the Tyndall Centre among others as problem particular to fracking given that water resources in many parts of the UK are already under pressure. However, in its **response** (pdf file) to a 2011 ECCC inquiry, the Government said that adverse effects on water resources are not expected. Any operator must have a licence to abstract water from the Environment Agency who will assess existing abstraction water levels and licences. Because water abstraction is controlled in the UK, the general expectation is that further water use can be managed sustainably.

Regulatory regime

Exploration for shale gas is covered by the UK regime for all oil and gas exploration and development. A UK Petroleum Exploration and Development Licence (PEDL) allows a company to pursue a range of exploration activities, including exploration and development of unconventional gas, subject to necessary drilling and

development consents and planning permission. DECC has outlined the onshore licensing system on its oil and gas **website**. DECC publishes drilling activity figures for exploration, appraisal and development wells drilled each year.

After the last (13th) Onshore Licensing Round in 2008 and following the grant of planning permission, consent was given to drill for shale gas exploration in five locations. Of these, consent for fracking of the shale was given to Cuadrilla at two sites at Poulton-le-Flyde. A 14th round of onshore licence applications is expected in 2014

PEDLs allow a company only exclusivity in an area to search for, bore for and get hydrocarbons. They are separate from all other permissions, including:

- Planning permission
- Any need to gain access rights from landowners
- Environmental permits, including for mining waste, from the Environment Agencies
- Health and safety regulations and permits from the HSE
- Consent to drill and frack, from DECC.

Each site is assessed by the Environment Agency (SEPA in Scotland) who regulate discharges to the environment, issue water abstraction licences, and are statutory consultees in the planning process. A permit will also be needed if large quantities of gas are to be flared and for groundwater activities, depending on the local hydrology. HSE monitors shale gas operations from a well integrity and site safety perspective.

As indicated, DECC's consent for all drilling or production operations for oil and gas is given only after planning permission has been obtained. The Minerals Planning Authority (MPA) takes the final decision in accordance with the National Planning Policy Framework and the July 2013 Government guidance, **Planning Practice Guidance for Onshore Oil and Gas** (pdf file) which attracted some criticism for limiting the issues that local councils can consider and of being weighted in favour of granting permission. In addition, planning authorities should have a section on mineral extraction in their local plan

In January 2014, following a period of consultation, the Government published its revised proposals for requirements in planning applications for onshore oil and gas (available **here**), in which it proposes removing the requirement to serve notice on individual owners and tenants of land where solely underground operations may take place. One reason given for this is that because of the depths that drilling takes place it is often not possible to identify the exact route of any lateral drilling. .

In November 2012, the Government consulted on extending the major infrastructure planning regime to onshore oil and gas extraction developments of over 500 tonnes per day for petroleum and 500,000 cubic metres per day for gas. It concluded that applications for planning permission for onshore oil and gas schemes, including any future planning proposals for shale gas development, should not be included in the regime, but will keep this under review.

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Shale Gas and Carbon Reduction

A key argument among environmental groups against shale gas is that it diverts attention and investment from more expensive up-front alternatives such as renewables, and slows the reduction in the reliance on fossil fuels. Attention has also been drawn to the emissions of methane in the production process itself. This has been countered by industry claims that methane leakages can be either captured or flared. The 2013 ECCC report recommended that policies on flaring and venting of methane should be reviewed and emissions should be monitored by DECC.

In September 2013 DECC published a report on the **Potential Greenhouse Gas Emissions Associated with Shale Gas Extraction and Use**. It concluded that local emissions should not be significant if properly regulated, compared to the overall emissions from burning shale gas. The overall carbon footprint was comparable to gas extracted from conventional sources, lower than that of LNG, and, when used for generating electricity, significantly lower than that of coal. Responding to the report, the Secretary of State said that shale gas is a 'bridge' in the transition to low carbon. Onshore production would also contribute to energy security and maintain tax revenues as the North Sea wound down.

Comment

Despite the considerable uncertainties that remain over the benefits and risks of fracking for shale gas, it would appear that a consensus has formed among politicians and experts in favour of shale gas, but with the proviso that rigorous safeguards against its environmental risks are in place and properly implemented and monitored. The consensus has ensured a powerful institutional momentum driving shale exploration and development forward, including through the planning system.

In the face of this powerful presumption in favour, it is unclear how much local discretion is allowed local communities. Nonetheless, local authorities need to satisfy themselves on what sort of resource is being drilled for (shale gas is not the only unconventional source) and the associated techniques being employed, including the chemical mix used in the fracking process. They also need to satisfy themselves on appropriate safeguards against water contamination, unsustainable water use, disposal of waste water and chemicals, and the risks of seismic disturbance. Whatever leverage they possess could be used to commission independent geological surveys, to seek mitigation against the inevitable disturbance for local residents, and ensure that benefits flow to the local economy.

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