



## BRIEFING PAPER

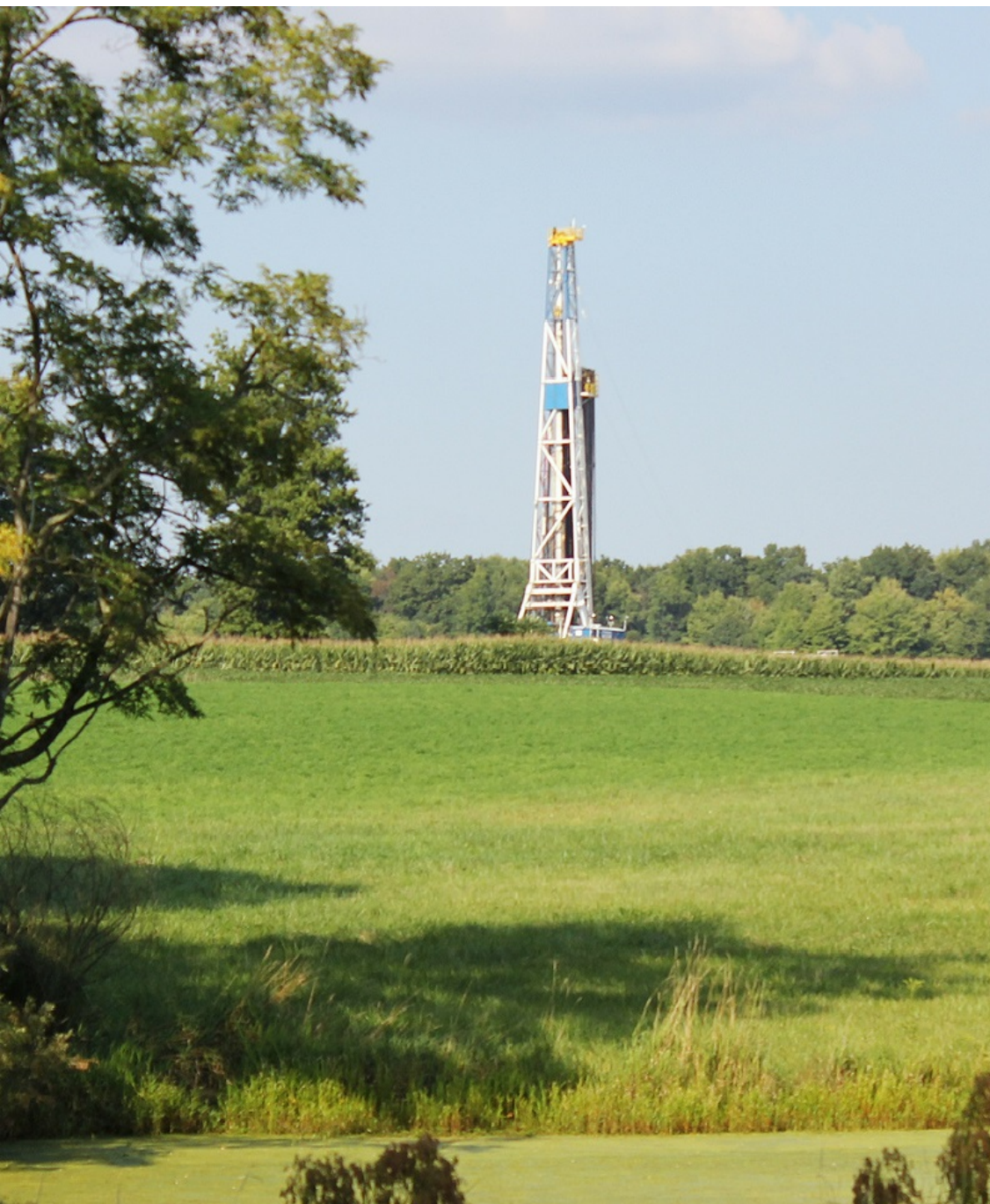
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# Shale gas and fracking

By Edward White  
Mike Fell, Louise Smith

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Edward White , Science and Environment

## Summary

In the UK, drilling for shale gas is at only the exploratory phase. But the rapid development of shale gas resources in North America has transformed the world gas-market outlook.

The consensus seems to be that shale gas will not be a 'game changer' in the UK as in the US. There is, for example, less land available to drill on and landowners do not own the rights to hydrocarbons beneath their land. However, in June 2013 Centrica acquired a 25% stake in Cuadrilla's exploration licence in Lancashire and the Government and British Geological Survey published raised estimates of the shale gas resource in Northern England. The Government is also consulting on legislation to introduce tax incentives for shale gas exploration, and has announced community financial benefits.

Existing onshore petroleum exploration and development licences, which are not specific to shale gas, are therefore more likely now to be explored for their shale potential.

Shale gas is extracted from solid rock using a process called hydraulic fracturing, or 'fracking'. The Royal Society and Royal Academy of Engineering have [reviewed](#) the risks associated with fracking. They concluded that the health, safety and environmental risks can be managed effectively in the UK, by implementing and enforcing best operational practice. However, they made several recommendations including calling for more research on the carbon footprint of shale gas extraction.

A report on this was published by DECC in September 2013, in which shale gas emissions were said to be similar to those of conventional gas and lower than those of coal and LNG, leading the Secretary of State to describe shale gas as a 'bridge' to a low-carbon future.

The Queen's speech in 2014 confirmed Government plans to streamline the underground access regime and make it easier for companies to drill for shale gas. The Infrastructure Bill has been amended to provide this. It also provides a number of new 'safeguards'.

On 16 December [regulations](#) were approved by the House that provide some protection fracking at depths shallower than 1200m in protected areas. Further protections, through the licencing process have [been consulted on](#).

On 17 December 2015, the Oil & Gas Authority (OGA) announced that licences for a total of 159 blocks were formally offered to successful applicants under the 14th Onshore Oil and Gas Licensing Round.

All the licence blocks are mapped out on the OGA's [interactive map](#).

There are no commercial shale gas operations in the UK.

# 1. Hydraulic fracturing, or fracking

## 1.1 A note of definitions

In short, 'unconventional gas' is natural gas, but from unconventional sources. 'Shale gas', as the name suggests, is found within organic-rich shale beds, which are actually layers of rock, rather a conventional 'reservoir' capped by shale or other beds.

The conventional view was that oil and gas would mature within these organic-rich and low-permeability rocks, and then migrate into conventional reservoirs from where they could be recovered. However, with advances in drilling and wellsite technology, and increases in the wholesale prices of hydrocarbons, production of gas directly from the shale beds is now commercially viable. The processes are described below.

DECC has produced a note on [Resources vs Reserves: What do estimates of shale gas mean?](#)<sup>1</sup> The Parliamentary Office of Science and Technology (POST) has also published a POSTbox on [UK Shale Gas Potential](#). The following terms are used most commonly:

- **Total Resources:** the estimated total volume of oil and gas physically contained in the rock. One measure of total resources used commonly, including by the BGS, is the **Gas in Place (GIP)** which is an estimate of the total amount of gas that is trapped within the shale rock.
- **Reserves:** the amount of resources that are deemed to be technically and commercially recoverable.
- **Technically Recoverable Resource (TRR):** the estimated volume of gas that it is possible to extract from the total resource if not constrained by economics (and therefore larger than the reserves estimates).<sup>2</sup>

POSTnote 374, [Unconventional Gas](#) (April 2011), also gives some background.

## 1.2 What is Fracking?

Gas held within shale beds is accessed through a technique called "hydraulic fracturing" or "fracking" for short. Water, containing sand, is pumped at high pressure into the rock. The sand keeps the small fractures in the rock open while the gas is extracted. According to the [British Geological Survey](#) (BGS):

After initial exploration of the shale deposits, a borehole is drilled into the shale horizon at a carefully selected site. It may be drilled horizontally to increase the volume of rock that can be accessed by the borehole. A process called hydraulic fracturing ('fracking')

<sup>1</sup> DECC, 27 June 2013 (erroneously dated as 27 July 2013 on its cover)

<sup>2</sup> DECC, [Resources vs Reserves: What do estimates of shale gas mean?](#) 27 June 2013 and [UK Shale Gas Potential](#), POSTbox July 2013

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is undertaken. This involves pumping water into isolated sections of the borehole at pressures high enough to fracture the surrounding rock. Sand entrained in the water helps to 'prop' open the fractures, create permeability in the rock and allow the gas to flow into the borehole. Chemicals are also added to improve the efficiency of the fracking operation.<sup>3</sup>

Horizontal drilling is a technique used increasingly in conventional exploration and development. It gives access to harder-to-reach deposits and allows drilling (and fracking) in several directions from a single well bore.

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<sup>3</sup> BGS website, [New shale gas resource figure for central Britain](#) accessed 11 July 2013

## 2. The shale gas resource in the UK

### 2.1 Where is it, and how much is there?

Shale beds are not found all over the UK. A report for DECC by the BGS on the [Unconventional Hydrocarbon Resources of Britain's Onshore Basins – Shale Gas](#) shows the British formations with most shale gas potential.<sup>4</sup> The diagrams reflect geological maps, where the same outcrops or formations run roughly on a South-East/North-West axis, running for example from the North East of England down to the South/South West coast.

These include the Upper Bowland Shale (the source rock for the Irish Sea conventional fields, and where Cuadrilla were first exploring), and both the Kimmeridge Clay and Lias of the Weald Basin (source rocks for the North Sea and English Channel fields).

The British Geological Survey (BGS) in association with the Department of Energy and Climate Change (DECC) has completed shale resource estimates for several areas in the UK. For more information follow these links:

- [Midland Valley of Scotland](#) (30th June 2014)  
Read the brief summary on our website or download the full reports.
- [Wales](#) (26th June 2014):  
Download the full report on potential unconventional gas resources in Wales.
- [Jurassic shale of the Weald Basin](#) (23rd May 2014):  
Read the brief summary on our website or download the full reports.
- [Bowland Shale](#) (published 27th July 2013):  
Read the brief summary on our website or download the full reports

On 27 June 2013 the BGS/DECC published a [Bowland Shale Gas Study](#), including a gas-in-place (GIP) resource assessment for the Bowland shale formation in Northern England.<sup>5</sup> This is not therefore an assessment for the entire country. Nor is it an estimate of the commercially recoverable gas.

Their central estimate of GIP is 37.6 trillion cubic meters (tcm). A [POSTbox](#) shows how this can be extrapolated to potentially recoverable resources of 1,800-13,000 billion cubic meters (bcm) by assuming similar

<sup>4</sup> DECC/BGS, [Unconventional Hydrocarbon Resources of Britain's Onshore Basins – Shale Gas](#), 2012

<sup>5</sup> Andrews, I.J. 2013. The Carboniferous Bowland Shale gas study: geology and resource estimation. British Geological Survey for Department of Energy and Climate Change, London, UK.

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recovery factors to the US, of 8-20%. This compares to DECC's published figures of a current annual UK gas consumption of 77 bcm and potentially recoverable conventional gas resources of 1,466 bcm.<sup>6</sup>

These are much higher than earlier BGS estimates, although a 2013 report from the [US Energy Information Agency](#) had suggested the technically recoverable resource could be as high as 736 bcm.<sup>7</sup>

A September 2012 [report](#) from the UK Energy Research Centre (UKERC) formed part of a larger study of unconventional gas resources by the Joint Research Centre of the European Commission.<sup>8</sup> This noted many significant uncertainties in assessing the recoverable volumes of shale gas, at regional and global level. It notes also that recovery rates are much lower than for conventional gas, around 15-30% of original gas in place (OGIP) compared to perhaps 80% in conventional reservoirs.

The most accurate estimates can really be obtained by test drilling. A company called [Cuadrilla](#) started drilling shale gas exploration wells near Blackpool in August 2010.<sup>9</sup> In September 2011 Cuadrilla [estimated](#) that 5.7 tcm of gas was in the Bowland shale under Lancashire.<sup>10</sup> The BGS expressed scepticism about the accuracy of this estimate, and pointed out that recovery rates would be much lower.<sup>11</sup> In August 2013 Cuadrilla started test drilling at Balcombe in West Sussex before scaling back drilling operations after a protest camp; it has recently submitted a new planning application for the area.<sup>12</sup>

In June 2013 [IGas](#), another company which has been conducting exploratory studies in the UK, [published estimates](#) of "gas initially in place" (or total resource) in shales in the North West (including the Bowland shale) with a "most likely" value of 102 trillion cubic feet (2.9 tcm). Drilling to be conducted in Q4 of 2013 was expected to further refine these estimates.<sup>13</sup>

The British Geological Survey has completed [an estimate for the amount of shale oil and shale gas in the Weald Basin in south-east England in 23 May 2014](#). Though it is estimated that large quantities of shale oil are present, No significant gas resource is recognised using the current geological model because the shale is not thought to have reached the geological maturity required to generate gas.

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<sup>6</sup> [UK Shale Gas Potential](#), POSTbox July 2013

<sup>7</sup> EIA/ARI, [World Shale Gas and Shale Oil Resource Assessment](#), June 2013, XI-2, converted from original figure of 26 trillion cubic feet

<sup>8</sup> European Commission, Energy Security Unit of the Joint Research Centre [Unconventional Gas: Potential Energy Market Impacts in the European Union](#), 2012

<sup>9</sup> <http://www.cuadrillaresources.com/what-we-do/locations/>

<sup>10</sup> Cuadrilla Resources, [About natural gas](#), accessed 25 June 2013

<sup>11</sup> "What the frack?" *Economist*, 1 October 2011

<sup>12</sup> <http://www.cuadrillaresources.com/our-sites/balcombe/> accessed 9 September 2013

<sup>13</sup> IGas, [Shale Gas in place in IGas' North West licences of up to ca.170Tcf](#), 3 June 2013

## 2.2 Economic implications

An Energy and Climate Change Select Committee (ECCC) [inquiry](#) in 2011 concluded that shale gas was unlikely to be a “game-changer” as in the US, or perhaps countries like Poland.<sup>14</sup> A major factor is that there is less land available to drill on.<sup>15</sup>

A follow-up inquiry by ECCC in 2013 into [the impact of shale gas on energy markets](#), recommended that further exploratory operations be encouraged to help establish reliable resource estimates. It found 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.<sup>16</sup>

In October 2011 Cuadrilla published Regeneris Consulting’s [full economic assessment of the impact of shale gas exploration and production in Lancashire and the UK](#). This estimated that for test wells alone:

- A single test well operation, in 2011 prices, costs in the region of £10.5 million, made up of Cuadrilla’s own costs, that of its two internal service companies and expenditure on a range of first tier suppliers.
- Some 18% of expenditure is shown to be deployed on Lancashire workers/suppliers, with a third going overseas. Of all UK expenditure (circa £7 million per test well), a third is deployed on labour costs, with 7% being utilised for subsistence expenditure of workers most of which flows to Lancashire businesses.
- We estimate the test well activity will support some 250 FTE jobs across the UK over a 12 month period. Half of the jobs will occur within Cuadrilla and its extensive range of 1st tier suppliers.
- Some 15% of the jobs (circa 40) are estimated to be taken by Lancashire residents. ... At this stage very few of the specialist supply chain contractors make extensive use of local labour although this would change under a full commercial extraction scenario.<sup>17</sup>

Cuadrilla’s report estimated that test well activity might support 250 FTE jobs across the UK over a twelve month period. Also at the UK Level, the estimated FTE employment impact peaks at some 5,600 FTE jobs in the period 2016 through to 2019, with a build up in the years from 2013 onwards, if there is a move to a commercial extraction phase.<sup>18</sup>

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<sup>14</sup> House of Commons Energy and Climate Change Committee, [Shale Gas](#), May 2011

<sup>15</sup> British Geological Society [Shale Gas Prospectivity web pages](#)

<sup>16</sup> House of Commons Energy and Climate Change Committee, [The Impact of Shale Gas on Energy Markets](#), April 2013

<sup>17</sup> Regeneris Consulting for Cuadrilla, *Economic Impact of Shale Gas Exploration & Production in Lancashire and the UK* September 2010 published 5 October 2011

<sup>18</sup> Ibid, p.44



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In June 2013 [Centrica acquired](#) a 25% interest in the Bowland exploration license from Cuadrilla.<sup>19</sup>

A May 2013 [report](#) from the Institute of Directors presented a scenario where UK shale gas production attracts investment of £3.7 billion per year and supports up to 74,000 jobs, often focused in regions with currently high unemployment and in sectors such as manufacturing. It also potentially contributes significant tax revenue.<sup>20</sup>

In a speech in September 2013 the Secretary of State repeated these IoD figures, and even proposed hypothecation of shale gas revenues, a policy normally opposed by Chancellors:

One policy proposal before our party conference is that a Low Carbon Transition Fund is established from some of the tax revenues from any future shale gas production<sup>21</sup>

However, he noted that the uncertainties around the amount that could be commercially extracted were too great to know what effect shale gas would have on energy prices. Reporting the speech, [Business Green](#) noted that the Secretary of State was therefore being more cautious than the Prime Minister and the Chancellor, both of whom had argued shale gas could play a significant role in bringing down energy costs.<sup>22</sup>

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<sup>19</sup> [Centrica, Centrica acquires a 25% interest in UK shale exploration licence](#), 13 June 2013

<sup>20</sup> IoD, [Infrastructure for Business: Getting shale gas working](#), 22 May 2013

<sup>21</sup> DECC, Speech by Ed Davey [The Myths and Realities of Shale Gas Exploration](#) 9 September 2013

<sup>22</sup> Business Green 9 September 2013 [Davey: UK shale gas is compatible with climate change targets](#)

## 3. Regulatory regime

### 3.1 Petroleum exploration and development licences (PEDLs)

Shale gas drilling is covered by the normal 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 activities, including exploration and development of unconventional gas, subject to necessary drilling/development consents and planning permission.<sup>23</sup>

The [Petroleum Act 1998](#) vests all rights to the nation's petroleum resources in the Crown, but the Government grants PEDL licences that confer exclusive rights to 'search and bore for and get' petroleum. Each of these confers such rights over a limited area and for a limited period. DECC outlines the onshore licensing system on its [oil and gas website](#).

DECC advises that there is no firm licencing distinction between exploration for shale gas and exploration for conventional oil and gas. Some companies who are drilling mainly for conventional oil and gas have decided to drill deeper than they otherwise might have, in order to see whether there is prospective shale in their licensed areas (coring is all that is envisaged in these cases and no fracking is involved).<sup>24</sup>

PEDL licences are granted in 'rounds' where the Oil & Gas Authority (OGA) – the UK's oil and gas regulator – calls for applications from interested parties to submit bids for advertised license blocks.

An [interactive map](#) has been produced by the OGA to provide information on onshore oil and gas exploration and production activity in Great Britain. This includes those areas already under license, any areas are on offer in an OGA licensing round and an illustration of shale gas resources.

#### The 14<sup>th</sup> Round

The 14th Onshore Oil and Gas Licensing Round was launched on 28 July 2014 and closed on 28 October 2014. The [Gov.uk website states](#):

A total of 95 applications were received from 47 companies covering 295 Ordnance Survey Blocks. Following scrutiny of the applicants' competency, financial viability, environmental awareness and geotechnical analysis, and following the decision not to award licences in Scotland and Wales, 159 blocks were taken forward for further consideration

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<sup>23</sup> See [http://www.decc.gov.uk/en/content/cms/meeting\\_energy/oil\\_gas/shale\\_gas/shale\\_gas.aspx#7](http://www.decc.gov.uk/en/content/cms/meeting_energy/oil_gas/shale_gas/shale_gas.aspx#7) for more links to information on the regulatory regime

<sup>24</sup> DECC pers. comm., August 2013

### Initial offers and consultation

On 18 August 2015, OGA announced that 27 onshore blocks from the 14th Onshore Oil and Gas Licensing Round will be formally offered to companies.

A second group of 132 further blocks was subjected to detailed assessment under the Conservation of Habitats and Species Regulations 2010, the findings of which are now out for consultation.

The Government [consultated](#) on the approach to providing PEDL licenses for areas where oil and gas developments might impact on European protected areas. EU law requires that an impact assessment is required of any “plan or project” that is likely to have a significant effect on a ‘European site’. European sites are conservation areas established by European law.

The consultation proposes a methodology for determining which licencing areas might impact on a European site and proposes a policy on how conditions could be attached to PEDL licences so that European sites would not be impacted by fracking.

### Final offers

On 17 December 2015, the Oil & Gas Authority (OGA) announced that licences for a total of 159 blocks were formally offered to successful applicants under the 14th Onshore Oil and Gas Licensing Round.

It was [announced](#) that following the [conclusion of the consultation process](#),

[...] the OGA is now satisfied that the approval of the 14th Licensing Round, and the award of each of the licences under the Round, will not have an adverse effect on the integrity of any protected European site. As a result, the OGA is offering licences for a total of 159 blocks. For 75 of these blocks, the licence will contain a condition that prohibits all or specific activities in parts of the block.

All the licence blocks are mapped out on the OGA’s [interactive map](#).

## Other permissions

Other permissions are required before fracking can commence. These controls were outlined by DECC in its [Synopsis of main questions raised in responses to DECC consultation on mitigation of seismic risks from hydraulic fracturing for shale gas, with Government responses](#).<sup>25</sup>

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

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<sup>25</sup> 21 December 2012

- 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.

The terms of the PEDL licences require DECC's approval for the choice of operator. One of the issues DECC checks before approving an operator is coverage of relevant insurances.<sup>26</sup>

All drilling operations are subject to notification to the Health and Safety Executive. Also, 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.<sup>27</sup> The Environment Agency has [issued guidance](#) on this which notes that a mining waste permit will be required for drill cuttings, spent drill muds and drill fluids, flowback fluids, waste gases and wastes left underground. A permit will also be needed if large quantities of gas are to be flared and for groundwater activities, depending on the local hydrology.<sup>28</sup>

The UK has, alongside Norway, one of the most stringent offshore drilling safety regimes in the World. According to the [HSE](#);

HSE monitors shale gas operations from a well integrity and site safety perspective. We oversee that safe working practices are adopted by onshore operators as required under the Health and Safety at Work Etc Act 1974, and regulations made under the Act. These specifically are:

- The Borehole Site and Operations Regulations 1995 (BSOR) applies to shale gas operations. (These regulations are primarily concerned with the health and safety management of the site).
- The Offshore Installations and Wells (Design and Construction, etc) Regulations 1996 (DCR) apply to all wells drilled with a view to the extraction of petroleum regardless of whether they are onshore or offshore.<sup>29</sup>

In November 2012 the [Environment Agency](#) and HSE produced a [joint working strategy](#) on how they will work together to ensure a joined up approach and that there is appropriate monitoring and inspection of unconventional oil and gas operations.<sup>30</sup>

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<sup>26</sup> DECC pers. comm., 22 February 2013

<sup>27</sup> HC Deb 1 February 2011 c669w and <http://www.environment-agency.gov.uk/business/topics/126689.aspx>

<sup>28</sup> <http://www.environment-agency.gov.uk/business/sectors/148556.aspx> December 2012

<sup>29</sup> HSE [The regulation of onshore unconventional oil and gas exploration \(shale gas\)](#) webpage accessed 13 August 2013

<sup>30</sup> HSE/Environment Agency, November 2012

## 3.2 Planning permission

As with all other proposals for oil and gas developments, proposals for shale gas exploration or extraction are subject to the requirements of the [Town and Country Planning Act 1990](#) administered by the Minerals Planning Authority (MPA) for the area in which the development is located. DECC's consent for all drilling or production operations for oil and gas is given only once planning permission has been obtained.<sup>31</sup>

The MPA will take the decision in accordance with the policies set out in the [National Planning Policy Framework](#) (NPPF) and the "minerals" section of the online [Planning Practice Guidance](#) (PPG).

The procedure used to determine these applications is set out in the [Town and Country Planning Act 1990](#) and the [Town and Country Planning \(Development Management Procedure\) \(England\) Order 2015](#) (SI 2010/595). Under these rules planning applications must be publicised by site display and in local newspapers and information about the application must also be available on the relevant local authority website. This must include a section on how interested people can submit representations about the application, giving a period of at least 14 days.

Following a [consultation](#), in September 2013 and [Government response](#) in January 2014 changes were made to the system of how landowners and tenants should be notified by applicants of applications for onshore oil and gas development.<sup>32</sup> The requirement to serve notice on individual owners and tenants of land on the above ground area where works are required was retained, but the requirement for owners of land beyond this area i.e. the owners of land where solely underground operations may take place, was removed. This was implemented by the [Town and Country Planning \(Development Management Procedure and Section 62A Applications\) \(England\) \(Amendment No. 2\) Order 2013](#) (SI 2013/3194), which came into force from 13 January 2014.

All representations on a planning application must be submitted in writing, either on paper or electronically. Verbal comments are not accepted. If the planning application is to be determined at a planning committee meeting a constituent may be able to speak at the meeting.

When a decision is made on a planning application, only planning matters called "material considerations" can be taken into account. There is no exhaustive list of what constitutes a material planning consideration. The Government, in the [PPG](#), lists the following as some "principal issues" for consideration:

- noise associated with the operation

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<sup>31</sup> HC Deb 11 June 2012 c200W

<sup>32</sup> Department for Communities and Local Government, [Revised requirements relating to planning applications for onshore oil and gas: Proposals for comment](#), 2 September 2013

- dust;
- air quality;
- lighting;
- visual impact on the local and wider landscape;
- landscape character;
- archaeological and heritage features;
- traffic;
- risk of contamination to land;
- soil resources;
- geological structure;
- impact on best and most versatile agricultural land;
- blast vibration;
- flood risk;
- land stability/subsidence;
- internationally, nationally or locally designated wildlife sites, protected habitats and species, and ecological networks;
- impacts on nationally protected landscapes (National Parks, the Broads and Areas of Outstanding Natural Beauty);
- nationally protected geological and geo-morphological sites and features;
- site restoration and aftercare;
- surface and, in some cases, ground water issues;
- water abstraction.<sup>33</sup>

While there is no definitive list of what is a material consideration, certain types of issue have been held by the courts *not* to be material considerations. These include issues such as loss of property value, loss of view and opposition to the principle of development – representations on these issues will not be considered when a planning decision is taken.

For more information about how to comment on a planning application see the Planning Aid England guide, [Commenting on Planning Applications](#).

MPAs must take relevant comments into account and make their decisions and the reasons for either accepting or refusing a planning application public.

In addition to this process, planning authorities should have a section on mineral extraction in their local plan. Government guidance directs that these plans should identify and include policies for extraction of

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<sup>33</sup> NPPG, Minerals: [What are the environmental issues of minerals working that should be addressed by mineral planning authorities?](#), Paragraph: 013Reference ID: 27-013-20140306

mineral resources. The plan may identify particular sites in an area where the local authority believes such extraction would be suitable. The local plan would have gone through (or will go through if not yet in place) a period of public consultation. For more information about how the public consultation process works see the RTPI factsheet, [The Local Plan: why, when and how to get involved](#).

### **Faster decisions on shale gas planning applications**

On 13 August 2015 a Government [policy statement on shale gas and oil](#) announced a number of measures designed to speed up the planning process for shale gas applications.<sup>34</sup> These measures are:

- Recovery of shale gas appeals. For a period of two years the Secretary of State for Communities and Local Government will “recover” planning appeals for relating to exploring and developing shale gas. This means that on appeal from a refusal by a local authority, the Secretary of State would take the final decision on the appeal, rather than a planning inspector.
- Call-in of shale gas applications. The Secretary of State also has powers to “call in” planning applications, for his own determination before they are decided by the local planning authority. The 13 August statement said that “the Secretary of State will also actively consider calling in shale applications. Each case will be considered on its individual merits in line with his policy. Priority will be given to any called-in planning applications.”
- Identifying underperforming local planning authorities. The statutory deadline for determining a planning application 16 weeks where an application is subject to Environmental Impact Assessment. The 13 August statement said that the Government would identify underperforming local planning authorities that “repeatedly fail” to determine oil and gas applications within statutory timeframes. When such applications are made to underperforming local planning authorities, the Secretary of State “will consider whether he should determine the application instead.”<sup>35</sup>

### **New permitted development rights**

A March 2015 Consultation, [Amendment to permitted development rights for drilling boreholes for groundwater monitoring for petroleum exploration: technical consultation](#), proposed to grant permitted development rights for the drilling of boreholes for groundwater monitoring for petroleum exploration (including for shale gas exploration). This would enable limited works to be carried out to establish baseline information on the groundwater environment without the need for planning permission. The *Infrastructure Act 2015* requires that, as one of a number of conditions that need to be met before

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<sup>34</sup> [Shale gas and oil policy statement by DECC and DCLG](#), 13 August 2015

<sup>35</sup> [Shale gas and oil policy statement by DECC and DCLG](#), 13 August 2015

certain high volume hydraulic fracturing can occur, methane in groundwater is monitored over a twelve months period. The change to permitted developments is being made so that this condition can be met more easily. The proposals include increasing the structure height of the rig that can be used for drilling.

The Government [responded](#) to this consultation in August 2015.<sup>36</sup> It confirmed that it will amend legislation so that development which consists of the drilling of boreholes for groundwater monitoring for petroleum exploration can take place as permitted development. It also confirmed that the structure height of rigs that can be used will be increased from 12 to 15 metres.

The Government's response also contained an invitation for further changes to permitted development rights in this area. The proposed change is for further rights to enable, as permitted development, the drilling of boreholes for seismic investigation and to locate and appraise shallow mine workings. The Government's view is that this would "speed up the delivery of essential monitoring information for safety and environmental protection and free local resources for where the express attention of the local planning authority is required."<sup>37</sup> The deadline for responses to these proposals is 24 September 2015.

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<sup>36</sup> Amendment to permitted development rights for drilling boreholes for groundwater monitoring for petroleum exploration [Government response to the consultation and Invitation for views](#) on further amendments to permitted development rights for petroleum exploration site investigation and monitoring, 13 August 2015

<sup>37</sup> [Shale gas and oil policy statement](#) by DECC and DCLG, 13 August 2015



## 4. The Infrastructure Act - access rights, protected areas and other issues

The 2014 [Queen's Speech](#) confirmed [Government plans](#) to streamline the underground access regime and make it easier for companies to drill for shale gas. It also confirmed that the new underground access regime would apply to drilling for geothermal energy.

Under the existing system, licence holders do not have automatic access rights to drill under landowners' property and permission should be sought before they can do this. If permission is refused then licence holders can apply through the Secretary of State and courts to gain access but the Government considers this route to be too time consuming.

The Secretary of State issues Petroleum Exploration and Development Licences (PEDLs) under powers granted by the [Petroleum Act 1998](#). They confer the right to search for, bore for and get hydrocarbons, but do not provide access rights to do this. However, section 7(1) of the Act applies the [Mines \(Working Facilities and Support\) Act 1966](#) in England, Wales and Scotland so a licensee can acquire ancillary rights to assist with development, including access rights. Such rights can be granted by the court if it is not reasonably practicable to obtain them by private negotiation. In these instances the landowner is entitled to compensation, determined in line with the principles established by the Supreme Court in *Star Energy Weald Basin Ltd & Anor v Bocardo SA* [\[2010\] UKSC 35](#).

### 4.1 Consultation

The Government consulted during summer 2014 on proposals to improve the access regime. The changes set out in the consultation would:

- Grant underground access rights to companies extracting petroleum resources (including shale gas and oil) and for geothermal energy in land at least 300 metres below the surface;
- Provide a voluntary community payment of £20,000 for each unique lateral (horizontal) well that extends by more than 200 metres laterally. Alongside this would be powers to make such payments compulsory if companies fail to volunteer; and
- Provide a public notification system, under which the company would set out drilling proposals along with details of the voluntary payment.<sup>38</sup>

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<sup>38</sup> DECC, [Underground Drilling Access: Consultation on Proposal for Underground Access for the Extraction of Gas, Oil or Geothermal Energy](#), May 2014

The consultation received over forty thousand responses. The vast majority of which came as letters from individuals opposing the proposals.<sup>39</sup> At the same time the *Guardian* reported a YouGov survey that found 74% of people opposed changes allowing companies to drill under peoples' property without permission.<sup>40</sup> Industry stakeholders had few substantial issues with the proposals, other than concerns about the impact of deep drilling on existing mineral rights. The Government considered that existing regulation could manage such issues and that:

[...] the proposed policy remains the right approach to underground access and that no issues have been identified that would mean that our overall policy approach is not the best available solution.<sup>41</sup>

A side issue that arose during the consultation was the application of the proposals to Scotland and Wales. In particular, their application in Scotland was opposed by Scottish Ministers during the referendum build up.<sup>42</sup> The UK Government considered that the new rights would apply in both Scotland and Wales and were compatible with devolved legislative powers.<sup>43</sup> However, it has since been confirmed by the Smith Commission that the licensing of onshore oil and gas extraction underlying Scotland will be devolved to the Scottish Parliament.<sup>44</sup>

Further information on the consultation is available from the Gov.uk web site:

- [Government proposals to simplify deep underground access for shale gas and geothermal industries](#)
- [Access rights workshop presentation](#)
- [Underground Drilling Access](#)

## Progress of the Bill through Parliament – a summary

Clauses to provide underground access, in line with the proposals set out in the Government consultation from summer 2014, were introduced into the Infrastructure Bill during the Lords Committee stage. Opposition amendments seeking to define a more prescriptive regulatory process and provide greater assurance around the voluntary community benefits package were tabled during the Lords and

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<sup>39</sup> DECC, [Government Response to the Consultation on Proposal for Underground Access for the Extraction of Gas, Oil or Geothermal Energy](#), 25 September 2014

<sup>40</sup> "[Fracking trespass law changes opposed by 74% of British public, poll finds](#)", *The Guardian*, 6 May 2014

<sup>41</sup> op cit., [Government Response to the Consultation on Proposal for Underground Access for the Extraction of Gas, Oil or Geothermal Energy](#), p10

<sup>42</sup> BBC News, "[Minister opposes change in fracking residential drilling rules](#)", 15 August 2014

<sup>43</sup> DECC, [Underground drilling access](#) [accessed 4 December 2014]

<sup>44</sup> Smith Commission, [Report of the Smith Commission for further devolution of powers to the Scottish Parliament](#), 27 November 2014, p21

Commons Committee stages, but the Bill was not significantly amended until the Commons report stage.

At report stage the extent of the underground access provision was limited by amendment to England and Wales - reflecting the recommendation of the [Smith Commission](#) to devolve onshore oil and gas licensing to the Scottish Government.

An amendment was added that would require the Secretary of State to seek advice from the Committee on Climate Change and report on the likely impacts of greenhouse gas emissions resulting from onshore petroleum resources and drilling activity.

An opposition amendment was added to the Bill setting out 13 conditions before fracking could take place –including conditions relating to site monitoring and inspections; ground water protection, environmental assessment and permitting; community benefits, protected areas and the depth at which access provided.

Following this a [Government amendment](#) was agreed in the Lords that primarily redrafted the 13 conditions.

More detail on the Bill's passage is set out below.

### The Bill in the Lords

On [14 October Government amendments](#) were agreed in Lords Grand Committee, taking forward the Government's proposals through the following clauses:

- **Clause 39 (as numbered for Commons report stage)** would provide for a right to use deep-level land for the purpose of exploiting petroleum or deep geothermal energy. It defines deep level land as being 300 metres below the surface; **Clause 40** defines the scope of activity for which the access is provided; **Clauses 41 to 43** would provide the Secretary of State with a power to introduce a payment scheme and a notification scheme and that consultation would be required if these powers were to be used; and
- **Clause 44** is an interpretation provision, defining relevant terms.

The amendments provide that when drilling and fracking companies would be able to pump various substances underground to aid with the fracking process. Clause 39 covers the ways in which the access right may be exercised and includes a right of 'passing any substance through, or putting any substance into, deep-level land or infrastructure installed in deep-level land'. The wording of the legislation was criticised by a number of campaign groups who were concerned it gave 'free reign' to use any chemicals in the fracking process.<sup>45</sup> Such chemicals are regulated through the permissions process that fracking operators are required to adhere to, as explained by Baroness Verma:[...] chemical

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<sup>45</sup> ["UK to allow fracking companies to use 'any substance' under homes"](#), *The Guardian*, 14 October 2014

disclosure, is already required on a well-by-well basis. Operators must notify the environmental regulator of the volume and composition of the frack fluid and seek its permission prior to proceeding. The regulator will set this out when publishing the permit, including each chemical and the maximum concentration authorised for use. In addition, the industry has committed to publish this information, including each of the chemicals used, the total volume of frack fluid used and the maximum volume of each chemical within that.<sup>46</sup>

Subsequent amendments were tabled during Report stage to bring about a statutory monitoring and assessment process for any wells using the new access rights, and for the access rights to be excluded from protected areas such as National Parks, Sites of Special Scientific Interest and Areas of Outstanding Natural Beauty.<sup>47</sup> These were withdrawn following debate. Baroness Verma considered that existing planning policy was sufficient to protect such areas.<sup>48</sup> Renewable Heat Incentive

**Clause 45** of the Bill was introduced as a Government amendment in the Lords. The new clause would allow the Secretary of State to appoint an alternative body to administer the Renewable Heat Incentive (RHI), although Ofgem would continue to administer the scheme for the moment. It would also allow payments under the RHI to be made to third parties assigned by the current owner of an installation, and would simplify the procedure to amend the scheme by making it subject to the negative resolution procedure. DECC published a [policy briefing](#) explaining the reason for the proposals. With regard to third party payments its states:

This could lead to an increase in both demand for and supply of renewable heat technologies by allowing consumers to access finance for renewable heat installations more cheaply and easily. This could lead to a mix of higher deployment and lower costs, depending in part on future spending decisions.<sup>49</sup>

## Commons Committee Stage

A series of amendments were debated during the Commons committee stage dealing with environmental regulation and community benefits. However these clauses were not amended.

The first of these were concerned with the regulatory process and in particular the issue of pumping 'any substance' into the ground was revisited. Tom Greatrex said that the term "any substance" was 'needlessly open-ended' and 'provocative-sounding'. An amendment was voted against that would have required any fracking fluid substance to be approved by the Environment Agency.<sup>50</sup> Amendments were also tabled, but not agreed to, to prevent fracking in certain protected areas

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<sup>46</sup> [HL Deb, 14 October 2014, cc58-61GC](#)

<sup>47</sup> [HL Deb, 10 November 2014, cc59-63](#)

<sup>48</sup> [HL Deb, 14 October 2014 c46GC](#)

<sup>49</sup> DECC, [Infrastructure Bill: The Renewable Heat Incentive](#), 24 October 2014

<sup>50</sup> PBC [13 January 2015 c298](#)

such as National Parks and to set out, more prescriptively, the process for assessing the environmental impacts of fracking developments, monitoring these sites and disclosing information about processes being used at them.<sup>51</sup>

The set of amendments relating to community benefits was tabled with the aim of providing a more clear assurance and structure around the way contributions from fracking development would be spent in communities. The industry has agreed to pay £100,000 to communities per hydraulically fractured well site at exploratory stage, and 1% of revenue if it successfully goes into production. In addition, the industry has confirmed that operators will contribute a voluntary one-off payment of £20,000 for the right to use deep-level land for each unique lateral well that extends by more than 200 metres, and will notify the public when exercising this power. The Minister explained that more detail on how funding would be spent would emerge from pilot projects:

The industry will work with UK Community Foundations on two pilot exploration schemes. UK Community Foundations is an independent registered charity, which is experienced in engaging with and consulting communities and in dealing with funding allocation. This will ensure that these community benefit schemes are independent of the industry and that communities have the lead role in identifying local priorities for the funds. In terms of the payment scheme, in return for the right of use, the current provisions already allow the Secretary of State, if not satisfied with the schemes, to introduce regulations to set up a statutory payment or notification mechanism. The focus should now be on exploration, so that we can first know how much shale gas we can really extract, to see what benefits will actually go to communities.<sup>52</sup>

### Commons report and third reading

At report stage the extent of the underground access provision was limited by amendment to England and Wales - this reflected the recommendation of the [Smith Commission](#) to devolve onshore oil and gas licensing to the Scottish Government.

Amendment, clause 15 was added that requires the Secretary of State to seek advice from the Committee on Climate Change and report on the likely impacts of greenhouse gas emissions from onshore petroleum.

An opposition amendment, new clause 19, was added to the Bill setting out 13 conditions before fracking could take place:

- (a) unless an environmental impact assessment has been carried out;
- (b) unless independent inspections are carried out of the integrity of wells used;

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<sup>51</sup> PBC [13 January 2015 c293](#)

<sup>52</sup> PBC [13 January 2015 c299](#)

- (c) unless monitoring has been undertaken on the site over the previous 12 month period;
- (d) unless site-by-site measurement, monitoring and public disclosure of existing and future fugitive emissions is carried out;
- (e) in land which is located within the boundary of a groundwater source protection zone;
- (f) within or under protected areas;
- (g) in deep-level land at depths of less than 1,000 metres;
- (h) unless planning authorities have considered the cumulative impact of hydraulic fracturing activities in the local area;
- (i) unless a provision is made for community benefit schemes to be provided by companies engaged in the extraction of gas and oil rock;
- (j) unless residents in the affected area are notified on an individual basis;
- (k) unless substances used are subject to approval by the Environment Agency
- (l) unless land is left in a condition required by the planning authority, and
- (m) unless water companies are consulted by the planning authority."

An amendment table by the Environmental Audit Committee, New Clause 9, for a moratorium on fracking was not agreed to.

## Ping Pong

The Lords had an opportunity to change these Commons amendments on 9 February 2015. A [Government amendment to do this](#) was tabled and accepted.

[Concerns were reported](#) from environmental groups that the Lords amendment would 'water down' some of the 13 conditions. The amendment means monitoring of fugitive emission will not be required after a permit had expired; that residents will not have to be individually notified about fracking; fracking could not take place in "protected groundwater source areas", a type of designation to be defined in secondary legislation, rather than established groundwater source protection zones. Secondary legislation will also be used to define the other 'protected areas' within which fracking could not take place.

[The Act sets](#) out that this secondary legislation is required to be tabled by the end of July 2015.

## Protected areas regulations

The [Government laid a draft of this secondary legislation](#) (Draft Onshore Hydraulic Fracturing (Protected Areas) Regulations 2015) before Parliament on 16 July 2015. The draft set out that in National Parks,

Areas of Outstanding National Beauty, the Broads and World Heritage Sites, hydraulic fracturing could only take place in ground at least 1200 metres below the surface.

The draft regulations were approved on division by a Delegated Legislation Committee on 28 October 2015. The Minister, Andrea Leadsom, announced during the debate that further rules would be brought in to provide restrictions that would prevent surface activity associated with fracking in protected areas.<sup>53</sup>

A key opposition argument against the regulations was that, though the regulations covered activity underground, drilling at the surface within a National Park to allow fracking deep beneath a National Park could still be approved.

Another concern raised by the opposition was that the regulations did not provide any protection for Sites of Special Scientific Interest. As noted above, while the Infrastructure Act 2015 was being debated in the last Parliament the Secretary of State had indicated that a blanket ban on fracking would cover SSSI sites as well as National Parks and Areas of Outstanding Natural Beauty.

The regulations were approved by the House of Commons, by deferred division on 16 December 2015. A record of the vote is [online here](#) (at col 1671).

### Protected areas through the licencing process

The [Government launched a consultation on 4 November 2015](#), establishing the further protections for protected areas noted above. These protections will be provided through the licencing process and would prevent any surface operations associated with fracking in the following locations:

- National Parks, the Broads and Areas of Outstanding Natural Beauty (AONBs) – representing landscapes with the highest level of protection from damaging development within the planning system.
- World Heritage sites - the highest international heritage designation.
- Source Protection Zones (SPZ) 1 - the areas close to a drinking water source where the risk associated with groundwater contamination is at its greatest.
- Sites of Special Scientific Interest (SSSIs) - areas designated by the statutory nature conservation agencies in accordance with the Wildlife and Countryside Act 1981 in order to provide protection for specific flora, fauna, or geological or physiographical features. Around 70% of Sites of Special Scientific Interest carry a European designation which means that the protections in the Conservation

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<sup>53</sup> Second Delegated Legislation Committee, Draft Onshore Hydraulic Fracturing (Protected Areas) Regulations, 27 October 2015

of Habitats and Species Regulations 2010 must be observed (see below).

- Natura 2000 - an EU-wide network of nature protection areas established under the 1992 Habitats Directive<sup>10</sup> in order to protect biodiversity. Natura 2000 sites are comprised of Special Areas of Conservation (SAC) and Special Protection Areas (SPAs) designated by Member States under the Habitats Directive and the 1979 Birds Directive respectively.
- Ramsar sites - areas designated as Wetlands of International Importance in accordance with the Ramsar Convention. They are afforded the same protection as Natura 2000 sites under current Government policy (see above).



## 5. Environmental considerations

In 2012 the Royal Society and Royal Academy of Engineering (RS/RAE) conducted a short [review of the risks associated with fracking](#). The report concluded that the health, safety and environmental risks can be managed effectively in the UK, by implementing and enforcing best operational practice. The report also made some specific recommendations however, referred to further below.

The May 2012 *World Energy Outlook* special report on unconventional gas, [Golden rules for a golden age of gas](#), summarises the concerns around fracking. While unconventional resources could boost energy diversity and security, this has to be done in an environmentally acceptable manner:<sup>54</sup>

Producing unconventional gas is an intensive industrial process, generally imposing a larger environmental footprint than conventional gas development. More wells are often needed and techniques such as hydraulic fracturing are usually required to boost the flow of gas from the well. The scale of development can have major implications for local communities, land use and water resources. Serious hazards, including the potential for air pollution and for contamination of surface and groundwater, must be successfully addressed. Greenhouse-gas emissions must be minimised both at the point of production and throughout the entire natural gas supply chain. Improperly addressed, these concerns threaten to curb, if not halt, the development of unconventional resources.

The IEA has developed a set of 'golden rules' in response, which it estimates would add on 7% to the cost of developing a typical shale gas wellsite, but which it says would give the industry public and environmental acceptance and a 'social licence' to operate.<sup>55</sup>

### 5.1 Greenhouse gas emissions

It has been argued that generating electricity from natural gas is relatively clean in comparison to coal fired generation.<sup>56</sup> It has been suggested that more gas could help bridge the gap to cleaner renewables or more nuclear generation.<sup>57</sup> US carbon emissions have fallen by 9% since 2005, reversing a strong upwards trend, and the US Environmental Protection Agency (EPA) has attributed almost half of the reduction to shale gas use.<sup>58</sup>

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<sup>54</sup> International Energy Agency, [Golden rules for a golden age of gas](#) WEO special report 29 May 2012

<sup>55</sup> Ibid, in text box on pages 13 and 14

<sup>56</sup> e.g. ["The case for shale and tight gas"](#), Speech given by Malcolm Brinded, Executive Director, Upstream International, at the Foundation for Science and Technology, London, England, November 9, 2011

<sup>57</sup> Pearce, F., ["Fracking: the monster we greens must embrace"](#), *Guardian*, 15 March 2013, accessed 14 June 2013

<sup>58</sup> "Frack to the Future", *New Scientist*, 10 August 2013 pp. 36-41

From the UK perspective, the IoD highlight the emissions benefits of domestic production over importing liquid natural gas (LNG), the potential of shale gas as a transport fuel and avoided emissions through supporting energy efficient manufacturing in the UK.<sup>59</sup>

However, cheap gas may divert investment from more expensive (up-front) alternatives such as renewables and nuclear, weakening the case for reducing reliance on fossil fuels.<sup>60</sup> The former Director of the Tyndall Centre for Climate Change Research, Professor Kevin Anderson, has said that "From a climate-change perspective this stuff simply has to stay in the ground."<sup>61</sup> A Tyndall Centre [report](#) published in November 2011 concluded:

... emissions from a fully developed UK shale gas industry would likely be very substantial in their own right. If the UK Government is to respect its obligations under both the Copenhagen Accord and Low Carbon Transition Plan, shale gas offers no meaningful potential as even a transition fuel.<sup>62</sup>

A [letter to the Guardian](#) (27 September 2011) said that the lower CO<sub>2</sub> emissions of gas compared to coal or oil were countered by methane releases of up to 10% of production. However, in a [letter in response](#) (6 October 2011), a petroleum engineer said that methane leakage with frac fluids can be either captured or flared and leakage of 10% would not be tolerated by any commercial company.

The 2013 ECC Committee [final report](#) recommended that policies on flaring and venting of methane should be reviewed to keep fugitive emissions as close to zero as possible, and that these emissions should be monitored by DECC.<sup>63</sup>

The RS/RAE in its [June 2012 report](#) considered that more work was needed to monitor this, and to explore the carbon footprint and climate risks associated with extraction and use.<sup>64</sup>

In June 2013, Energy Minister Michael Fallon said that a study and report on this had been requested by the Secretary of State, to include recommendations to mitigate the impacts of shale gas exploration, production and use.<sup>65</sup> On 9 September 2013 DECC published a report by its Chief Scientific Adviser, Professor David Mackay, and Dr Timothy Stone on the [Potential Greenhouse Gas Emissions Associated with Shale Gas Extraction and Use](#).

<sup>59</sup> IoD, [Infrastructure for Business: Getting shale gas working](#), 22 May 2013

<sup>60</sup> Schrag, D.P., "Is shale gas good for climate change?" *Daedalus*, 141(2), 72-80, 2012

<sup>61</sup> "What the Frack?" *The Economist*, 1 October 2011 p.34 and "Natural Gas: Should fracking stop?" *Nature* Volume 477, pp 271-275 15 September 2011

<sup>62</sup> Tyndall Centre for Climate Change Research, [Shale gas: an updated assessment of environmental and climate change impacts](#), Executive summary, November 2011, p7

<sup>63</sup> House of Commons Energy and Climate Change Committee, [The Impact of Shale Gas on Energy Markets](#), April 2013

<sup>64</sup> RS/RAE [Shale gas extraction in the UK: a review of hydraulic fracturing](#) June 2012

<sup>65</sup> [HC Deb 3 June 2013 cc942-3W](#)

This concludes that local emissions should not be significant if properly regulated, compared to the overall emissions from burning shale gas. It found that shale gas's 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 on the same day in a [speech to the Royal Society](#), the Secretary of State said this meant that gas was 'part of the answer to climate change', as a bridge in our transition to a green future. Indigenous 'on-shore' production would allow the UK to control the emissions better rather than off-shoring them, contribute to energy security, and maintain tax revenues as the North Sea wound down. He said:

The continued use of gas is perfectly consistent with our carbon budgets over the next couple of decades.

If shale gas production does reach significant levels we will need to make extra efforts in other areas.

Because by on-shoring production we will be on-shoring the emissions as well.<sup>66</sup>

This overall effect on keeping within Carbon Budgets is likely to be challenged by those who say that any dash for gas risks these.<sup>67</sup>

## 5.2 Pollution incidents in the US and implications for the UK

The [Chartered Institution of Water and Environmental Management](#) considers that "Many apprehensions over fracking in the UK are a result of the experience of regulation in the US", where "each State regulates separately and to varying levels of stringency."<sup>68</sup>

Anecdotal instances of pollution in the USA received prominence through the Gasland film. Some states (e.g. [New York](#)) have put in place moratoriums on fracking, as have some countries including Northern Ireland and France.<sup>69</sup>

The RS/RAE report noted differences in practice between the UK and North America:

Studies in North America have used well data to identify key factors affecting leakage, especially the number of casings and the extent to which these casings were cemented. Some of the leaky wells in a Canadian study had only a single casing or were

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<sup>66</sup> DECC, Speech by Ed Davey [The Myths and Realities of Shale Gas Exploration](#) 9 September 2013

<sup>67</sup> See for example BBC 19 March 2012 [Has the 'greenest government ever' gassed itself?](#)

<sup>68</sup> CIWEM position paper [Hydraulic Fracturing \(Fracking\) of Shale in the UK](#) October 2012

<sup>69</sup> Reuters, [New York State Assembly votes to block fracking until 2015](#) 6 March 2013 or see list on p.53 of Policy Exchange 24 February 2012 [Gas Works? Shale gas and its policy implications](#)

left uncased except in the section from the surface casing down to just below the aquifer (Watson and Bachu 2009). Others had not been cemented at all or the cementation had not reached the required height (Watson and Bachu 2009). Several percent of older oil and gas wells leaked, while fewer than 0.5% of those constructed since 2000 according to stricter standards were found to be leaky (Watson and Bacchu 2009).

In the USA, it is common to have two strings of casings. When intermediate casing is not installed, cementing the production casing to the surface should be considered (API 2009). Intermediate casing is not always cemented all the way back to the surface. At a minimum, the cement should extend above any exposed water or hydrocarbon bearing zones (API 2009). In some states, such as Pennsylvania and Texas, there is a requirement to cement casing to approximately 75 ft below any aquifers. Failure to do this can lead to groundwater contamination as occurred in Pavillion, Wyoming (DiGiulio et al 2011). In the UK, standard practice is to have three strings of casing with at least two (intermediate and production casing) passing through and thereby isolating any freshwater zones. Best practice is to cement casings all the way back to the surface, depending on local geology and hydrogeology conditions.<sup>70</sup>

Given this, public concern and the proliferation of fracking, the US EPA has embarked on studies on the '*Potential Impacts of Hydraulic Fracturing on Drinking Water Resources*', publishing a [progress report](#) in December 2012 and with a final draft report due in 2014.<sup>71</sup>

The EPA notes that it is hard to compile and isolate statistics on incidents due to fracking (compared to 'conventional' leaks) given also that there is no national database in the US, with many data recorded at State level.

The EPA has also said that it is "supporting the State of Wyoming in its further investigation of drinking water quality in the rural area east of Pavillion, Wyoming".<sup>72</sup>

In 2011, the former Energy Minister Charles Hendry noted that the investigated US incidents of water pollution were explained by accidents on the surface rather than underground leaks, and said that the UK would learn from this. Regarding US methane leaks,

Also, some incidents of methane contamination of water were not attributable to oil or gas operations at all; they were caused by methane of recent biological origin.

However, there were cases in which gas leaks had occurred. That was attributed to unsatisfactory well construction or cementing. That confirms, if any confirmation were needed, that drilling for shale gas—like drilling for any other kind of oil or gas—is a

<sup>70</sup> RS/RAE [Shale gas extraction in the UK: a review of hydraulic fracturing](#) June 2012 page 26

<sup>71</sup> <http://www.epa.gov/hfstudy/index.html> accessed 17 December 2012

<sup>72</sup> EPA website [Pavillion groundwater investigation](#) accessed 9 September 2013

hazardous operation that requires careful and consistent regulation. However, that also supports the Committee's conclusions that there is no evidence that the fracking process itself poses a direct risk to underground water resources, and that the risks are related to the integrity of the well and are not different from those encountered in conventional oil and gas extraction.<sup>73</sup>

### 5.3 Opinions on fracking in the UK

The Environment Agency describes fracking as an established technology.<sup>74</sup> The 2011 Tyndall Centre report set out concerns about ground and surface water contamination, possibly even affecting quality of drinking water and wetland habitats, depending on factors such as the connection between ground and surface waters.

The depth of shale gas extraction gives rise to major challenges in identifying categorically pathways of contamination of groundwater by chemicals used in the extraction process.<sup>75</sup>

The ECC Committee's 2011 inquiry found no evidence that fracking poses a direct risk to underground water aquifers provided the drilling well is constructed properly.<sup>76</sup> In its response to the Committee, the Government noted:

The technologies used in shale gas operations are not generically novel or unfamiliar. Hydraulic fracturing, water injection and lateral drilling, individually or in combination, are all familiar techniques that DECC and the other regulators have had to deal with robustly for a long time.<sup>77</sup>

The RS/RAE considered that because fracking takes place many hundreds of metres or even several kilometres below aquifers, it is very unlikely that fracking will affect those aquifers. However, more likely causes of possible contamination include faulty wells, and the report called for the same stringent controls for offshore wells to be applied onshore:

Ensuring well integrity must remain the highest priority to prevent contamination. The probability of well failure is low for a single well if it is designed, constructed and abandoned according to best practice. The UK's well examination scheme was set up so that the design of offshore wells could be reviewed by

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<sup>73</sup> HC Deb 3 November 2011 c363WH

<sup>74</sup> <http://www.environment-agency.gov.uk/business/topics/126689.aspx>

<sup>75</sup> Tyndall Centre for Climate Change Research, [Shale gas: an updated assessment of environmental and climate change impacts](#), November 2011, pp9-10

<sup>76</sup> Committee Press Release, *Shale gas gets support from MPs in new report*, 23 May 2011 <http://www.parliament.uk/business/Committees/Committees-a-z/commons-select/energy-and-climate-change-Committee/news/new-report-shale-gas/>

<sup>77</sup> Energy and Climate Change - *Seventh Special Report Shale Gas: Government Response to the Committee's Fifth Report of Session 2010-12* 19 July 2011

independent, specialist experts. This scheme must be made fit for purpose for onshore activities.<sup>78</sup>

According to an answer in June 2011, the fluids used by Cuadrilla have comprised: fresh water and sand—99.96% and polyacrylamide friction reducers—0.04%. Other potential additives include hydrochloric acid, typically at a concentration of 0.125%, or biocide at a concentration of 0.005% if required to purify the local water supply.<sup>79</sup>

## 5.4 Water use

The Tyndall Centre highlighted excessive water use for fracking as a particular problem “given that water resources in many parts of the UK are already under pressure”.<sup>80</sup> For its exploration sites Cuadrilla anticipated using approximately 1,600 m<sup>3</sup> of water for each hydraulic fracture operation.<sup>81</sup> The RS/RAE report recommends recycling and re-use of wastewaters and that water disposal options should be planned from the outset.

Because shale gas reserves are more diffuse than conventional reservoirs, productivity at each well falls relatively quickly. The IEA considers that, apart from local community buy-in, the most important above-ground considerations for unconventional gas developments are the availability of sufficient land and water. Shale gas drilling leaves “a large and comparatively invasive footprint on the landscape” because of the large number of wells needed. The IEA also notes that access to water may be a barrier to unconventional gas developments, although technology is starting to reduce the amount required.<sup>82</sup>

In its [response](#) to the 2011 ECC Committee inquiry, the Government said that “Adverse effects on water resources as a result of possible expansion of the shale gas industry in the UK are not expected.”<sup>83</sup> Any operator will also need a licence to abstract water from the Environment Agency who will assess existing abstraction levels and licences.<sup>84</sup> Because abstraction is controlled in the UK, the RS/RAE consider that water use can be managed sustainably.<sup>85</sup>

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<sup>78</sup> RS/RAE [Shale gas extraction in the UK: a review of hydraulic fracturing](#) June 2012 page 4

<sup>79</sup> [HC Deb 29 June 2011 c853w](#)

<sup>80</sup> Tyndall Centre for Climate Change Research at Manchester University, [Shale gas: a provisional assessment of climate change and environmental impacts](#), January 2011, p6-7

<sup>81</sup> [HC Deb 29 June 2011 c853w](#)

<sup>82</sup> IEA [World Energy Report 2009](#) Chapter 11, p.415

<sup>83</sup> Energy and Climate Change - *Seventh Special Report Shale Gas: Government Response to the Committee's Fifth Report of Session 2010-12*, 19 July 2011

<sup>84</sup> [HC Deb 23 April 2012 c614W](#)

<sup>85</sup> RS/RAE [Shale gas extraction in the UK: a review of hydraulic fracturing](#) June 2012 [http://royalsociety.org/uploadedFiles/Royal\\_Society\\_Content/policy/projects/shale-gas/2012-06-28-Shale-gas.pdf](http://royalsociety.org/uploadedFiles/Royal_Society_Content/policy/projects/shale-gas/2012-06-28-Shale-gas.pdf)

## 5.5 Seismic events

In April and May 2011 there were some small earth tremors near Blackpool.<sup>86</sup> Cuadrilla issued a [statement](#) on 31 May 2011 saying it was postponing fracking operations while it interpreted seismic information. In its July 2011 response to the ECCC report,<sup>87</sup> the Government agreed that a pause in hydraulic fracturing operations was appropriate.

'Induced seismicity' can occur in previously aseismic areas following oil and gas activities. Thousands of induced earthquakes are registered annually, and operators can take steps to reduce or control seismicity.<sup>88</sup> Natural or mining-induced earthquakes in the UK are not uncommon with around 150 earthquakes recorded on average each year.<sup>89</sup>

The BGS said in January 2012 that the risks to groundwater and of earthquakes had been exaggerated, with the minor earthquakes caused by fracking "Comparable in size to the frequent minor quakes caused by coal mining. What's more, they originate much deeper in the crust so have all but dissipated by the time they reach the surface".<sup>90</sup>

Cuadrilla funded a geomechanical study by the BGS which was given to DECC to consider. In April 2012 DECC [published the report](#), which said:

The report concludes that minor earth tremors detected in the area of Cuadrilla's Preese Hall operations near Blackpool in April and May last year were caused by fracking and, among other measures, recommends a real time seismic monitoring system and a "traffic light" control regime based on this monitoring.<sup>91</sup>

A consultation period was announced, and in the meantime the Environment Agency continued studies to ensure it had all the information it needed to regulate the industry. On 13 December 2012 the Secretary of State [announced](#) that exploratory hydraulic fracturing for shale gas could resume in the UK.<sup>92</sup> New regulatory requirements for operators seeking consent under licences for fracking are related to seismicity only and are to:

- Conduct a prior review of information on seismic risks and the existence of faults;
- Submit to DECC a frac plan showing how any seismic risks are to be addressed;
- Carry out seismic monitoring before, during and after the frac;

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<sup>86</sup> "Gas drilling on hold after earth tremor", *Daily Post (Liverpool)* 1 June 2011 p.14

<sup>87</sup> Op cit.

<sup>88</sup> *Petroleum Review* April 2012 p.16 "Shakin' all over"

<sup>89</sup>

[http://www.earthquakes.bgs.ac.uk/publications/annual\\_reports/2011\\_22nd\\_annual\\_report.pdf](http://www.earthquakes.bgs.ac.uk/publications/annual_reports/2011_22nd_annual_report.pdf)

<sup>90</sup> *New Scientist* "[Fracking risk is exaggerated](#)" 11 January 2012

<sup>91</sup> HC Deb 23 April 2012 c617WA

<sup>92</sup> HC Deb 13 December 2012 c44WS

- Implement a “traffic light” system which will be used to identify unusual seismic activity requiring reassessment, or halting, of operations.<sup>93</sup>

In the Secretary of State’s December 2012 statement he also said that the Government would act on the [RS/RAE] recommendations regarding regulation of a future production phase and environmental risk assessment:

...the academies have in addition recommended that an environmental risk assessment should be mandatory for all shale gas operations, involving the participation of local communities at the earliest possible opportunity, and that this assessment should address risks across the entire lifecycle of shale gas extraction.

DECC will therefore take steps to enhance the existing frameworks for consultation and consenting to these activities, in line with these recommendations. Licensees will be required to carry out a comprehensive high-level assessment of environmental risks, including risks to human health, and covering the full cycle of the proposed operations, including well abandonment; and to consult with stakeholders including local communities, as early as practicable in the development of their proposals.<sup>94</sup>

Cuadrilla would, he said, be asked to do this in Lancashire. Even as exploratory drilling resumes in Lancashire, or begins in West Sussex<sup>95</sup>, this is some way away from full commercial development, as the then Energy Minister Charles Hendry noted in July 2012. This is not least because the situation regarding ownership of underground resources is different.<sup>96</sup> In the UK, the Crown holds the right to gold and silver, and the State to oil, petroleum and natural gas - landowners hold only the remaining mineral rights.

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<sup>93</sup> DECC press release [New controls announced for shale gas exploration](#) 13 December 2012.

<sup>94</sup> HC Deb 13 December 2012 c51WS

<sup>95</sup> <http://www.cuadrillaresources.com/our-sites/balcombe/>

<sup>96</sup> HC Deb 12 July 2012 c441



## 6. Support for the industry and support for communities

During a [Westminster Hall debate](#) on the Government's response to the ECC Committee's 2011 report on shale gas, the overall consensus was that the Committee, which was broadly supportive of the industry, had taken a balanced and cautious approach.<sup>97</sup>

In the 2012 Autumn Statement, the Chancellor set out the overall Government policy:

Today, we publish our gas strategy to ensure that we make the best use of lower-cost gas power, including new sources of gas under the land. We are consulting on new tax incentives for shale gas and announcing the creation of a single office so that regulation is safe but simple. We do not want British families and businesses to be left behind as gas prices tumble on the other side of the Atlantic.<sup>98</sup>

The Government's [Gas Generation Strategy](#) noted that shale gas production might commence in the second part of this decade, but production was likely to grow more slowly than in the US. There were two main commitments:

- A new DECC Office for Unconventional Gas and Oil, to join up responsibilities across Government, ensure a simplified and streamlined regulatory process, and engage with communities.
- A 'fair tax regime' for future shale gas production.<sup>99</sup>

[Budget 2013](#) said that the Government would introduce a new field allowance for shale gas and consult on the detail.<sup>100</sup> In July 2013 the Government launched its consultation on [tax incentives for drilling companies](#).<sup>101</sup> Following this it was announced in the 2013 Autumn Statement that the tax rate on a portion of a company's profits would be reduced from 62 to 30% and that companies will receive a tax allowance equal to 75% of capital spent on projects.<sup>102</sup> The Government is [consulting](#) on the draft legislation that would provide this.

Energy Minister Michael Fallon said in June 2013 that the Government would soon be consulting on community benefits "through grants or expenditure, or, better still, through discounts on their bills, which could be significant".<sup>103</sup> Details of the package were announced on 27 June 2013:

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<sup>97</sup> HC Deb 3 November 2011 c399WH

<sup>98</sup> [HC Deb 5 December 2012 c881](#)

<sup>99</sup> DECC Gas Generation Strategy 5 December 2012 Cm 8407

<sup>100</sup> DECC, [New Office to look at community benefits for shale gas projects](#), 20 March 2013

<sup>101</sup> HM Treasury and DCLG press release 19 July 2013 [Shale gas: government unveils plan to kick start investment with generous new tax breaks](#)

<sup>102</sup> HM Treasury, [Autumn Statement](#), Dec 2013

<sup>103</sup> [HC Deb 6 June 2013 c1655](#)

- The Government has also welcomed a package of community benefits that has been brought forward by industry today. Companies have pledged to engage with communities early (prior to any application for planning permission), and to provide community benefits in areas where shale is commercially extracted.
- These will include £100,000 for communities situated near each exploratory (hydraulically fracked) well, and 1% of revenues from every production site.<sup>104</sup>

These all send clear signals of Government support for the industry. The [Energy Act 2012-13 to 2013-14](#), currently in the Lords, includes an Emissions Performance Standard set at a level to allow new gas generating plant to be built. More detail can be found in the Library Research Paper on the [Energy Bill \(Committee Stage Report\)](#).<sup>105</sup>

A further statement, made by the Prime Minister on 13 January 2014, announced that councils would be able to keep 100 per cent of business rates collect from shale gas sites. This doubled the existing 50 per cent figure under the Government's business rate retention scheme which according to a Government estimate could be worth up to £1.7 million for a typical 12 well site.<sup>106</sup> The Local Government Association responded to the announcement, which they saw as a 'step in the right direction' but argued that more financial support should be given to communities. It should be proportionate to the tax breaks the industry received.<sup>107</sup>

## 6.1 Autumn Statement 2014

On 3 December 2014 the Chancellor announced a range of measures to further encourage the development of shale gas resources in the UK. These were:

- a £5 million fund to provide independent evidence directly to the public about the robustness of the existing regulatory regime.
- £31 million of funding to create world class sub-surface research test centres through the Natural Environment Research Council. This aims to establish world leading knowledge which will be applicable to a wide range of energy technologies including shale gas and carbon capture and storage.
- setting up a long-term investment fund from tax revenues from shale for the North and other areas hosting shale gas

<sup>104</sup> DECC press release 27 June 2013 [Estimates of shale gas resource in North of England published, alongside a package of community benefits](#)

<sup>105</sup> [Energy Bill: Committee Stage Report - Commons Library Research Paper](#), 9 April 2013

<sup>106</sup> [Millions of pounds in business rates will be handed to councils in England which give the green-light to shale gas developments](#). Gov.uk, 13 January 2013

<sup>107</sup> [LGA responds to Government fracking announcement](#), LGA media release, 13 January 2014

developments, to capture the economic benefits of shale gas for future generations.



## BRIEFING PAPER

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