



BRIEFING PAPER

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Shale gas and fracking

By Sara Priestley

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1. Onshore hydraulic fracturing (fracking)
2. Shale gas in the UK
3. Regulation of fracking in the UK
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Contributing Authors: Suzanna Hinson, Energy, Box 2

Summary

Hydraulic fracturing (known as fracking) is a technique used to extract gas or oil from subterranean rock by injecting a mixture of water, sand and chemicals (known as ‘fracturing fluid’) at high pressure into horizontally drilled boreholes. Hydraulic fracturing is not a new technique and has been carried out both offshore and onshore in the UK for many years. However, fracking for shale gas in the UK is in the very early stages (exploration).

The [UK Government is encouraging shale gas exploration](#) to determine its potential to provide the UK with greater energy security, growth and jobs. The Government has introduced, or plans to introduce, a number of measures to support such exploration, including:

- Sharing the proceeds of the wealth generated with communities affected;
- Legislating to change planning law and policy;
- Setting up a new Shale Environmental Regulator.

However, all the main opposition parties (Labour, Scottish National Party, Liberal Democrats and the Green Party) are opposed to fracking and have committed to stop or ban the practice. Similarly, each of the devolved Administrations have planning measures in place which prevent or create a presumption against unconventional oil and gas development (which includes shale gas). The licensing of onshore oil and gas has recently been devolved to Scotland and Wales and both governments are carrying out assessments or consultation on final policy positions on onshore oil and gas exploration (including fracking).

Before commencing drilling operations for onshore oil and gas development (including shale gas) an operator must attain several permissions, including a petroleum exploration and development licence (PEDL), planning permission (unless permitted development rights apply) and environmental permits. For hydraulic fracturing for shale the last of these permissions is a Hydraulic Fracturing Consent issued by the Secretary of State for Business, Energy and Industrial Strategy which is only issued once a list of pre-conditions are satisfied. To date, only two such consents have been issued: both to Cuadrilla Bowland Ltd for two separate wells on its Preston New Road Site in Lancashire.

Results from the [Government’s Energy and Climate Change Public Attitudes Tracker](#) (March 2018) found that 47% polled neither supported nor opposed fracking; 17% supported or strongly supported; and 32% opposed or strongly opposed. Shale gas extraction and fracking has received significant Parliamentary attention, community and media interest. Like most industrial processes there are identifiable risks, including geological risks like potential induced seismicity; and environmental risks like water contamination. There is a detailed regulatory framework in place to reduce these risks to a level deemed acceptable by the regulators. A number of independent reports and analysis are available which examine including economic, environmental, seismic events, greenhouse gas emissions and health and safety. In addition, the industry has committed to a [Community Engagement Charter](#) to try to address some concerns and provide benefits to local communities including:

- At exploration stage, £100,000 in community benefits per well-site where fracking takes place
- 1% of revenues at production will be paid out to communities.
- Operators will publish evidence each year of how they have met these commitments.

1. Onshore hydraulic fracturing (fracking)

1.1 What is fracking?

Hydraulic fracturing (known as fracking) is a technique used to extract gas or oil from subterranean rock by injecting a mixture of water, sand and chemicals (known as ‘fracturing fluid’) at high pressure into horizontally drilled boreholes. The water mixture opens up cracks (or ‘fractures’) in the rock and the sand lodges into the spaces to keep them open, allowing the released gas/oil to flow out. Fracturing fluid flows back to the surface (known as ‘flowback’) over the lifetime of the well.

A detailed explanation of shale gas and fracking, including FAQs, is available on the [British Geological Survey webpages on shale gas](#).¹

Broadly speaking the fracking process for shale gas (see Box 1) can be divided into the following stages:

- 1 **Exploration (approx. 2-6 months):** a pad is built and a drilling rig installed to carry out exploratory drilling to identify if shale gas/oil can be produced profitably. Typically a small number of vertical wells are drilled (perhaps two or three). This stage can involve activities such as seismic surveys, transport of equipment, water and chemicals in and out of the site, and one or more fracks. Fracking for shale gas in the UK is at exploration stage.
- 2 **Moving into production (approx. 6 months-2 years):** if the site is found suitable for production, more wells may be drilled and fracked.
- 3 **Production (approx. 20 years):** this involves the commercial production of shale gas. Horizontal wells are likely to be drilled and fractured. However, overall level of activity likely to decline. Some maintenance activities and possibly some further wells may be drilled.
- 4 **Decommissioning and restoration:** similarly to any other well, once a shale gas well reaches the end of viable production life, the site is abandoned and restored to its original condition. This can involve filling sections of the well with cement to prevent gas flowing up, and covering wells with a cap. This can happen at any stage, depending how the particular site develops.²

Detailed information on fracking is available on the [Gov.UK page: Guidance on fracking: developing shale gas in the UK](#).

¹ British Geological Survey, [Shale Gas](#) [accessed 3 October 2018]

² See: Royal Society and Royal Academy of Engineering 2012 [Report on Shale gas extraction in the UK](#); and Gov.uk, [Guidance on fracking: developing shale gas in the UK](#), 13 January 2017 [accessed 20 September 2018]

Box 1: What is shale gas?

Shale is a common type of sedimentary rock. Shale gas is a natural gas mostly composed of methane, which can be found trapped in shale with very low permeability. It is referred to as an 'unconventional' gas. It does not readily flow into a well without additional intervention (such as fracking).

Conventional gas is found in more permeable 'reservoir' rock formations (such as sandstones and carbonates). If it is trapped in the reservoir rock by overlying impermeable rock (referred to as 'cap' or 'seal' rocks) the gas can be extracted by drilling through the cap rock into the reservoir.

The ReFINE [factsheet on fracking FAQs](#) provides a simple overview of shale and shale gas.³ [ReFINE](#) is a research consortium on fracking led by Newcastle and Durham Universities.

Hydraulic fracturing is not a new technique, nor is it only used to extract shale gas/oil. In the UK, offshore fracking in the North Sea has been a commonplace activity for many years and onshore fracking has been carried out since the 1970s. The Royal Society and Royal Academy of Engineering 2012 [Report on Shale gas extraction in the UK](#) provides further context:

Over the last 30 years, more than 2,000 wells have been drilled onshore in the UK, approximately 200 (10%) of which have been hydraulically fractured to enhance recovery. The combination of hydraulic fracturing and directional drilling allowed the development of Wytch Farm field in Dorset in 1979. Discovered by British Gas in the 1970s and operated by British Petroleum since 1984, the field is responsible for the majority of UK onshore oil production and is Europe's largest onshore oil field. Over 200 wells have been drilled. Drilling vertically onshore then horizontally out to sea has proved more cost-effective than building offshore platforms, allowing oil to be produced beneath the Sandbanks estate, Bournemouth, from oil reservoirs 10km away. In 1996, British Gas hydraulically fractured a well in the Elswick Gas field in Lancashire (4.5km from Cuadrilla's Preese Hall well). Gas has been produced from it ever since. In the 1990s, several wells were also fractured in the UK to extract coal bed methane.⁴

Further explanation is provided by the Gov.uk guidance [England: Onshore oil and gas exploration in the UK: regulation and best practice](#):

What is the history of hydraulic fracturing and unconventional gas development in the UK?

The UK has experience of hydraulic fracturing and directional drilling for non-shale gas applications. The first UK well to encounter shale gas (accidentally) was drilled in West Sussex in 1875 (Netherfield) and in 1895 the nearby Heathfield well produced enough gas to light the local railway station until well into the 20th century. Advances in directional drilling (involving record-breaking offsets up to 11km) have enabled the development of the Wytch Farm field onshore and offshore Dorset. Discovered by British Gas in the 1970s and now operated by Perenco, the field is responsible for the majority of UK onshore oil production and is a giant oil field, with over 200 wells drilled and reserves of 500 million barrels of oil. Drilling vertically onshore then horizontally out to sea has proved more cost effective

³ ReFINE, [Frequently Asked Questions about Fracking](#) [accessed 25 September 2018]

⁴ The Royal Society and The Royal Academy of Engineering, [Report on Shale gas extraction in the UK](#), 2012 [accessed 10 September 2018]

and environmentally sensitive than building offshore platforms. Horizontal drilling has also allowed the operator to choose drilling locations away from environmentally sensitive areas. The first hydraulic fracturing of onshore conventional UK wells was done in the late 1950s, and it has been a common field operation to increase flow rates since then. Offshore, tight (low permeability) sandstone wells are also now commonly hydraulically fractured. In the 1990s, several wells were also fractured in the UK to improve coal bed methane flow rates, but this is not always necessary for CBM. In the mid-1980s research began into the potential for gas production from UK shales.⁵

This briefing paper focuses on onshore hydraulic fracking for shale gas and recent policy and regulatory developments.

1.2 Government position on fracking

The UK Government is encouraging shale gas exploration to determine its potential to provide the UK with greater energy security (see Box 2), growth and jobs.⁶ Building on its [2017 Conservative party manifesto](#) the Government has introduced, or plans to introduce, a number of measures to support fracking, including:

- Sharing the proceeds of the wealth generated with communities affected (see section 4.6 of this paper)
- Legislating to change planning law and policy (see section 3.3 of this paper)
- Setting up a new Shale Environmental Regulator (see section 3.6 of this paper).⁷

In a written ministerial statement on 25 January 2018 ([HCWS428](#)) the Secretary of State for Business, Energy and Industrial Strategy (Greg Clark) provided the following summary of the Government's position:

Exploring and developing the UK's shale gas resources could bring substantial benefits and the government's view is that there is a national need to develop these resources in a safe, sustainable and timely way. As set out in the Clean Growth Strategy, the government is fully committed to the development and deployment of low carbon technologies for heat and electricity generation. As we move towards this low carbon economy, natural gas will continue to play an important role in our energy system. The government is confident that the right protections are in place to explore shale safely and has always been clear that shale development must be safe and environmentally sound.⁸

In a further written ministerial statement on 17 May 2018 the Secretary of State provided the following summary of the Government's view of the role shale gas has to play in the UK's energy mix and as a new economic driver:

⁵ Gov.uk guidance [England: Onshore oil and gas exploration in the UK: regulation and best practice](#), p.8 [accessed 5 October 2018]

⁶ Gov.uk, [Guidance on fracking: developing shale gas in the UK](#), 13 January 2017 [accessed 20 September 2018]

⁷ The Conservative and Unionist Party Manifesto 2017, [Forward, together](#), 2017

⁸ [HCWS428](#) [on energy policy] 25 January 2018

[...] Our current import mix, via pipelines from Norway and Continental Europe and LNG terminals that can source gas from around the world, provides us with stable and secure supplies. However, we believe that it is right to utilise our domestic gas resources to the maximum extent and exploring further the potential for onshore gas production from shale rock formations in the UK, where it is economically efficient, and where environment impacts are robustly regulated.

We also believe that further development of onshore gas resources has the potential to deliver substantial economic benefits to the UK economy and for local communities where supplies are located by creating thousands of new jobs directly in extraction, local support services, and the rest of the supply chain. A potential new shale gas exploration and production sector in the shale basins of England could provide a new economic driver. We also see an opportunity to work with industry on innovation to create a “UK Model” - the world’s most environmentally robust onshore shale gas sector - and to explore export opportunities from this model, a core theme of our modern industrial strategy.

But to achieve these benefits, we need to work with responsible companies prepared to invest in this industry as they proceed with the exploration process, to test the size and value of the potential reserves and to ensure that our planning and regulatory systems work appropriately whilst assisting local councils in making informed and appropriate planning decisions.⁹

Box 2: Shale gas and UK energy security

One of the arguments the UK Government use in support of fracking is that it would increase the UK’s energy security by securing domestic supplies of fuel. The UK has been a net importer of both oil and gas since the early 2000s, and import dependency has increased despite reduced demand, due to falling domestic production such as in the North Sea. The large majority of UK gas imports come via pipeline from Norway. Other important sources are Liquefied Natural Gas (LNG) from Qatar and pipelines with Belgium and the Netherlands.¹⁰ The UK imports small amounts of LNG from many different countries. LNG imports started in 2005 and peaked in 2011. Since then LNG from Qatar has fallen substantially while imports via pipelines with Norway have increased.¹¹

Increasing domestic production would reduce the need for imports, and in addition to supporting fracking, the Government have also introduced reforms aimed at helping North Sea production. At present, the Government’s annual Statutory Security of Supply report to Parliament suggests that gas supplies are secure. On gas the 2017 report states:

GB’s gas system has delivered security to date and is expected to continue to function well, with a diverse range of supply sources and sufficient delivery capacity to meet demand. The UK Continental Shelf (UKCS) remains a major source of gas in the GB market, with supplies also coming from a variety of international partners via pipelines and Liquid Natural Gas (LNG) cargoes. There are a range of future supply outlooks, but all show sufficient gas available from the combination of domestic, regional and global markets.¹²

National Grid, who operate GB’s electricity and gas networks, produce an annual report on [Future Energy Scenarios](#), which suggests four possible scenarios of GB’s future energy needs. On gas the 2018 scenarios state:

⁹ [HCWS690](#) [on energy policy] 17 May 2018

¹⁰ Department for Business, Energy and Industrial Strategy, [Digest of UK Energy Statistics 2018](#) Table G.5

¹¹ Department for Business, Energy and Industrial Strategy, [Digest of UK Energy Statistics 2018](#) para 4.5-4.7

¹² Department for Business, Energy and Industrial Strategy and Ofgem, [Statutory security of supply report 2017](#), 2017

- The UK Continental Shelf declines in all scenarios and is exhausted by 2050 in all but one scenario
- The development of shale is still highly uncertain, leading to a wide potential supply range and two scenarios without any shale
- In three out of four scenarios, imported gas will become even more important. In the scenarios without shale gas, import dependency rises to between 60 and 90 per cent by 2050.
- In some scenarios we consider the development of biomethane and bio-substitute natural gas
- On a year-to-year view it is uncertain whether imports will come from Continental Europe or from liquefied natural gas.

Although all scenarios predict a decline in annual gas demand from 2018 onwards, the report states that gas will “play a role in providing reliable, flexible energy supplies for the foreseeable future”. The report also highlights changing uses for gas in the UK energy mix, such as potential conversion to hydrogen, or changes to gas’s use in electricity generation as renewable capacity increases.¹³

1.3 Proposals to ban fracking

The [2017 Labour Party manifesto](#) promised that a Labour Government would ban fracking:

Labour will ban fracking because it would lock us into an energy infrastructure based on fossil fuels, long after the point in 2030 when the Committee on Climate Change says gas in the UK must sharply decline.¹⁴

This was reiterated by Labour’s Shadow Business Secretary (Rebecca Long Bailey) in May 2018, stating that Labour would ban fracking and boost renewable energy projects.¹⁵ The [Labour Party’s environment policy document](#) (23 September 2018) stated:

Fracking would lock the UK into high carbon energy infrastructure, would increase local air pollution, create large volumes of waste water, do little for the UK’s energy security, and is unpopular with affected communities. That is why Labour will join France, Germany and other countries around the world in banning fracking.¹⁶

The Scottish National Party policy on fracking is that is “will have no place in Scotland’s energy mix”.¹⁷ Similarly in their 2017 Manifesto the Liberal Democrats pledged to “oppose ‘fracking’ because of its adverse impact on climate change, the energy mix, and the local environment”¹⁸ and the Green Party position is to stop fracking in the UK by creating “frack-free zones”.¹⁹

¹³ National Grid, [Future Energy Scenarios](#), July 2018 [accessed 8 October 2018]

¹⁴ Labour Party manifesto 2017, [For the many not the few](#), 2017

¹⁵ Labour Party, Environment webpage: [Fracking should be banned, not promoted](#), 17 May 2018 [accessed 10 September 2018]

¹⁶ Labour Party, [The Green Transformation: Labour’s environment policy](#), 23 September 2018 [accessed 25 September 2018]

¹⁷ SNP, [What is the SNP policy on fracking?](#) [accessed 10 September 2018]

¹⁸ Liberal Democrat Manifesto 2017, [Changing Britain’s future](#)

¹⁹ Green Party, [Stop fracking webpage](#) [accessed 10 September 2018]

1.4 Approach in the devolved Administrations

Scotland

Licensing of onshore oil and gas extraction was devolved to Scotland by the *Scotland Act 2016*.²⁰

The Scottish Government does not support the development of unconventional oil and gas in Scotland. On 28 January 2015, the Scottish Government put in place a planning moratorium on unconventional oil and gas development in Scotland, which temporarily prevents hydraulic fracturing and coalbed methane extraction taking place.²¹ A Strategic Environmental Assessment and Business Regulatory Impact Assessment is being carried out and will be considered by the Government before the policy position is finalised.²²

In September 2018, the petrochemical company INEOS lost a legal challenge against the Scottish Government's position on fracking, arguing that the Government was exceeding their powers and lacked the legal competence to impose an effective ban.²³

Wales

Licensing of onshore oil and gas extraction was devolved to Wales by the *Wales Act 2017*.²⁴

Since 16 February 2015, the Welsh Government has taken a precautionary approach by requiring that a minerals planning authority that is minded to approve a minerals application for "unconventional oil and gas development" first refer the planning application to Welsh Ministers to determine whether the application should be called in for their determination.

The Welsh Government launched a [consultation on Petroleum extraction policy in Wales](#) (2 July 2018) seeking views of its proposed policy on petroleum extraction, including fracking.²⁵ The consultation proposed not undertaking any new petroleum licensing in Wales or supporting applications for hydraulic fracturing petroleum licence consents. The consultation closed on 25 September 2018 and the responses are being reviewed.

A [consultation on the Draft Planning Policy Wales](#) was published in February 2018 and proposed placing the extraction of onshore oil and gas at the bottom of the planning energy hierarchy to reflect their position as

²⁰ Responsibility for the onshore oil and gas licensing regime in Scotland transferred to Scottish Ministers on 9 February 2018.

²¹ Scottish Government, [Onshore oil and gas webpage](#) [accessed 10 September 2018]

²² Scottish Government, [Onshore oil and gas webpage](#) [accessed 10 September 2018]

²³ See: the Scotsman, [Ineos loses its legal challenge to Scottish Government fracking "ban"](#), Diane King, 19 June 2018 [accessed 12 September 2018]

²⁴ Responsibility transferred to Welsh Ministers on 1 October 2018.

²⁵ Welsh Government consultation, [Petroleum extraction policy in Wales](#), 3 July 2018 [accessed 1 October 2018]; Welsh Government, [News: Welsh Government consults on new powers for petroleum extraction](#), 2 July 2018 [accessed 10 September 2018]

the least preferred source of fuel for power generation.²⁶ The response to the planning consultation is expected to be published alongside the response to the consultation on Petroleum extraction policy in Wales.

Northern Ireland

The Department for Economy (previously the Department of Enterprise, Trade and Investment) grants petroleum licences in Northern Ireland under powers granted by the *Petroleum (Production) Act (Northern Ireland) 1964*.²⁷

The Strategic Planning Policy Statement for Northern Ireland creates a "presumption against" the extraction of unconventional hydrocarbons "until there is sufficient and robust evidence on all environmental impacts".²⁸

²⁶ Welsh Government consultation, [Planning Policy wales: Edition 10](#), 12 February 2018 [accessed 1 October 2018]

²⁷ Gov.uk, [Northern Ireland: Onshore oil and gas exploration in the UK: regulation and best practice](#), last updated 1 October 2018 [accessed 3 October 2018]

²⁸ Northern Ireland [Strategic Planning Policy Statement](#) (SPPS) para 6.157; see more in Business Green, [Northern Ireland adopts no fracking policy](#), Jocelyn Timperley, 29 September 2015 [accessed 1 October 2018]

2. Shale gas in the UK

2.1 Shale gas areas in the UK

The British Geological Survey (in association with the Oil and Gas Authority) have completed shale gas resource estimates for the following areas in the UK: Jurassic shale in the Wessex area; Midland valley of Scotland; Jurassic shale of the Weald Basin; Bowland Shale in central Britain; and Wales.²⁹

Location of shale gas wells in the UK

The Oil and Gas Authority's [interactive map](#), which can be searched by place name or postcode, shows the location of all onshore wells including shale gas wells in the UK. Each well location also lists the relevant operator of that well. Further information on petroleum exploration development licences (PEDLs) held is available in section 3.1 of this paper.

Detailed local reports of sites are often available on the [Drill or Drop website](#) (an independent journalism website on fracking and reactions to it).

2.2 How much shale gas is there in the UK?

It is not possible to definitively answer this question as shale gas exploration is in the very early stages in the UK. In this context, some estimations / predictions are included below.

The Government provides the following information on its [Guidance page on developing shale gas in the UK](#):

Scientists from the British Geological Survey (BGS) have estimated that the total volume of gas in the Bowland-Hodder shale in northern England is some 1300 trillion cubic feet (central estimate).

But it is not possible to estimate how much shale gas and oil the UK can produce until there has been some exploration and testing.³⁰

The British Geological Survey (in association with the Oil and Gas Authority) completed shale gas resource estimates for several areas in the UK. Its full reports are available on the [BGS webpages on shale gas](#).

The [Grantham Research Institute on Climate Change](#) provides a short overview of potential reserves of shale gas in the UK, stating that:

Estimates suggest that the amount of shale gas (regardless of the feasibility of extraction) lies between 2.8 and 39.9 trillion cubic metres (tcm). The lower figure is based on analogies drawn with similar formations in the United States, and envisages 2.7 tcm in the Bowland shale (the largest resource) and less than 1 tcm in the Weald basin. The higher figure is based on 3D geological modelling by the British Geological Survey (BGS), which estimates around 37.6 tcm in the Bowland Shale, 2.3 tcm in the Midland Valley, and no shale gas in the Weald Basin.

²⁹ British Geological Survey, [Shale gas](#) [accessed 3 October 2018]

³⁰ Gov.uk, [Guidance on fracking: developing shale gas in the UK](#), 13 January 2017 [accessed 1 October 2018]

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Some background information on estimation methodologies is available in a 2013 [POSTbox on UK Shale Gas Potential](#).

3. Regulation of fracking in the UK

The Department for Business, Energy and Industrial Strategy (BEIS) has published [regulatory roadmaps for onshore oil and gas exploration in England and Northern Ireland](#), which set out the process to be followed within each legislative and regulatory framework. Similar roadmaps for Wales and Scotland have been recently removed from Gov.uk due to powers being devolved.³¹ UK Onshore Oil and Gas (UKOOG) represent the onshore oil and gas industry and provide further resources including on [regulation on its website](#).³²

Before carrying out commencing drilling operations for onshore oil and gas development (including shale gas) an operator must attain a number of permissions and approvals as set out in Box 3. Further information on each of these regimes is set out below.

Box 3: Pre-drilling approvals

Before commencing drilling operations for onshore oil and gas development the operator must have

- Obtained a petroleum exploration and development licence (PEDL) from the OGA
- Secured a lease / access rights from the landowner
- Submitted relevant petroleum operations notifications
- Satisfied BEIS that effective operational and environmental management systems are in place
- Secured planning permission from the local minerals planning authority (permitted development rights may cover some of the works)
- Discharged any relevant conditions placed on the planning permission
- Obtained a permit from the Coal Authority if the well will encroach on coal seams (excluding NI)
- Informed the British Geological Survey of the intention to drill
- Completed the necessary consultation processes with all the statutory/relevant consultees
- Obtained all the necessary environment permits from the relevant environmental agency
- Notified the Health and Safety Executive (HSE/HSENI) of the intention to drill (minimum 21 days' notice)
- Provided HSE/HSENI with details of the proposed well design that have been examined by an independent and competent well examiner (minimum 21 days' notice)
- Agreed data-reporting methods with BEIS
- Agreed a method for monitoring induced seismicity and fracture growth height with BEIS, where hydraulic fracturing is planned
- Received consent from the BEIS to drill and frack (referred to as a "Hydraulic Fracturing Consent").³³

This paper focuses on the consents needed for exploration stage, as onshore shale gas development is still in early stages in the UK. England is the main focus due to the restrictions / moratoriums in place in Scotland, Wales and Northern Ireland.

³¹ [Gov.uk site updates](#) state: Removal of document relating to Scottish onshore oil and gas exploration regulation - due to powers being devolved to Scottish government.

³² See: UKOOG website: <http://www.ukoog.org.uk/regulation>

³³ Gov.uk, [Onshore oil and gas exploration in the UK: regulation and best practice, England](#), December 2015, p10 [accessed 3 October 2018]

3.1 Petroleum exploration and development licences (PEDLs)

The *Petroleum Act 1998* (as amended) vests all rights to the nations petroleum resources in the Crown, allowing the Secretary of State to grant Petroleum exploration and development licences (PEDLs) that confer exclusive rights to “search and bore for and get” petroleum.³⁴ Each PEDL confers such rights over a limited area and for a limited period.

In England, the [Oil and Gas Authority](#) (OGA) is responsible for awarding licences, and will assess operator competency, safety management systems, well examination schemes and financial capability as part of the process.³⁵ The OGA is an executive agency of BEIS, formally established under powers in the *Energy Act 2016*. Licensing of onshore oil and gas extraction is devolved to Scotland and Wales.³⁶

PEDLs are granted through licensing rounds, of which there have now been fourteen. The [results of the fourteenth round were announced in 2015](#) and included 93 new licences covering 159 ordnance survey blocks. The previous 13 licensing rounds resulted in 137 licences covering 360 blocks. These licences are not just for shale gas, as they cover all onshore exploration including conventional oil and gas and coalbed methane. The OGA has grouped the 159 blocks into a total of 93 licence areas. Of these, 63 are for shale exploration. Another 19 are for conventional oil or gas, 6 for abandoned mine methane vents and 5 for coal bed methane.

All of the blocks can be seen on the [OGA’s interactive map](#), which can be searched by place name or postcode. OGA also published data on the fourteenth licensing round on the [operator’s proposed work programmes](#).³⁷

3.2 Land access rights

The operator needs the landowner’s permission to access the relevant land. This may also involve gaining consent to access any neighbouring land for access routes. This will be negotiated on a case by case basis between the landowner and operator.

Pursuant to the [Infrastructure Act 2015](#), consent is not required from owners of surrounding properties under which any horizontal drilling will take place at depths of 300 metres or more.³⁸

3.3 Planning permission

In England and Wales, proposals for shale gas exploration or extraction are subject to the requirements of the *Town and Country Planning Act 1990* (as

³⁴ Section 3 of the *Petroleum Act 1998* (as amended)

³⁵ Gov.uk, [Onshore oil and gas exploration in the UK: regulation and best practice, England](#), December 2015, p14 [accessed 3 October 2018]

³⁶ Scotland Act 2016 and Wales Act 2017

³⁷ OGA, [14th round offers by operator](#), 2015. ‘S’ in the type column refers to shale.

³⁸ Section 43

amended) administered by the Minerals Planning Authority (MPA) for the area in which the proposed development is located.³⁹

The operator needs to secure planning permission (also known as a minerals permission), although permitted development rights may cover some of the works (see below). The planning authority may also decide that an environmental impact assessment (EIA) is needed. A PQ response from June 2018 stated that, “since 2012, 10 planning applications for individual shale exploration proposals have been submitted. 5 of these applications have been granted planning permission.”⁴⁰

In England, the MPA will take the decision in accordance with the policies set out in the [National Planning Policy Framework](#) (NPPF) (updated July 2018) and the [“minerals” section of the online Planning Practice Guidance \(PPG\)](#). The PPG is expected to be updated to reflect the updated NPPF, but at the date of this paper has not yet been published. More information on the updated NPPF is available in the Library Briefing Paper [What next for planning in England? The National Planning Policy Framework](#) (CBP 08260).

Environmental charity Friends of the Earth has filed a legal challenge at the High Court against the Government, claiming that the Government failed to carry out a strategic environmental assessment (SEA) on the updated NPPF, and calling for the Government to undertake such an SEA which would require public consultation.⁴¹

Planning authorities should also have a section on mineral extraction in their Local Plan which would have gone through (or will go through if not yet in place) a period of public consultation.

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, although the [Planning Practice Guidance on minerals](#) lists some “principal issues” for consideration (see Box 4).⁴²

Box 4: National Planning Policy Guidance “principal issues” for consideration

The principal issues that mineral planning authorities should address, bearing in mind that not all issues will be relevant at every site to the same degree, include:

- noise associated with the operation;
- dust;
- air quality;
- lighting;
- visual impact on the local and wider landscape;
- landscape character;
- archaeological and heritage features (further guidance can be found under the Minerals and Historic Environment Forum’s Practice Guide on mineral extraction and archaeology;

³⁹ Planning permission in Scotland is subject to the *Town and Country Planning (Scotland) Act 1997* (as amended).

⁴⁰ [PQ 149061](#) [on fracking: planning permission] 11 June 2018

⁴¹ See: Friends of the Earth, Planning and Environmental law, [Government faces legal challenge from Friends of the Earth over new planning rules](#), 4 September 2018 [accessed 3 October 2018]

⁴² Gov.uk, [Planning Practice Guidance on Minerals](#), 17 October 2014

- 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.

On the appeals process and calling in of shale gas planning applications, the Government has made a number of commitments in relation to the planning process which were summarised by the Secretary of State for Business, Energy and Industrial Strategy (Greg Clark) in a [Written Ministerial Statement on 17 May 2018](#) as follows:

- we will continue to treat appeals against any refusal of planning permission for exploring and developing shale gas, or against any non-determination as a priority for urgent determination by the Planning Inspectorate, making additional resources available where necessary.
- under the Written Ministerial Statement in 2015 the criteria for recovering planning appeals were amended to include proposals for exploring and developing shale gas. This was applied for a two-year period subject to further review. The Secretary of State for Housing, Communities and Local Government has conducted a review and remains committed to scrutinising appeals for these proposals. We are therefore announcing that the criteria for considering the recovery of planning appeals are continued for a further two years. The new criterion is added to the recovery policy of 30 June 2008, Official Report, column 43WS.
- the Secretary of State for Housing, Communities and Local Government will actively consider calling in shale applications particularly where statutory deadlines have been exceeded. Each case will be considered on its facts in line with his policy. Priority timeframes for urgent determination will be given to any called-in applications.
- the Government continues to commit to identifying underperforming local planning authorities that repeatedly fail to determine oil and gas applications within statutory timeframes. When any future applications are made to underperforming authorities, the Secretary of State will

consider whether he should determine the application instead.⁴³

More general information and background on these powers is available in the [Library Briefing on Planning Appeals](#) (19 August 2015) and [Calling In a Planning Application](#) (17 July 2017).

Permitted development for preparatory work

Permitted development rights derive from a general planning permission granted by Parliament – principally through the [Town and Country Planning \(General Permitted Development\) \(England\) Order 2015](#).⁴⁴ As such, development done under permitted development rights does not need planning permission.

From 6 April 2016 (and following a [March 2015 consultation](#)), the [Town and Country Planning \(General Permitted Development\) \(England\) \(Amendment\) Order 2016](#) allows during a period not exceeding 28 consecutive days the drilling of boreholes for the purposes of (a) carrying out groundwater monitoring; (b) seismic monitoring or (c) locating and appraising the condition of mines, in each case which is preparatory to potential petroleum exploration.⁴⁵ This right is subject to a number of exceptions (for example where drilling would be carried out within a National Park or protected groundwater source area) and a number of conditions (including no operations between 6pm-7am, and notification to the Environment Agency).

This work can be carried out to establish baseline information on the groundwater environment without the need for planning permission, although other regulatory consents, such as a PEDL, would still be required.

The Commons Library briefing [Permitted development rights](#) offers more general information.⁴⁶

Forthcoming consultations and Government proposals for change

In the [Written Ministerial Statement on 17 May 2018](#) Greg Clark also said that the Government would:

- set up a Shale Environmental Regulator and new Planning Brokerage Service;
- launch a new £1.6 million shale support fund over the next 2 years to build capacity and capability in local authorities dealing with shale applications;
- consult “in the summer” on:
 - the principle of whether the early stages of shale exploration should be treated as permitted development: and

⁴³ [HCWS690](#) [on energy policy] 17 May 2018

⁴⁴ SI 2015/596

⁴⁵ MHCLG, [Amendment to permitted development rights for drilling boreholes for groundwater monitoring for petroleum exploration: technical consultation](#), March 2015

⁴⁶ SN 00485, 14 June 2017

- the criteria required to trigger the inclusion of shale production projects into the Nationally Significant Infrastructure Projects regime.
- strengthen community engagement by consulting in due course on the potential to make pre-application consultation a statutory requirement.

At the date of this paper, the consultation on permitted development had been launched, but the remaining proposals above had not yet been actioned.

Permitted development for non-hydraulic shale gas exploration

The [consultation on permitted development for shale gas exploration](#) ran from 19 July 2018 to 25 October 2018. The consultation document invited views on creating a permitted development right for non-hydraulic shale gas exploration development in England:

6. The purpose of this consultation is to seek views on the principle of whether non-hydraulic fracturing shale gas exploration development should be granted planning permission through a permitted development right, and in particular the circumstances in which it would be appropriate. Any permitted development right would not apply to the appraisal and production operations of shale gas extraction.⁴⁷

The consultation document stated it would only apply to non-hydraulic fracturing operations to take core samples for testing purposes. It would not allow injection of any fluids for the purposes of hydraulic fracturing. The consultation proposed the following definition for non-hydraulic fracturing shale gas exploration:

Boring for natural gas in shale or other strata encased in shale for the purposes of searching for natural gas and associated liquids, with a testing period not exceeding 96 hours per section test.⁴⁸

The consultation document also set out the proposed limitations and exclusions from permitted development on environmental and other grounds:

23. The Government remains committed to ensuring that the strongest environmental safeguards are in place. The formulation of any permitted development right will have regard to environmental and site protection laws such as those for Areas of Outstanding Natural Beauty, Scheduled Monuments, conservation areas⁴, Sites of Special Scientific Interest and World Heritage Sites, National Parks or Broadss.

24. By law, development which is likely to have significant effects on the environment requiring an Environmental Impact Assessment would not be permitted development. If the proposed development would fall into Schedule 2 of the Environmental Impact Assessment Regulations, it would only be permitted where a local planning authority has issued a screening opinion determining that the development is not Environmental Impact Assessment development,

⁴⁷ MHCLG, [Permitted development for shale gas exploration: Consultation](#), July 2018: page 7

⁴⁸ MHCLG, [Permitted development for shale gas exploration: Consultation](#), July 2018: page 10

or where the Secretary of State has directed that it is not Environmental Impact Assessment development, or that the development is exempt from the Environmental Impact Assessment Regulations.

25. Some existing permitted development rights also exclude various other types of land. For example there are restrictions on agricultural change of use on sites designated as a scheduled monument, safety hazard areas, and military explosive areas. Others do not permit development on land safeguarded for aviation or defence purposes.⁴⁹

Nationally Significant Infrastructure Projects

The May 2018 Written Ministerial Statement also committed to consulting, in summer 2018, on the criteria required to trigger the inclusion of shale production projects into the Nationally Significant Infrastructure Projects regime (see Box 5).⁵⁰ This consultation has not yet been published.

Box 5: NSIPs

Nationally Significant Infrastructure Projects (NSIPs) are large scale developments (relating to energy, transport, water, or waste) which require a type of consent known as “development consent”. The [Planning Act 2008](#) introduced a new development consent process for NSIPs which was subsequently amended by the [Localism Act 2011](#).

A Development Consent Order (DCO) automatically removes the need to obtain several separate consents, including planning permission and is designed to be a much quicker process than applying for these separately.

The DCO process starts when an application is formally accepted by the National Infrastructure Planning Unit and lasts approximately 12-15 months. The process however, is front-loaded with a number of pre-application consultation requirements, which, depending on the complexity of the project, can take a number of years to carry out.

The final decision on granting a DCO rests with the Secretary of State for that field. The [National Infrastructure Planning website](#) provides guidance on the processes.

The Commons Library briefing on [planning for nationally significant infrastructure projects](#) offers more information.⁵¹

Shale support fund for local authorities

The May 2018 Written Ministerial Statement committed to provide a new “£1.6 million shale support fund” over the next 2 years” to build capacity and capability in local authorities dealing with shale applications.⁵² No further information was available at the time this paper was published.

Planning brokerage service

The May 2018 Written Ministerial Statement⁵³ also committed to “the creation of a new planning brokerage service for shale applications to provide guidance to developers and local authorities on the planning process to help facilitate timely decision making. The service would focus exclusively on the planning process and would have no role in the consideration or determination of planning applications. The service would

⁴⁹ MHCLG, [Permitted development for shale gas exploration: Consultation](#), July 2018, p11

⁵⁰ [HCWS690](#) [on energy policy] 17 May 2018

⁵¹ SN 06881, 17 July 2017

⁵² [HCWS690](#) [on energy policy] 17 May 2018

⁵³ [HCWS690](#) [on energy policy] 17 May 2018

not comment on the merits of a case and would also have no role in the appeals process.” No further information was available at the time this paper was published.

Parliamentary scrutiny on planning for fracking (2018)

The Housing, Communities and Local Government Select Committee published a [report on Planning guidance on fracking](#) on 5 July 2018 which made a number of recommendations on the Government’s planning proposals, including that fracking planning applications should not be brought under the NSIP regime nor acquire permitted development rights. The Committee also concluded that it would be “inappropriate” for fracking to be regulated by one single body and proposed the Government’s Shale Environmental Regulator (see section 3.5 below) should be renamed and repurposed as the Shale Information and Coordination Service.⁵⁴ The Committee is awaiting a Government response.

On 12 September 2018, a [Westminster Hall debate](#) led by Conservative MP Lee Rowley, considered planning permission for shale gas exploration. Concerns were raised in relation to the Government’s proposals for permitted development and extending the NSIP regime. The Minister for Energy and Clean Growth (Claire Perry) responded to a number of the concerns:

As set out in our manifesto, we intend to consult on what can be done to the planning process. As well as looking at moving production rights into a national regime, as we have done for other complicated energy sources, we have considerably increased the level of support for local authorities and local decision makers. We have set up training; we have provided funding. I will shortly appoint a shale gas commissioner, who will have deep and extensive constituency knowledge of the issue and will be out there, helping local residents to understand some of the challenges that exist. To put the myth-buster in place again, we are not overriding local decision making; there are plenty of opportunities for decision makers to express their views in the pre-consultation stage, as is done for other complicated and difficult energy policies.⁵⁵

3.4 Environmental permits and consents

The operator needs to obtain various environmental permits and consents from the relevant environment regulator (the Environment Agency, Natural Resources Wales, or the Scottish Environment Protection Agency).

In England, the Environment Agency’s role is to ensure that any shale gas operations are conducted in a way that protects people and the environment. The Environment Agency has published [guidance on the environmental permits and permissions an operator needs for onshore oil and gas operations](#)⁵⁶ which sets out detailed information and explanation of this regime.

⁵⁴ Housing, Communities and Local Government Select Committee, Planning guidance on fracking, Eight Report of Session 2017-19, [HC 767](#), 5 July 2018

⁵⁵ HC Deb 12 September 2018 [Col 328WH](#)

⁵⁶ Gov.uk guidance: [onshore oil and gas operations: environmental permits](#), 14 November 2016 [accessed 5 October 2018]

Broadly speaking, the Environment Agency's environmental permitting regulations cover:

- protecting water resources, including groundwater (aquifers) as well as assessing and approving the use of chemicals which form part of the hydraulic fracturing fluid;
- appropriate treatment and disposal of mining waste produced during the borehole drilling and hydraulic fracturing process;
- suitable treatment and management of any naturally occurring radioactive materials (NORM); and
- disposal of waste gases through flaring and disposal of waste water (known as flowback fluid).

The operator may also need a water abstraction licence which would be issued by the relevant environmental regulator.

Under the environmental permitting regulations, the Environment Agency (EA) can issue standard and bespoke permits. The EA has confirmed that "all applications for high volume hydraulic fracturing or any other well stimulation involving the use of proppants" will require full bespoke permits with site specific risk assessment, public consultation and conditions which the operator will be required to comply with.⁵⁷ Information about how the Environment Agency inspects, monitors and enforces environmental permits is available on [Gov.uk guidance: How you'll be regulated: environmental permits](#).

The EA is also a statutory consultee in the planning process and provides local mineral planning authorities (normally the county or unitary local authority) with advice on the potential risks to the environment from individual gas exploration and extraction sites.⁵⁸

3.5 Health and safety

The operator must notify the Health and Safety Executive (HSE) of the well design and operation plans at least 21 days before drilling is due to start. The HSE is responsible for health and safety regulation in England, in particular inspecting the well design, its construction and upkeep to ensure that measures are in place to manage risks effectively throughout its life cycle.⁵⁹

The HSE has a [webpage on the HSE's role in regulating onshore shale gas and hydraulic fracturing](#) which sets out key information on the health and safety regime, including:

For shale gas operations, HSE focuses on ensuring wells are designed, constructed, operated, maintained, and ultimately abandoned to ensure that the flow of fluids in the well, whether fracking fluids or

⁵⁷ Gov.uk Guidance, [standard rules for the environmental permitting regulations consultation: no.11](#), 24 February 2016

⁵⁸ Gov.uk, [Guidance on fracking: developing shale gas in the UK](#), 13 January 2017 [accessed 20 September 2018]

⁵⁹ Gov.uk, [Guidance on fracking: developing shale gas in the UK](#), 13 January 2017 [accessed 20 September 2018]

produced gas or water is controlled and stays within the well. This is called 'well integrity' and is equally important for safety and environmental protection.⁶⁰

The HSE and the Environment Agency have published a [joint working strategy](#) (2012)⁶¹ which sets out how they will work together to regular environmental and health and safety, for instance by conducting joint inspections and sharing information.

3.6 Shale environmental regulator group

The Conservative Party 2017 manifesto pledged to set up a new shale environmental regulator which would take on the functions of BEIS, the environment agency and the HSE in order to streamline the regulatory process. This was confirmed in a Written Ministerial Statement in May 2018, in which the Government committed to set up the regulator for England from "summer 2018".⁶²

On 5 October 2018, BEIS announced the set up of a Shale Environmental Regulator Group, which would bring the regulators (Oil and Gas Authority, Health and Safety Executive and Environment Agency) together as a virtual body. The Shale Environmental Regulator Group is expected to act as one, coherent, single face for local authorities and industry, helping to resolve regulatory issues on sites and sharing best practice with local authorities considering shale gas applications.⁶³

3.7 Hydraulic fracturing consent

The *Infrastructure Act 2015* (amending the *Petroleum Act 1998*) introduced the concept of a hydraulic fracturing consent, as a safeguard for onshore fracking. To date, two hydraulic fracturing consents have been issued to Cuadrilla Bowland Ltd (see Box 6).

Box 6: Preston New Road Site, Lancashire

Cuadrilla Bowland Ltd's Preston New Road site in Lancashire was awarded a hydraulic fracturing consent for one of its wells (horizontal well, number 'PNR-1z') by the Government on 24 July 2018, subject to certain conditions. The conditions were: that no associated hydraulic fracturing may commence until Cuadrilla had submitted audited accounts of Spirit Energy Ltd (who are joint and several licensees of the the relevant PEDL) or had deposited £557,000 into an escrow account, and the Secretary of State had confirmed the arrangements as satisfactory. A further condition was that existing arrangements for publication of the results of the monitoring required by section 4A(6)(a) of the *Petroleum Act 1998* must remain in place for the period for the Hydraulic Fracturing Consent remains in force.

The [Government decision notice](#) and the [accompanying press notice](#) set out more detailed information.⁶⁴ Cuadrilla was awarded a second hydraulic fracturing consent for a second well (horizontal well, number 'PNR-2') at the same site on 19 September 2018. The [Government decision notice](#) sets out more detailed information.

⁶⁰ HSE [Shale gas](#) [accessed 5 October 2018]

⁶¹ Environment Agency and HSE, [Working together to regulate unconventional oil and gas developments](#), November 2012

⁶² [HCWS690](#) [on energy policy] 17 May 2018

⁶³ OGA Announcement, [Shale Environmental Regulator Group launched today](#), 5 October 2018

⁶⁴ This BBC News article provides further coverage of reactions to this decision: <https://www.bbc.co.uk/news/uk-england-lancashire-44941862>

The law sets out that hydraulic fracturing cannot take place at a depth of less than 1000 metres, and the Secretary of State must issue a hydraulic fracturing consent for any “associated hydraulic fracturing” which will take place at a depth of 1000 metres or more. This is defined in the Act by reference to purpose of the fracking of shale and volume of water used as follows:

“Associated hydraulic fracturing” means hydraulic fracturing of shale or strata encased in shale which— (a) is carried out in connection with the use of the relevant well to search or bore for or get petroleum, and (b) involves, or is expected to involve, the injection of— (i) more than 1,000 cubic metres of fluid at each stage, or expected stage, of the hydraulic fracturing, or (ii) more than 10,000 cubic metres of fluid in total.⁶⁵

Before issuing a hydraulic fracturing consent, the Secretary of State must be satisfied that a list of specific conditions are met (see Box 7). The Secretary of State must also be satisfied that it is appropriate to issue the consent and may apply any other conditions they consider appropriate. The Secretary of State (Greg Clark) made a written statement on 25 January 2018 confirming the Government considers the financial resilience of all companies wishing to carry out fracking as a relevant consideration:

The Government considers that the financial resilience of a company wishing to hydraulically fracture is a relevant consideration. As a matter of policy, we will therefore look at the financial resilience of all companies wishing to carry out hydraulic fracturing operations alongside their application for Hydraulic Fracturing Consent.⁶⁶

Box 7: Pre-conditions for the issue of an onshore hydraulic fracking consent

- The environmental impact of the development which includes the relevant well has been taken into account by the local planning authority
- Appropriate arrangements have been made for the independent inspection of the integrity of the relevant well
- The level of methane in groundwater has, or will have, been monitored in the period of 12 months before the associated hydraulic fracturing begins
- Appropriate arrangements have been made for the monitoring of emissions of methane into the air appropriate arrangements have been made for the publication of the results of the monitoring
- The associated hydraulic fracturing will not take place within protected groundwater source areas (see below).
- The associated hydraulic fracturing will not take place within other protected areas (see below). In considering an application for the relevant planning permission, the local planning authority has (where material) taken into account the cumulative effects of—
 - (a) that application, and
 - (b) other applications relating to exploitation of onshore petroleum obtainable by hydraulic fracturing
- The substances used, or expected to be used, in associated hydraulic fracturing—
 - (a) are approved, or
 - (b) are subject to approval,by the relevant environmental regulator

⁶⁵ Section 50 *Infrastructure Act 2015*, inserting section 4B into *Petroleum Act 1998*.

⁶⁶ [HCWS428 \[on Energy Policy\]](#) 25 January 2018

- In considering an application for the relevant planning permission, the local planning authority has considered whether to impose a restoration condition in relation to that development
- The relevant undertaker has been consulted before grant of the relevant planning permission
- The public was given notice of the application for the relevant planning permission
- A scheme is in place to provide financial or other benefit for the local area

Protected groundwater source areas and other protected areas

The [Onshore hydraulic fracturing \(protected areas\) Regulations 2016](#) define the terms “protected groundwater source areas” and “other protected areas” for the purposes the conditions set out by the *Infrastructure Act 2015* (inserting section 4A of the *Petroleum Act 1998*).

A “**protected groundwater source area**” is defined as any land at a depth of less than 1,200 metres beneath a relevant surface area. A “relevant surface area” means any land at the surface that is—

- a. within 50 metres of a point at the surface at which water is abstracted from underground strata and is used to supply water for domestic or food production purposes, or
- b. within or above a zone defined by a 50-day travel time for groundwater to reach a groundwater abstraction point that is used to supply water for domestic or food production purposes.

“**Other protected areas**” is defined as areas of land at a depth of less than 1,200 metres beneath—

- a. a National Park;
- b. the Broads;
- c. an area of outstanding natural beauty; or
- d. a World Heritage site.

4. Potential implications of fracking

Shale gas extraction and fracking has received significant Parliamentary and media interest. Like most industrial processes, there are identifiable risks, including geological risks like potential induced seismicity and environmental risks like water contamination. There is a complex and detailed regulatory framework in place to reduce the risks to a level deemed acceptable by the regulators. The regulatory framework is detailed in Section 3 above. Some further discussion of key implications and responses to some of the main concerns is provided below, along with some further resources for more detailed analysis.

The Government's Chief Scientific Adviser, Sir John Beddington FRS, asked the Royal Society and the Royal Academy of Engineering (RS&RAE) to review the scientific and engineering evidence and consider whether the risks associated with fracking could be managed effectively in the UK. In 2012, the review concluded that:

the health, safety and environmental risks associated with hydraulic fracturing (often termed 'fracking') as a means to extract shale gas can be managed effectively in the UK as long as operational best practices are implemented and enforced through regulation.⁶⁷

However, the Report did note the fact that the industry was at exploration stages at a very small scale and that "there is greater uncertainty about the scale of production activities should a future shale gas industry develop nationwide. Attention must be paid to the way in which risks scale up."⁶⁸

The British Geological Survey has a [Frequently Asked Questions page](#) on fracking and shale gas which provides responses to some more common concerns including earthquakes and impact on groundwater.

Detailed documents on various impacts of unconventional oil and gas in Wales are available alongside a [2018 Welsh Government consultation on petroleum extraction policy in Wales](#), including: community impacts, Public Health Wales' initial view, socio-economic impacts.⁶⁹

Detailed documents on onshore oil and gas exploration in Scotland are available on the [Scottish Government webpages on Onshore oil and gas](#).

4.1 Economic

A [May 2013 report from the Institute of Directors on "Getting shale gas working"](#) (a report sponsored by Cuadrilla Resources Ltd) said the fracking industry had the potential to support 74,000 jobs at its peak:

If a potential shale gas production phase could reach scale, then the potential benefits could be very large indeed. A multi-year development of 100 shale gas pads of 40 laterals each could see peak

⁶⁷ Royal Society and the Royal Academy of Engineering, [Shale gas extraction in the UK: a review of hydraulic fracturing](#), June 2012

⁶⁸ Royal Society and the Royal Academy of Engineering, [Shale gas extraction in the UK: a review of hydraulic fracturing](#), June 2012

⁶⁹ Welsh Government consultation, [Petroleum extraction policy in Wales](#), 3 July 2018 [accessed 1 October 2018]

production of 853 bcf a year in the low scenario, 1,121 bcf in the central scenario and 1,389 bcf in the high scenario. Capex and opex could peak at £3.7 billion a year, supporting 74,000 jobs in total (direct, indirect and induced – around twice as many as our previous estimate).⁷⁰

Following this report, in October 2013 a Financial Times article reported that in a private meeting with the then Department of Energy and Climate Change, the consultancy AMEC said the number of jobs would likely be lower, between 15,900 and 24,300 direct and indirect full time equivalent jobs at ‘peak construction’.⁷¹ An April 2014 report by professional services firm Ernst and Young LLP on ‘[Getting ready for UK shale gas](#)’, commissioned by the onshore oil and gas industry (UKOOG) and part funded by the Department for Business, Innovation and Skills, found that fracking could result in 64,500 jobs at peak.⁷² However, anti-fracking campaign groups such as Friends of the Earth contest these findings, pointing to figures from the US where approximately 4 jobs were created per fracking well between 2005-12.⁷³

In October 2017, in response to a [parliamentary question](#), the Prime Minister said she thought fracking would create “thousands” of jobs:

This is an issue on which the hon. Gentleman and I are simply going to disagree. I think that shale gas has the potential to power economic growth in this country and to support thousands of jobs in the oil and gas industries and in other sectors. It will provide a new domestic energy source. We have more than 50 years’ drilling experience in the UK, and one of the best records in the world for economic development while protecting our environment. The shale wealth fund is going to provide up to £1 billion of additional resources to local communities, and local councils are going to be able to retain 100% of the business rates they collect from shale gas developments. We will be bringing forward further proposals in relation to this during this Parliament. This is an important potential new source of energy, and it is right that we should use it and take the benefits from it for our economy, for jobs and for people’s futures.⁷⁴

In May 2018, in response to a PQ, Energy and Clean Growth Minister (Claire Perry) stated:

A thriving UK shale industry could create a large number of jobs in the UK, indirectly support other industries, and help our economy grow. The Task Force on Shale Gas concluded in 2015 that the development of a shale gas industry would provide substantial employment in the UK, while noting that it will not be possible to ascertain an accurate estimate of the scale of this opportunity until we have a clearer idea of the amount of recoverable gas. Please see: <https://www.taskforceonshalegas.uk/reports/Fourth%20Report>

To determine the potential of the industry and how development will proceed, we need exploration to go ahead and the measures set out

⁷⁰ Institute of Directors, *Getting Shale Gas Working*, 2013, p17

⁷¹ Financial Times, [Fracking jobs now forecast to be a third of what Cameron quoted](#), Jim Pickard, 15 October 2013 [subscription needed] [accessed 3 October 2018]

⁷² Ernst & Young LLP, [Getting ready for UK shale gas](#), April 2014, p1

⁷³ Friends of the Earth, [Fracking: the facts](#) [accessed 5 October 2018]

⁷⁴ HC Deb 25 October 2017 [Col 300](#)

in the statement fulfil the Government's 2017 Manifesto commitments to support this industry.

Independently verified figures show that during the last quarter of 2017, spend in the Lancashire economy from Cuadrilla's shale gas operations increased to £6.8 million in total, with 55 full time and contract jobs and 6 apprenticeships created. Please see: <https://cuadrillaresources.com/media-resources/press-releases/cuadrilla-drives-7m-lancashire-economy/>

There will be opportunities for the insurance industry in shale gas exploration and production. UK Government Investments are in ongoing discussions with insurance brokers to discuss exactly what kind of insurance they can provide. Separately, the industry trade body has been discussing possible insurance products directly with insurance providers.

Regarding the impact on tourism, the UK has world class regulation to ensure that shale exploration can happen safely, respecting local communities and safeguarding the environment. For shale gas projects, the relevant planning authority decides whether activity is acceptable at a particular location, after local communities and other interested parties have had the opportunity to set out their view on the benefits and impacts of the proposal.⁷⁵

Further resources

A [2014 House of Lords Economic Affairs Committee report on The Economic Impact on UK Energy Policy of Shale Gas and Oil](#) has a section on Potential Economic Impact of the UK's Shale Gas. The 2013 [House of Commons Energy and Climate Change Committee report on 'The impact of Shale Gas on Energy Markets'](#) concluded it was "too early to say whether domestic production of shale gas could result in cheaper gas prices in the UK".

The following reports relating to Wales are available: Regeneris, [Socio-economic Impact of unconventional gas in Wales](#), 2015; and Cardiff Business School, [Socio-economic impact of unconventional gas in Wales](#) (revisiting Regeneris report) 25 September 2017.⁷⁶

KPMG prepared a report for the Scottish Government on the [Economic Impact Assessment and scenario development of unconventional oil and gas in Scotland](#) (November 2016) which is publicly available.⁷⁷

4.2 Environmental

A number of environmental concerns are often raised in relation to fracking, including by some environmental NGOs and local communities. Common examples include:

- **volume of water used:** fracking requires large volumes of water, which has the potential to place a strain on water resources.
- **water contamination risks:** including concerns that shale gas could leak into surrounding groundwater.

⁷⁵ PQ [146305](#) [on fracking] 29 May 2018

⁷⁶ Welsh Government consultation, [Petroleum extraction policy in Wales](#), 3 July 2018 [accessed 1 October 2018]

⁷⁷ KPMG, [Economic Impact Assessment and scenario development of unconventional oil and gas in Scotland](#), November 2016

- **traffic:** concerns over increased traffic to fracking sites, including the potential risk of increased accidents, air pollution impacts and noise impacts.

In relation to concerns relating to water contamination, the RS&RAE Report summarised:

Concerns have been raised about the risk of fractures propagating from shale formations to reach overlying aquifers. The available evidence indicates that this risk is very low provided that shale gas extraction takes place at depths of many hundreds of metres or several kilometres. Geological mechanisms constrain the distances that fractures may propagate vertically. Even if communication with overlying aquifers were possible, suitable pressure conditions would still be necessary for contaminants to flow through fractures. More likely causes of possible environmental contamination include faulty wells, and leaks and spills associated with surface operations. Neither cause is unique to shale gas. Both are common to all oil and gas wells and extractive activities.

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.⁷⁸

In relation to volume of water used, the RS&RAE Report noted that “water requirements can be managed through integrated operational practices, such as recycling and reusing wastewaters where possible.” In November 2013, Water UK (representing the water industry) and UKOOG (representing the onshore oil and gas exploration industry) signed a memorandum of understanding to ensure cooperation throughout the shale gas exploration and extraction process, in particular to minimise the effects on water resources and the environment.⁷⁹ Water UK does not support or oppose the exploitation of shale gas, but has published a number of resources on the possible impacts on water and the water industry.⁸⁰

On air quality, the Government published a report on [Potential Air Quality Impacts of Shale Gas Extraction in the UK](#) (July 2018), based on evidence compiled in early 2015. A PQ response in September 2018 explained the reason for the delay in publication:

This was a routine report by the Air Quality Expert Group (AQEG). Although it was based on an assimilation of evidence that took place in 2015, the report itself was not finalised until 2017. It was prepared alongside other AQEG reports, for example on ultrafine particles and vegetation, which were produced on similar timelines. These reports were released together following publication of the government’s Clean Air Strategy.⁸¹

⁷⁸ Royal Society and the Royal Academy of Engineering, [Shale gas extraction in the UK: a review of hydraulic fracturing](#), June 2012

⁷⁹ Water UK press release, [Water UK and UKOOG to work together to minimise the impact of shale gas development on water resources in the UK](#), 29 November 2013 [accessed 2 October 2018]

⁸⁰ See: Water UK [Impact of shale gas on water and waste water](#), 1 December 2016

⁸¹ PQ [169190](#) [on fracking] 6 September 2018

The following reports have been commissioned by the Welsh and Scottish Governments on the impact of transportation on communities:

- Ricardo Energy and Environment (for Natural Resources Wales), [Unconventional oil and gas: community impacts from transportation activities in Wales](#), 12 September 2017
- Ricardo Energy and Environment (for the Scottish Government) [Unconventional oil and gas development: understanding and mitigating community impacts from transportation](#), 8 November 2016

4.3 Seismic events

Following seismic activity that was felt in Blackpool in Spring 2011, concerns were raised regarding the potential for fracking activities to induce earthquakes. ‘Seismicity’ or ‘seismic events’ refer to sudden phenomena that release energy in the form of vibrations that travel through the Earth as sound (seismic) waves.

On 1st April 2011, the Blackpool area in north England experienced seismicity of magnitude 2.3 ML (local magnitude) shortly after Cuadrilla Resources hydraulically fractured a well at its Preese Hall site. Seismicity of magnitude 1.5 ML occurred on 27th May 2011 following renewed fracturing of the same well.⁸² Hydraulic fracturing was suspended. Cuadrilla commissioned a set of reports to investigate the cause of seismicity⁸³ which concluded that the earthquake activity was caused by fluid injection directly into a nearby fault zone, which reduced the effective normal stress on the fault and caused it to fail repeatedly in a series of small earthquakes. The then Department of Energy and Climate Change also commissioned an [independent report](#) that was published for public comment.⁸⁴ This Report agreed that the observed seismicity was induced by the hydraulic fracture treatments at Preese Hall and set out several recommendations for the mitigation of seismic risk in future hydraulic fracture operations for shale gas. Some of these recommendations were adopted as part of the regulatory framework for future operations. Controls are in place so that operators will have to assess the location of faults before fracking, monitor seismic activity in real time and stop if a magnitude greater than M0.5 (on the Richter scale) is detected. More information is available on the [BGS pages on hydraulic fracturing and induced seismicity](#) and the [Gov.uk infographic on its Traffic light monitoring system](#).⁸⁵

The Royal Society and the Royal Academy of Engineering Report summarised its views relating to seismicity as follows:

⁸² See, for example, Scottish Government, [Understanding and Monitoring Induced Seismic Activity](#), para 3.4 [accessed 2 October 2018]

⁸³ Geomechanical Study of Bowland Shale Seismicity, [Synthesis Report](#), de Pater and Baisch 2 November 2011

⁸⁴ Green et al., [Preese Hall shale gas fracturing Review and recommendations for induced seismic mitigation](#), 2012

⁸⁵ Gov.uk guidance, [Traffic light monitoring system](#), 9 September 2013 [accessed 5 October 2018]

Concerns have also been raised about seismicity induced by hydraulic fracturing. Natural seismicity in the UK is low by world standards. On average, the UK experiences seismicity of magnitude 5 ML (felt by everyone nearby) every twenty years, and of magnitude 4 ML (felt by many people) every three to four years. The UK has lived with seismicity induced by coal mining activities or the settlement of abandoned mines for a long time. British Geological Survey records indicate that coal mining-related seismicity is generally of smaller magnitude than natural seismicity and no larger than 4 ML. Seismicity induced by hydraulic fracturing is likely to be of even smaller magnitude. There is an emerging consensus that the magnitude of seismicity induced by hydraulic fracturing would be no greater than 3 ML (felt by few people and resulting in negligible, if any, surface impacts). Recent seismicity induced by hydraulic fracturing in the UK was of magnitude 2.3 ML and 1.5 ML (unlikely to be felt by anyone). The risk of seismicity induced by hydraulic fracturing can be reduced by traffic light monitoring systems that use real-time seismic monitoring so that operators can respond promptly.⁸⁶

4.4 Greenhouse gas emissions

Pursuant to the *Climate Change Act 2008*, the UK has a long-term statutory target to reduce greenhouse gas emissions by 80% by 2050 compared to 1990 levels. The Government must set five-yearly carbon budgets from 2008 to 2050 setting out reduction targets for that period. More information on carbon budgets is available in the Library Briefing Paper on the [UK Fifth Carbon Budget](#) (19 March 2018).

There are greenhouse gas emissions associated with most sectors, including energy supply powered by renewable and non-renewable resources. The Intergovernmental Panel on Climate Change (IPCC) estimated that the average full lifecycle emissions of natural gas is below oil and coal, but higher than nuclear and renewable resources.⁸⁷ Concerns have been raised in relation to the impact that fracking could have on UK greenhouse gas emissions and its ability to meet the carbon budgets.

The *Infrastructure Act 2015* introduced a requirement that the Secretary of State for BEIS regularly seek, and publish, advice from the Committee on Climate Change (CCC) on the impact of emissions from the onshore oil and gas sector (including shale gas) on the ability of the UK to meet the carbon budgets set by the *Climate Change Act 2008*.⁸⁸

The CCC published its advice in July 2016 and the Government response to this advice was published in the same month.⁸⁹ The [accompanying press release from the CCC](#) summarised as follows:

The CCC's report finds that the implications of UK shale gas exploitation for greenhouse gas emissions are subject to considerable uncertainty – from the size of any future industry to the potential

⁸⁶ Royal Society and the Royal Academy of Engineering, [Shale gas extraction in the UK: a review of hydraulic fracturing](#), June 2012

⁸⁷ IPCC, Renewable Energy Sources and Climate Change Mitigation, [Summary for policy makers and technical summary](#), 2012, Figure SPM.8 (p.19)

⁸⁸ Section 49 *Infrastructure Act 2015*

⁸⁹ Committee on Climate Change, [The compatibility of onshore petroleum with meeting the UK's carbon budgets](#), 7 July 2016

emissions footprint of shale gas production. It also finds that exploitation of shale gas on a significant scale is not compatible with UK carbon budgets, or the 2050 commitment to reduce emissions by at least 80%, unless three tests are satisfied:

1. Emissions must be strictly limited during shale gas development, production and well decommissioning. This requires tight regulation, close monitoring of emissions, and rapid action to address methane leaks.
2. Overall gas consumption must remain in line with UK carbon budgets. The production of UK shale gas must displace imports, rather than increase gas consumption.
3. Emissions from shale gas production must be accommodated within UK carbon budgets. Emissions from shale exploitation will need to be offset by emissions reductions in other areas of the economy to ensure UK carbon budgets are met.

At this early stage, it is not possible to know whether the tests will be met easily or not. The Committee will closely monitor steps taken by Government and other relevant agencies to satisfy these tests.⁹⁰

In relation to the three proposed tests, the Government response stated that the three tests would be met by the strong regulatory environment for shale gas development:

The Government believes that the strong regulatory environment for shale gas development, plus the determined efforts of the UK to meet its carbon budgets, means that the three “tests” put forward by the CCC will be met.⁹¹

Specifically, in relation to meeting carbon budgets (Test 2) the Government Response stated that it “believes that shale gas development is compatible with our goal to cut greenhouse gas emissions and does not detract from our support for renewables.” On accommodating emissions from shale gas production within UK carbon budgets (Test 3), the Government Response: stated that “the Government’s commitment to meeting carbon budgets means that any additional emissions from shale gas production would be accommodated within carbon budgets and offset by lower emissions in other sectors.”

The Government agreed with the CCC’s conclusion that uncertainty exists regarding the potential of a UK shale industry and its associated emissions footprint, highlighting that exploration was needed to determine this:

The Government therefore believes that there is a clear need to explore and test our shale resource to better understand the potential shale gas reserve. As such, the Government agrees with the CCC’s conclusion that uncertainty exists, and that exploration is required to determine the potential of both the size of a UK shale industry and its associated emissions footprint. The CCC report states that emissions associated with exploration are “generally small”. The Government agrees with the view in the report that “appropriate

⁹⁰ Committee on Climate Change, [Exploitation of onshore petroleum require three tests to be met, CCC says](#), 7 July 2016

⁹¹ [Government Response to the Committee on Climate Change Report](#), Compatibility of UK onshore petroleum with meeting the UK’s carbon budgets, July 2016

emission mitigation techniques should be employed where practical” during the exploration phase.

The Government will seek the CCC’s advice again in 2021, or sooner if it deems it necessary.⁹²

4.5 Public health

A wide range of concerns about potential health risks have been raised in relation to fracking, including in relation to the potential impact on health that the chemicals used in fracking water and emissions from fracking may have.

Public Health England has assessed the risk to human health of extracting shale gas. They evaluated available evidence on issues including air quality, radon gas, naturally occurring radioactive materials, water contamination and waste water. They concluded that “the risks to public health from exposure to emissions from shale gas extraction are low if operations are properly run and regulated.”⁹³

Public Health Wales published an [initial response](#) to Natural Resources Wales initial evidence programme on unconventional oil and gas.⁹⁴

Health Protection Scotland [published a summary of its assessment](#) of the potential impacts on health of developing shale oil and gas and coal bed methane.⁹⁵

4.6 Community

Local communities may feel more directly impacted by the range of potential economic, environmental and social impacts highlighted above. There have been a number of high profile protests and lobbying against fracking by local residents and anti-fracking organisations such as [Friends of the Earth](#).

The Government’s [Energy and Climate Change Public Attitudes Tracker](#) asked about fracking. The full findings on attitudes towards fracking were (March 2018):⁹⁶

Strongly support	2%
Support	15%
Neither support or oppose	47%
Oppose	19%

⁹² [Government Response to the Committee on Climate Change Report](#), Compatibility of UK onshore petroleum with meeting the UK’s carbon budgets, July 2016

⁹³ Gov.uk, Guidance, [Shale gas extraction: review of the potential public health impacts of exposures to chemical and radioactive pollutants](#), 25 June 2014

⁹⁴ Public Health Wales published an [initial response](#) to Natural Resources Wales initial evidence programme on unconventional oil and gas

⁹⁵ Health Protection Scotland [summary assessment](#) of the potential impacts on health of developing shale oil and gas and coal bed methane

⁹⁶ Gov.uk official statistics, [BEIS Public Attitudes Tracker: Wave 26](#), 16 August 2018. See Wave 26 [summary tables](#).

Strongly oppose	13%
Don't know	4%

In order to improve engagement with local communities, both the industry and UK Government has committed to the following support.

Community Engagement Charter

In 2013, UKOOG launched a Shale Community Engagement Charter to outline the steps the industry has committed to in order to address concerns about safety, noise, dust and other environmental issues. The [Community Engagement Charter](#)⁹⁷ includes:

- At exploration stage, £100,000 in community benefits per well-site where fracking takes place;
- 1% of revenues at production will be paid out to communities;
- Operators will publish evidence each year of how they have met these commitments.⁹⁸

The industry charter and offer to communities will be regularly reviewed as the industry develops and operators consult with communities.

Shale Wealth Fund

The Government has committed to creating a Shale Wealth Fund to ensure that communities which host shale sites can share the benefits of shale development. The fund will initially consist of up to 10% of tax revenues arising from shale gas production and could provide up to £1 billion of funding in total, a proportion of which could be paid out to each community over 25 years. The government consulted on the priorities and delivery models for the Shale Wealth Fund and HM Treasury published its response in November 2017.⁹⁹ The Government Response sets out a number of principles which will guide the detailed design of the fund, but also highlights that more evidence is required on a number of areas (see para 3.17 of the Response). Regarding next steps, the Government stated:

The deployment of the Shale Wealth Fund depends both on production and the profitability of the industry, which will determine the level of tax that can be attributed to shale production and, therefore the Shale Wealth Fund. In the meantime, we will work with the industry to learn from its exploration stage community benefits schemes and continue to consult openly with communities, local areas and industry on how best to design a Shale Wealth Fund that puts local people at its heart.¹⁰⁰

Commissioner for Shale Gas

On 5 October 2018, former MP Natascha Engel was appointed as an independent Commissioner for Shale Gas to be a direct communication link between local communities, the shale gas industry and the industry

⁹⁷ UKOOG, [Community Engagement Charter](#) [accessed 5 October 2018]

⁹⁸ See UKOOG [Annual Report 2017](#)

⁹⁹ HM Treasury, [Shale Wealth Fund: response to consultation](#), November 2017

¹⁰⁰ HM Treasury, [Shale Wealth Fund: response to consultation](#), November 2017

regulators. The commissioner will be a contact point for residents, to listen to their concerns, refer them to relevant and factual research and help improve communication with regulators and industry.¹⁰¹

¹⁰¹ Gov.uk press release, [Natascha Engel appointed as Commissioner for shale gas](#), 5 October 2018

5. Glossary

Shale gas: is a natural gas mostly composed of methane, which can be found trapped in shale with very low permeability.

Gas in Place (GIP): means the entire volume of gas contained in a rock formation regardless of the ability to produce it (also referred to as “Total Resource”).

Proved Reserves: means that volume of technically recoverable resources demonstrated to be economically and legally producible under existing economic and operating conditions.

Technically Recoverable Resource (TRR): means the volume of gas considered to be recoverable with available technology.

PEDL: means petroleum exploration and development licences. See Section 3.1 of the Paper.

OGA: means the Oil and Gas Authority (an executive agency of the Department for Business, Energy and Industrial Strategy Department).

UKOOG: means United Kingdom Onshore Oil and Gas, representing the onshore industry.

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