National Audit Office

Report
by the Comptroller
and Auditor General

Department for Business, Energy & Industrial Strategy

Fracking for shale gas in England

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National Audit Office

Department for Business, Energy & Industrial Strategy

Fracking for shale gas in England

Report by the Comptroller and Auditor General

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Gareth Davies
Comptroller and Auditor General
National Audit Office

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This report sets out the facts about the government's support of shale gas development in England to help Parliament consider whether the public bodies involved are protecting taxpayers' interests effectively.

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Contents

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Summary

1 Hydraulic fracturing (fracking) is a technique used to recover gas from shale rock. In England, this rock lies deep underground primarily in Yorkshire, the East Midlands and the North West. Fracking involves injecting a mixture of water, sand and chemicals at high pressure through a well. Typically, the well is first drilled vertically into the ground, and then horizontally. The water creates fractures in the rock and the sand lodges into the spaces to keep them open. This allows the released gas to flow out of the rocks and travel to the surface. The Department for Business, Energy & Industrial Strategy (the Department) leads government's policy for shale gas development (**Figure 1** on pages 8 and 9).

Scope of this report

2 Fracking for shale gas is the subject of media, public and Parliamentary interest. This report sets out the facts about the government's plans to support shale gas development in England to help Parliament consider whether taxpayers' interests are being protected effectively. It covers:

- an overview of fracking, and what activity has taken place to date (Part One);
- government's objectives (Part Two);
- managing the risks from fracking (Part Three); and
- the costs to taxpayers (Part Four).

3 It is not the remit of the National Audit Office to examine the merits of government's policy to support shale gas development. We have not sought to determine the quality of the scientific evidence underlying the case for or against fracking and the potential risks it presents. We do not conclude on whether the Department's approach to supporting shale gas development is value for money. Our methodology is set out in Appendix One.

Key findings

Government's objectives

4 **The Department believes shale gas could provide the UK with greater energy security through diversifying the sources of supply.** The Committee on Climate Change (CCC) considers that gas will have a significant role in the UK's future energy mix even though the demand for gas is expected to fall between 2020 and 2035. The Department believes shale gas may help counteract the decline of domestic oil and gas production and reduce the UK's reliance on oil and gas imports. The size of its contribution is unclear as the Department does not know how much shale gas can be technically and commercially extracted. It does not expect shale gas production to lead to lower energy prices. There are limitations to comparisons with the North American experience of large-scale shale gas production given differences in geology, regulation, population density and land ownership (paragraphs 1.9, 2.2 to 2.5, 2.7 and 2.8, and Figures 5 and 6).

5 **The Department believes shale gas can support economic benefits, but it has not analysed the benefits or costs of shale gas development.** Ministers have cited reports that indicate investments of up to £33 billion and the creation of 64,500 jobs. The Department believes an analysis of the costs and benefits of supporting the industry would not be meaningful in the absence of more evidence about how much shale gas can be extracted (paragraphs 2.9 and 2.10, and Figure 7).

6 **Progress to establish the commercial viability of extracting shale gas has been slower than government expected.** Government has introduced a series of measures to help operators to determine the viability of the shale gas industry, mainly focused on supporting the planning process. However, progress has been slow to date: in 2016, Cabinet Office expected up to 20 fracked wells by mid-2020, but three wells have been fracked to date. Government attributes this slow progress in part to low public acceptance. Operators say the time to gain regulatory permits and planning permissions, coupled with the current 'traffic light system' for managing fracking-induced earthquakes (which is more stringent than other countries), is hindering the industry's development. In May 2019, ministers stated there were no plans to review this system (paragraphs 2.6, 2.16 and 3.21, and Figures 9 and 10).

7 **The Department considers it can meet its climate change objectives while developing shale gas, but it has not yet developed the necessary technology.** The Department is confident it can meet the CCC's three tests to ensure that shale gas production is compatible with the government's commitment to reducing greenhouse gas emissions. The CCC states that the development of carbon capture, usage and storage technology (CCUS) is critical to this because it would provide a way to use fossil fuels, including shale gas, in a low-carbon way. The Department held two unsuccessful competitions in 2007 and 2012 to develop and implement CCUS. In 2018, the Department set out its aim to develop the first CCUS facility in the mid-2020s (paragraphs 2.13 to 2.15 and Figure 8).

Managing the risks from fracking

8 Alongside greenhouse gas emissions, other risks from fracking include air pollution, groundwater contamination and earthquakes. Any potential impacts shale gas development could have on air quality and water supplies is more likely to be felt at the local and regional level. The Environment Agency (EA) believes that with regulation, the environmental risks from fracking are low. The Oil & Gas Authority (OGA) is responsible for ensuring operators manage the risk of fracking-induced earthquakes. It requires operators to pause all fracking activity if earthquakes are equal to or greater than 0.5 magnitude on the Richter scale. The three fracking operations in the UK to date have resulted in earthquakes over 0.5 magnitude, with the most recent resulting in an earthquake of 2.9 magnitude in August 2019 (paragraphs 1.7, 3.5 to 3.20, and Figures 13 and 14).

9 Regulators will need to respond and build capacity quickly if operators begin producing shale gas at scale. Shale gas operators must apply for environmental permits and comply with the regulatory regime in place for conventional oil and gas, as well as three additional requirements. The OGA, the Health and Safety Executive (HSE), and EA, have so far focused on the exploratory stage and mainly rely on a system of statutory self-reporting by the operator, which presents risks. Should the industry move into production quickly, EA, the lead regulator, is confident it can respond at pace. At the end of a well's operational life, HSE must be satisfied that the well has been decommissioned safely. EA must be satisfied that there are no ongoing environmental risks before it allows an operator to surrender its environmental permit. Following this, there is no requirement on any public body or the operator to monitor the well for any leakages or emissions (paragraphs 3.2 to 3.4, 3.6, and Figures 1, 11 and 12).

10 Public support for shale gas development is low and has fallen over time. The Department's public attitudes survey shows the opposition to shale gas has increased from 21% to 40% between 2013 and 2019. Public concern has centred on the risks to the environment and public health; from fracking-induced earthquakes; and the adequacy of the environmental regulations in place. Local authorities we interviewed said the strength of public opposition for shale gas planning applications was unprecedented. One local authority received around 36,000 responses to the public consultations for planning applications to frack shale gas wells (paragraphs 1.8 and 4.5, and Figure 4).

The costs to taxpayers

11 The Department does not know the full costs of supporting shale gas development to date or the future public investment that may be required. Costs have been borne by government departments, regulators, local authorities and other local bodies. We have identified known costs of at least £32.7 million since 2011. This includes £13.4 million spent by three local police forces on managing protests around shale gas sites. It does not include the cost of appeals, judicial reviews, or the time and expenses of public servants. Because of the uncertainty over how much shale gas can be extracted, the Department has not estimated how much public investment will be required to support the production of shale gas at scale (paragraphs 4.2 to 4.9 and Figure 16).

12 The Department recognises its responsibility for decommissioning offshore oil and gas infrastructure, but not for onshore wells, including shale gas wells. In January 2019, we reported that government is ultimately liable for the total costs of decommissioning offshore infrastructure that operators cannot decommission. The Department discloses this risk in its financial accounts. In contrast, there is no equivalent legislation that establishes government liability for decommissioning onshore wells. In March 2019, the Committee of Public Accounts (the Committee) set out its concerns about the Department's arrangements for ensuring the cost of decommissioning shale gas wells does not fall to taxpayers (paragraphs 4.12 and 4.13).

13 The Department says landowners may be liable for decommissioning costs if an operator is unable to fund them, but these arrangements are unclear and untested. In May 2019, the Department wrote to the Committee and asserted that, for an abandoned well with no current operator, EA had the ability to pursue former operators for the cost of damages under the Environmental Liability Directive, and to pursue landowners under the Environmental Damage Regulations. It noted, however, that these measures were "relatively untested". In October 2019, EA told us it has since considered the extent of these powers and determined that it is unable to use them to pursue insolvent operators or landowners, contradicting the advice given by the Department to the Committee. The EA may be able to pursue landowners under other statutory powers, but these would have limitations and are untested in the oil and gas sector. The Department could not tell us what would happen should the landowner be unable to meet decommissioning costs (paragraphs 4.15 and 4.16).

Figure 1

Roles and responsibilities for shale gas development (including fracking)

Multiple organisations have responsibilities for policy and oversight of shale gas

Policy

Department for Business, Energy & Industrial Strategy

Has overall responsibility for coordinating shale gas policy.

Leads on oil and gas legislation.

The Secretary of State must issue hydraulic fracturing consent before an operator can undertake fracking.

Department for Environment, Food & Rural Affairs

Leads on environmental aspects of shale gas policy, such as air quality, chemical substances, waste and water management.

Ministry of Housing, Communities & Local Government

Responsible for the planning regime for shale gas.

The Secretary of State for Housing, Communities & Local Government can call in applications and recover appeals for decisions by ministers.

Regulators and oversight bodies

Oil & Gas Authority

Issues licences for hydrocarbons operations.

Assesses operator's financial capability.

Agrees operators' hydraulic fracturing plans, through which it ensures mitigations are in place to manage fracking-induced earthquakes.

Ensures operators manage the risk of earthquakes (induced seismicity) from fracking operations.

Environment Agency

Issues environmental permits to shale gas operations, which involves consultation with local communities and interested parties. The permits require environmental monitoring of sites before, during and after operations.

Approves use of chemicals that are used in the fracking process.

Places controls on the management of waste including handling of naturally occurring radioactive material from gas production.

Agrees operators' hydraulic fracturing plans.

Health and Safety Executive

Regulates well integrity by examining well design, construction, operation and maintenance.

Can comment on operators' hydraulic fracturing plans.

Regulates safety on well sites.

Gathers reporting and scrutinises plans for decommissioning wells.

Shale Environmental Regulator Group

A virtual group of shale gas regulators: the Oil & Gas Authority, the Environment Agency and the Health and Safety Executive.

Acts as single point for information to environmental regulation for industry, local authorities and local communities.

Others

Public Health England

Works with regulators to assess potential health impacts of shale gas operations.

Infrastructure & Projects Authority

Undertook the initial financial resilience tests of operators. The Oil & Gas Authority is due to take over this role.

British Geological Survey

Undertakes environmental baseline monitoring in Lancashire and Yorkshire of shale gas operations.

Reports on earthquakes (induced seismicity) resulting from fracking operations.

Operators must notify it of their intention to drill.

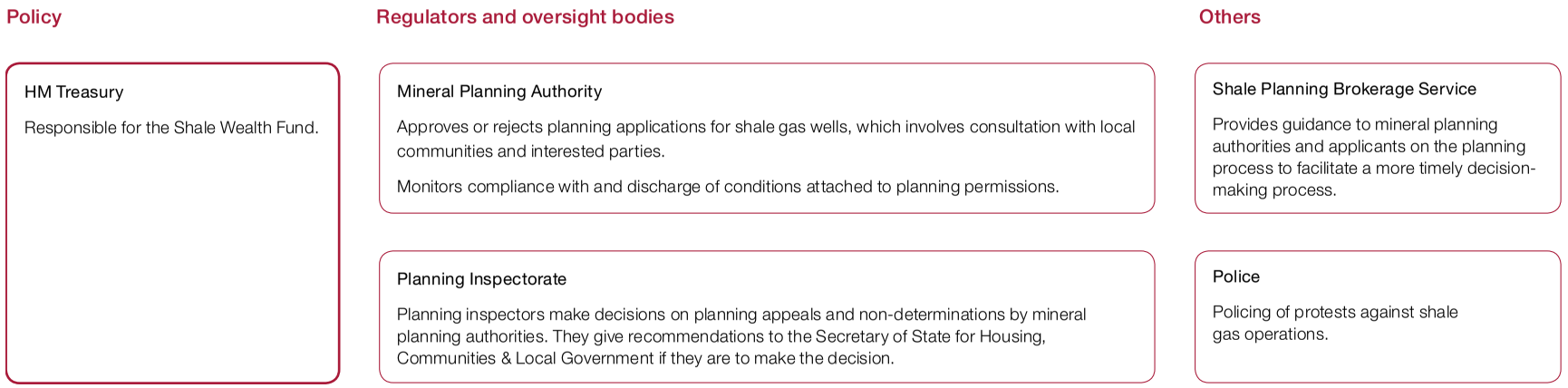
The Coal Authority

Issues a permit if an operator intends to drill in an area close to a coal seam.

Is consulted when an operator submits a fracking application in an area that has historical coal mining.

Figure 1 *continued*

Roles and responsibilities for shale gas development (including fracking)



Notes

1 A hydraulic fracturing plan sets out an operator's approach to controlling and monitoring fracking and mitigating the risks of earthquakes (induced seismicity).

2 A mineral planning authority is a county council (in two-tier authority), a unitary authority or a national park authority.

Source: National Audit Office analysis

Part One

Background

1.1 This part of the report sets out what hydraulic fracturing (fracking) for shale gas entails and what fracking activity has taken place in the UK and around the world to date.

Extracting shale gas

1.2 Shale gas is similar to the oil and gas conventionally extracted in the UK. The main difference is in where the reserves are found and how they are extracted. Shale rock is found deeper underground and is less porous than the rock in which conventional oil and gas reserves are found. Fracking is a technique used to fracture the shale rock to release the gas reserves it holds. It involves the injection of fracking fluid – a mixture of water, sand and chemicals – at high pressure through a well that has typically been drilled, first vertically then horizontally, into the ground. The fluid creates fractures in the rock and the sand then lodges in the fractures to keep them open. This allows gas released from the rock to flow up the well to the surface (**Figure 2**).

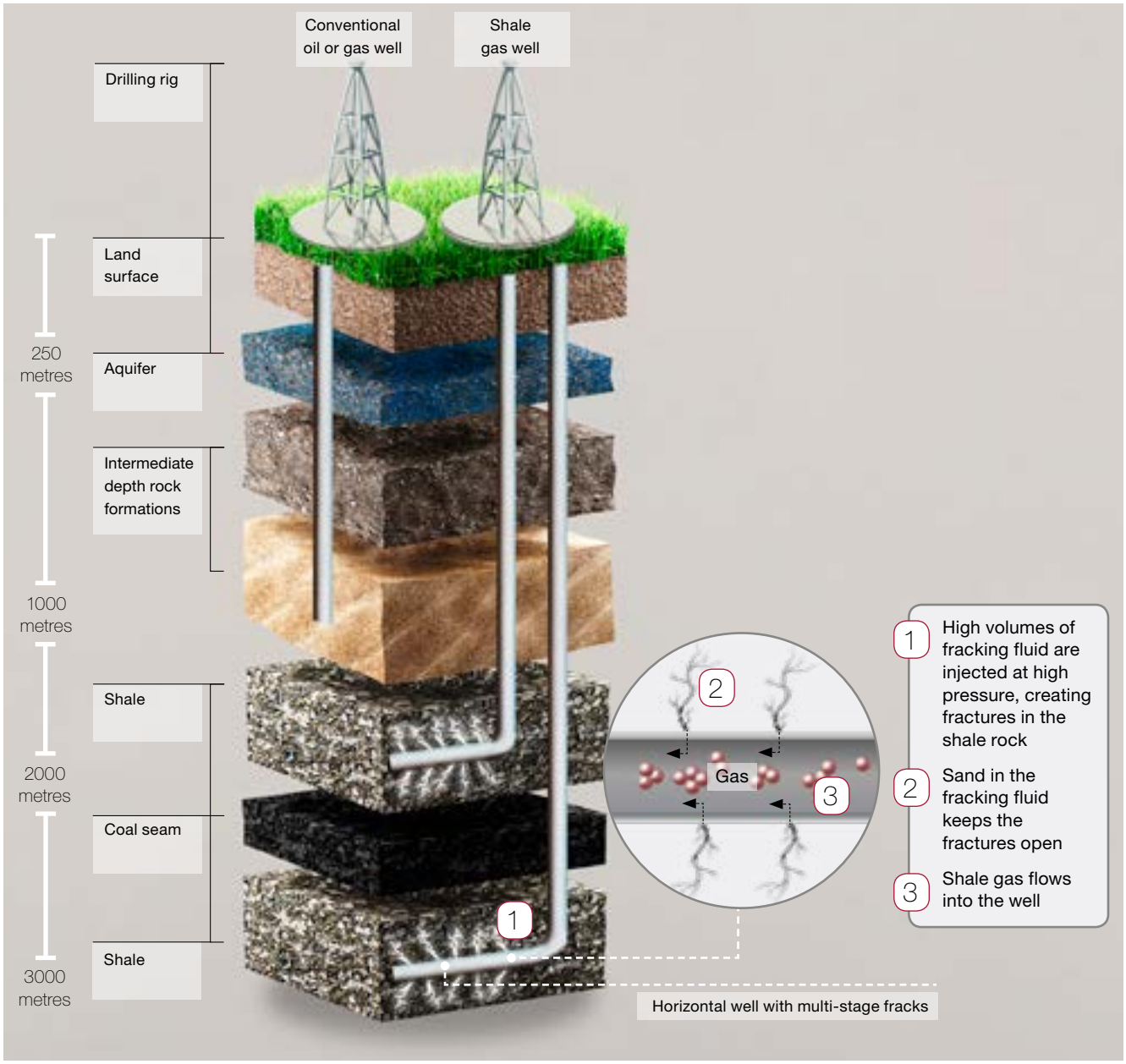
1.3 Fracking has been used to extract oil and gas from offshore and onshore reserves since the 1970s. Around 10% of conventional onshore wells in the UK have been fracked to boost oil and gas flow from them. Fracking for shale gas differs in that it requires fracking fluid to be injected in larger quantities. The 2015 Infrastructure Act also sets out that fracking for shale gas should take place at depths of at least 1,000 metres below the surface.

Shale gas extraction in the UK

1.4 As at October 2019, there are 2,130 onshore oil and gas wells in the UK, of which 341 are active. The Oil & Gas Authority (OGA), the body that issues petroleum exploration and development licences, has designated 12 as shale gas wells, seven of which have been plugged and abandoned. Shale gas wells are all located in England. Licensing for shale gas exploration is devolved to Scotland, Wales and Northern Ireland. These administrations do not support shale gas exploration.

Figure 2
Extracting shale gas

Shale gas is extracted through a combination of horizontal drilling and fracking



Notes

1 This figure is for illustrative purposes only and is not to scale.

2 Rig types and heights vary. In England, rig heights for shale gas wells to date have ranged between 30 metres and 37 metres.

3 Typically, conventional gas will flow easily from the rock to the well and then to surface. In contrast, the rocks in which shale gas is found has low permeability – the interconnectedness of the pore spaces through which the gas must move is very low. Fractures need to be created to allow the gas to flow.

4 Horizontal drilling is used to maximise shale gas recovery. It involves changing from a vertical to a horizontal direction deep underground. UK legislation requires fracking to occur at depths of at least 1,000 metres.

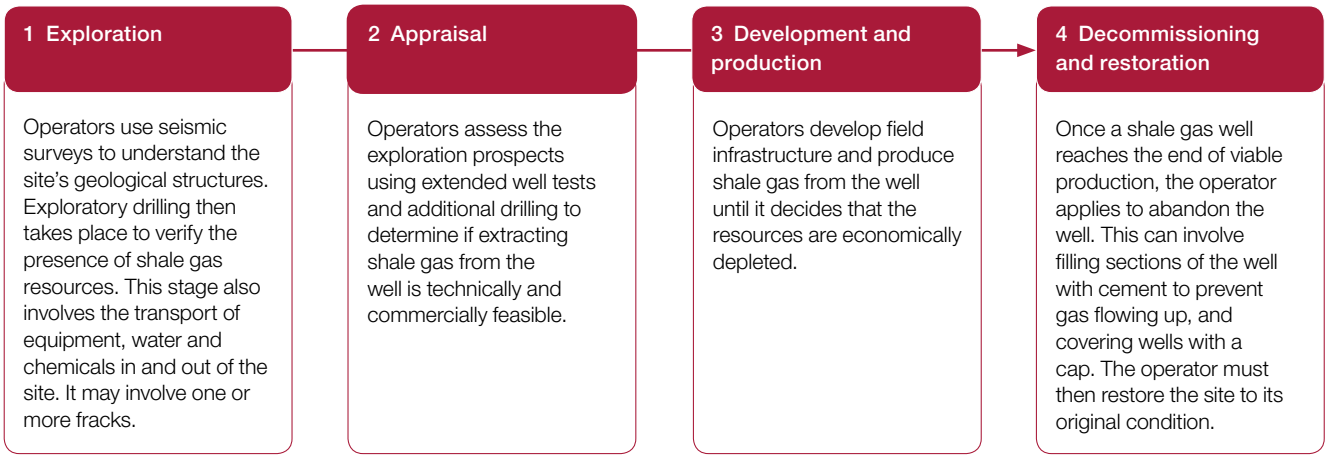
Source: National Audit Office analysis

1.5 The British Geological Survey estimates that there is around 1,329 trillion cubic feet of shale gas resource, primarily in northern England and the Midlands.[1] This compares to the UK's annual demand of around 3 trillion cubic feet of gas. Geological and technical uncertainties mean government does not know how much shale gas can be extracted but it expects it will be a fraction of the total resource. It has encouraged operators to explore licensed areas to determine the amount of shale gas that can be produced economically.

1.6 Currently, five operators are in the early stages of shale gas exploration to determine whether they can produce shale gas commercially. An operator's decision will be influenced by international gas prices and the planning and regulatory framework. **Figure 3** sets out the stages of shale gas development from exploration to decommissioning and site restoration.

Figure 3
The stages of shale gas development

Shale gas development in England is in the exploration phase



Note

1 An operator may decommission and restore a site after the exploration or appraisal phase if it decides not to continue with producing shale gas from the well.

Source: National Audit Office analysis

1 This is a central estimate of the Bowland Shale, which spans between Wrexham and Blackpool in the west and Nottingham and Scarborough in the east. British Geological Survey estimates that shale gas resources range from 822 trillion cubic feet to 2,281 trillion cubic feet.

1.7 To date, three wells in Lancashire have been fracked by Cuadrilla Bowland Limited (Cuadrilla). The operator stopped fracking its well in 2011 after detecting an earthquake of 2.3 magnitude (ML) and up to 1.5 ML in ensuing tremors. After this, government put in place a moratorium on fracking, lifting it in December 2012. Cuadrilla fracked a second well in late 2018 recording six earthquakes above 0.5 ML, with the highest reaching 1.5 ML. In August 2019, the operator suspended its fracking activity at a third well after inducing earthquakes of 1.6 ML, 2.1 ML and 2.9 ML over the course of five days. Third Energy, another operator, did not receive consent to frack its well in North Yorkshire.[2] All other operators have not yet applied for consent to frack.

Public attitudes to fracking in the UK

1.8 Since December 2013, the Department has tracked support of shale gas through its public attitudes tracker. **Figure 4** overleaf shows support for shale gas is lower than other energy sources and opposition to it has increased over time, although around half of respondents held no view. The primary objections to shale gas are the loss or destruction of the natural environment and the risk of earthquakes.

Fracking around the world

1.9 The US has significant shale gas resources, with proven reserves of about 308 trillion cubic feet.[3] It began producing commercial volumes of shale gas in 2000, and by 2018, shale gas made up 69% of total natural gas produced in the US. It became a net exporter of natural gas in 2017. There are limitations in comparing the UK to the North American experience with producing shale gas commercially given the difference in geology, regulation, land ownership and population density.

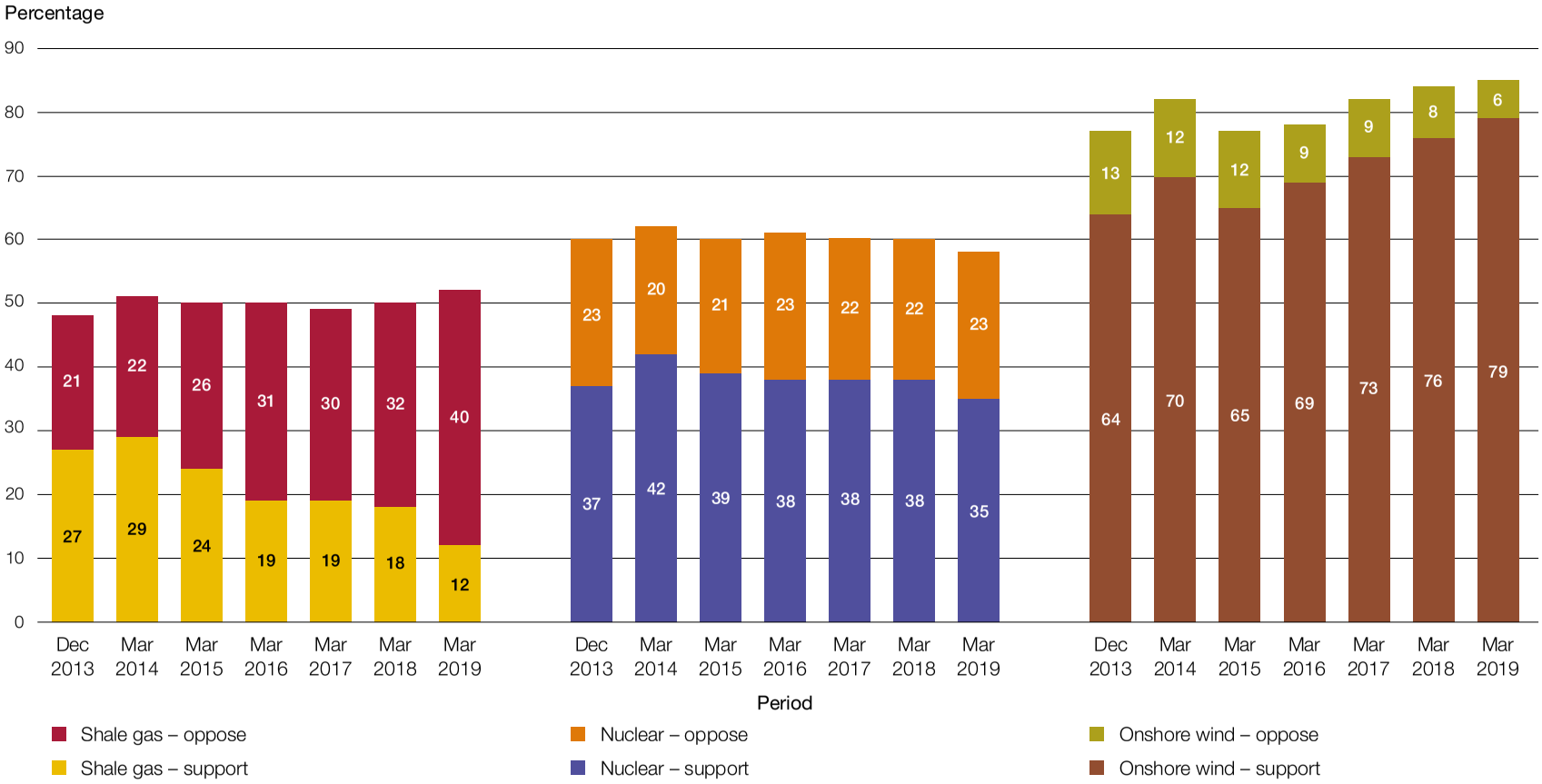
1.10 In 2015, the Energy Information Administration, part of the US Department of Energy, reported that 46 countries worldwide had shale gas resources.[4] The US, China, Argentina, Algeria and Canada have the largest shale gas resources, and all but Algeria have produced shale gas commercially. Other countries, including France, Germany, and the Republic of Ireland have banned the use of fracking for shale gas.

2 In July 2019, American firm, Alpha Energy Limited acquired Third Energy.
3 'Resource' is the estimate of gas contained in the shale rock. 'Reserve' refers to the amount that can be technically and commercially extracted.
4 These are the latest available data: US Energy Information Administration, *World Shale Resource Assessment*, September 2015. Available at: www.eia.gov/analysis/studies/worldshalegas/

Figure 4

Public support and opposition to different energy sources

Support for shale gas fell between December 2013 and March 2019



Notes

1 The chart excludes 'don't know' and 'neither support or oppose' responses. In the case of shale gas, 'neither support or oppose' has ranged between 44% and 49%, while 'don't know' has ranged between 2% and 5%.

2 In June 2019, support and opposition for shale gas was 15% and 35% respectively. Questions on the public's support and opposition of nuclear and onshore wind were not included in the June 2019 public attitudes tracker.

Source: National Audit Office analysis of the Department for Business, Energy & Industrial Strategy's data

Part Two

Government's objectives

2.1 This part of the report sets out the role of oil and gas production in the UK and the government's objectives in supporting shale gas development.

Oil and gas in the UK economy

History of production

2.2 The UK produces oil and gas from both onshore and offshore wells, primarily in the North Sea. Offshore extraction started in the 1960s, with production peaking in the mid-1980s and late 1990s. It has steadily declined since then: in 2018 UK oil production was 63% lower than the 1999 peak and gas production was 64% lower than the peak in 2000 (**Figure 5** overleaf). The onshore oil and gas industry started much earlier, and now accounts for around 1% of total domestic oil and gas production.

The demand for gas

2.3 The UK relies on oil and gas for its energy supply, complemented by nuclear power and renewable sources. Currently, the UK meets 75% of its energy demand from oil and gas. This is derived from a mix of UK production, and imported gas and liquified natural gas, primarily from Norway and Qatar respectively. In 2018, the UK imported just under 60% of the gas used for electricity generation, domestic heating and transport (**Figure 6** on page 17).

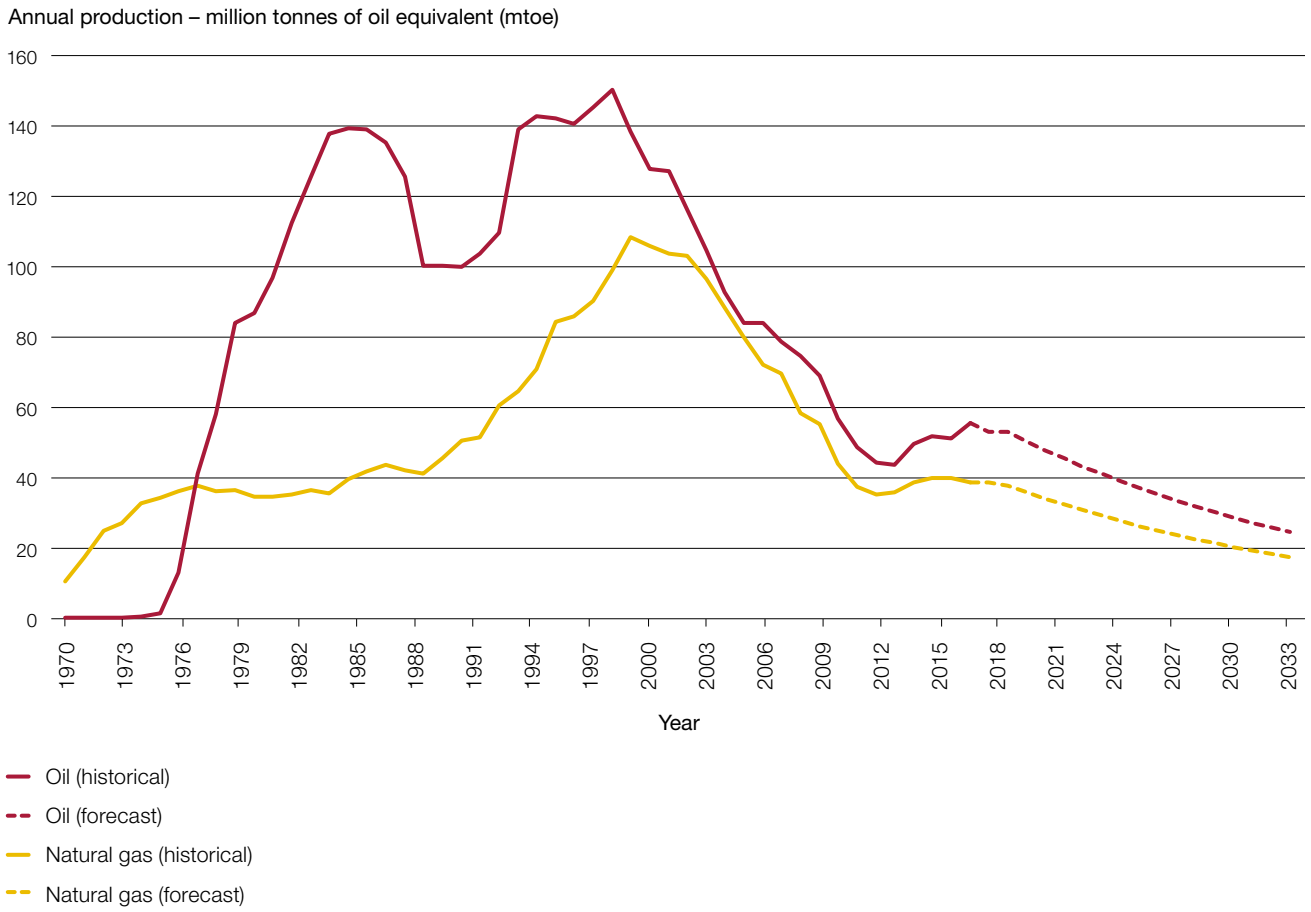
2.4 The UK's demand for gas is expected to fall between 2020 and 2035. The Department for Business, Energy & Industrial Strategy (the Department) forecasts that the use of gas for electricity generation will drop by half by 2032 and that its use in domestic heating will decline strongly by the 2040s. The Committee on Climate Change (CCC)[5] suggests it is likely that natural gas will be needed to produce hydrogen to decarbonise industrial heating and heavy-duty vehicles where electrification is less feasible. Its 2016 report set out that while the consumption of natural gas and oil will fall, imports are projected to rise to meet demand even as consumption falls. The Department expects imports to increase to 73% by 2035. It intended to publish an energy white paper in the summer of 2019 detailing the government's strategy for ensuring secure, sustainable and clean energy to support the UK economy. The Department had not published this at the time of writing.

5 The Committee on Climate Change is a non-departmental public body formed under the Climate Change Act (2008) to advise government and devolved administrations and Parliaments on tackling and preparing for climate change. Its advice is not legally binding.

Figure 5

UK oil and gas production since 1970 (offshore and onshore)

Oil and gas production is projected to decline



Note

1 A tonne of oil equivalent (toe) is a unit of energy equivalent to 10,000 megacalories, the theoretical energy content of 1 tonne of oil.

Source: National Audit Office analysis of Digest of UK Energy Statistics (2019) and Oil & Gas Authority data (2019)

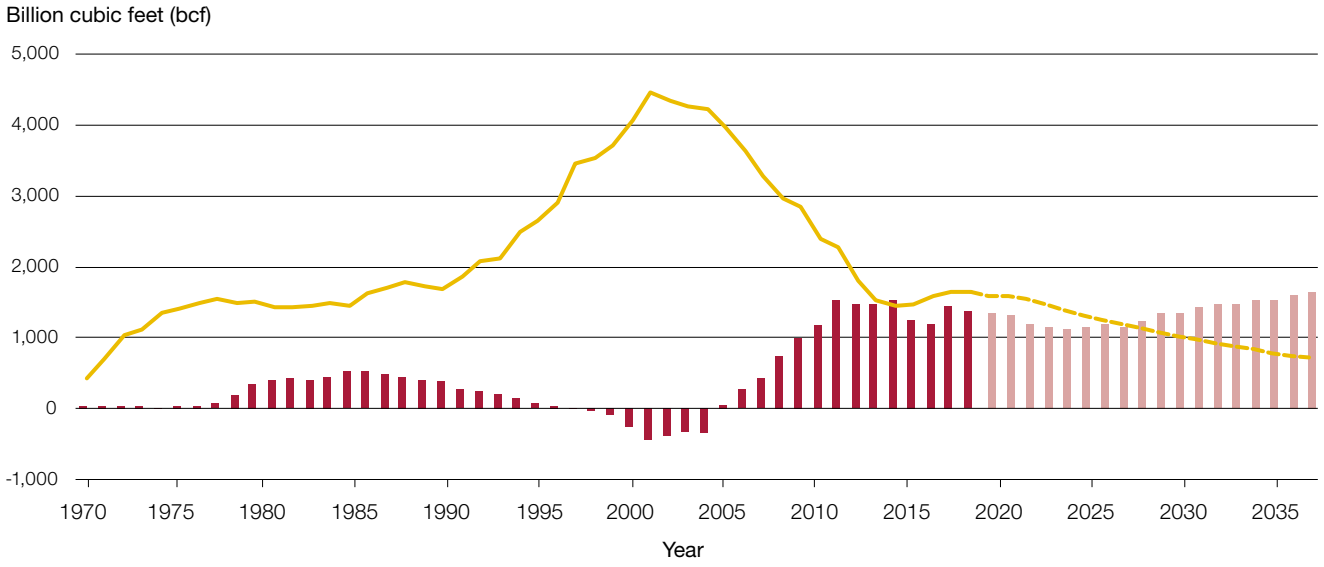
Government's objectives for shale gas

2.5 The Department does not know how much shale gas can be technically and commercially produced in the UK. It has relied on operators to determine the viability of a shale gas industry through exploration activity and says it requires data from wells in several regions before a robust estimate of the potential for shale gas production can be made.

Figure 6

UK gas production and net gas imports, 1970 to 2035

The UK will import more gas to meet its future demand for energy



Note

1 A negative value for net imports in a given year means the UK exported more gas than it imported.

Source: National Audit Office analysis of Oil & Gas Authority data (2019) and Digest of UK Energy Statistics (2019) data

2.6 Only three wells have been hydraulically fractured (fracked) so far. This contrasts with expected progress: in July 2013, ministers said they expected operators to have drilled between 20 and 40 exploration wells in two years. In 2016, a Cabinet Office report expected that between five and 20 wells could be fracked by the mid-2020s, that the viability of the industry could be proven by mid-2020, and that the industry could rapidly expand after that. Government attributes this slow progress partly to low public acceptance while operators attribute it to the time taken to obtain regulatory permits and planning permissions and the current threshold for managing fracking-induced earthquakes (see Part Three).

Energy security

2.7 The Department considers that shale gas could support energy security through diversifying the sources of supply. It is not currently concerned about the security of energy imports but believes the domestic production of shale gas could offset the decline in offshore production and reduce the future reliance on imported gas. The Department does not include estimates of shale gas production in its annual assessment of the security of supply because of the uncertainty over how much shale can be commercially extracted.

2.8 Irrespective of the size of any future shale gas industry, the Department does not expect it to reduce energy prices because the price of gas is set internationally, and the UK's shale gas output is likely to be small in comparison to international markets. The CCC concluded that shale gas production would do little to reduce energy bills.

Economic benefits

2.9 Government's view is that there are potentially substantial economic benefits from shale gas development. Ministerial statements have referenced the economic benefits set out in a report commissioned by industry and part-funded by government, which forecast £33 billion in investment across the supply chain and the creation of 64,500 jobs (see **Figure 7**).

2.10 The Department has not conducted an independent assessment of the potential costs or benefits of supporting the shale gas industry because it believes an assessment would not be meaningful while the industry is in the exploration stage. On the basis that its spending to support the shale gas industry has been relatively low, the Department has not undertaken an analysis of the opportunity costs of supporting the shale gas industry versus other energy sources, including renewables.

2.11 In 2015, the Department for Environment, Food & Rural Affairs (Defra) undertook preliminary work to identify the potential costs of shale development to the rural economy. A draft internal paper found that some sectors, including tourism, may suffer because of increased congestion. It added that long-term economic impacts and benefits were uncertain. Defra has cautioned against the use of this draft paper on the basis that it was an internal document which it does not consider analytically robust. Defra has discontinued this work.[6]

2.12 In 2016, we reviewed the Department's approach to supporting private investment in energy efficiency through the Green Deal. The then energy minister told Parliament that it had the potential to improve the UK's entire housing stock. As with shale gas, the Department believed the lack of precedent and the uncertainty over what the Green Deal would achieve meant it could not set meaningful expectations for the scheme. Ultimately only 14,000 households used a Green Deal loan. We concluded that setting clear measures of success for a policy, even where the Department is reliant on market participants to deliver it, remains a crucial part of delivering policy effectively.

6 The Department for Environment, Food & Rural Affairs (Defra's) statement '*Draft Shale gas rural economy impacts paper*', 1 July 2015. Available at: www.gov.uk/government/publications/draft-shale-gas-rural-economy-impacts-paper

Figure 7

Industry estimates of the potential benefits of shale gas development

Estimates of the number of jobs a shale gas industry could create have varied

	Britain's shale gas potential (2012) – Institute of Directors	Getting shale gas working (2013) – Institute of Directors	Getting ready for UK shale gas (2014) – EY	Updated shale gas production scenarios (2019) – UK Onshore Oil and Gas
Recovery rate	10%	10%	Not stated	Not stated
Number of horizontal wells	Not stated	4,000	4,000	4,000
Gas production (annual peak)	Not stated	1,121 billion cubic feet[1]	Not stated	1,375 billion cubic feet[1,2]
Number of jobs created	35,000	74,000[1]	64,500	Not stated
Saving in import bill per year	Not stated	£8 billion	Not stated	£8 billion
Investment (annual peak)	Not stated	£3.7 billion[1]	£3.3 billion[3]	Not stated

Notes

1 This is a central estimate.

2 Estimates assume unhindered flows.

3 The report estimates that total estimated investment over the lifetime of the industry is £33 billion.

Source: National Audit Office analysis

Fit with climate change objectives

2.13 The Climate Change Act (2008) committed government to reducing greenhouse gas emissions by at least 80% by 2050 when compared with 1990 levels through setting five-year caps on emissions, called 'carbon budgets'. In June 2019, government announced its target of becoming carbon neutral by 2050 (the 'net-zero' commitment).

2.14 The CCC advises government on how to meet carbon budgets. In 2016, it assessed the compatibility of shale gas production with these budgets and concluded that government must meet three tests before shale gas development would be compatible with the UK's carbon budgets. Government has said it is confident it can meet these tests (**Figure 8** overleaf).

2.15 The CCC also stated that the development of carbon capture, usage and storage (CCUS) technology is essential to ensuring the compatibility of fossil fuel consumption, including shale gas, with the UK's climate change objectives. CCUS allows for carbon dioxide to be captured from waste gases and stored in offshore geological facilities or reused. In 2019, the CCC reiterated that CCUS was crucial to the government meeting its net-zero commitment. So far, the Department has cancelled two competitions to develop CCUS in 2007 and 2012. In 2018, it published an action plan outlining its ambition for the first CCUS facility to open in the mid-2020s and the option for deployment at scale in the 2030s, subject to costs coming down sufficiently.

Figure 8

The Committee on Climate Change's three tests and government's response in 2016

Government states it can meet all three tests

The Committee on Climate Change's tests	Summary of government's response
Test 1: Well development, production and decommissioning emissions must be strictly limited. Emissions must be tightly regulated; technologies to limit methane emissions are required, including green completions;[1] and the impact of 'super-emitters'[2] must be limited.	Government is confident that the existing regulatory regimes means Test 1 will be met for the production stage of shale development.
Test 2: Gas consumption must remain in line with carbon budget requirements. UK shale gas production must displace imported gas rather than increasing domestic consumption.	Government believes Test 2 can be met and that lifecycle emissions from shale gas are comparable to conventional sources of natural gas. It does not believe that shale development will impact on overall gas consumption.
Test 3: Accommodating shale gas production emissions within carbon budgets. Additional production emissions will need to be offset through reductions elsewhere in the economy.	Government considers that Test 3 can be met. Any additional emissions for shale gas production would be accommodated within carbon budgets and offset by lower emissions in other sectors.

Notes

1 Some gas can flow back up the well alongside fracking fluid after fracking is complete. 'Green completions' is the use of equipment to capture this gas to stop it from being released into the air.

2 A 'super-emitter' is a leaking well that if left undetected can lead to significant methane emissions to the atmosphere.

Source: The Committee on Climate Change (CCC), *Onshore Petroleum: The compatibility of UK onshore petroleum with meeting the UK's carbon budgets*, March 2016 and Government's response to the CCC's report, July 2016

Government's support for shale gas development

2.16 Successive governments have supported shale gas development in England. Since 2015, government has set out a range of new measures to "facilitate timely decisions" in England in response to what it described as "disappointingly slow" planning applications against statutory timeframes.[7] Other measures also include coordinating the regulatory processes and engaging and supporting communities next to shale gas sites (**Figure 9**).

2.17 In England, mineral planning authorities (MPAs) are responsible for determining planning applications, including shale gas, in their local areas. MPAs report that determining planning applications for shale gas is costly and time-consuming, primarily because of an intense level of public concern. **Figure 10** on pages 22 and 23 shows the time taken to determine shale gas planning applications rose significantly after the 2011 fracking-induced earthquakes in Lancashire.

7 Written statement by the Secretaries of State for Business, Energy & Industrial Strategy and Housing, Communities & Local Government, 17 May 2018. Available at: www.parliament.uk/business/publications/written-questions-answers-statements/written-statement/Commons/2018-05-17/HCWS690

Figure 9

Government's main measures to support shale gas development

Government's measures have concentrated on planning

Issue	Measure	Description
Planning (England only)	Permitted development	Government is analysing the responses to its consultation on whether to treat non-hydraulic fracturing shale gas exploration[1] as permitted development in England.
	Inclusion into Nationally Significant Infrastructure Projects (NSIP)	Government is analysing the responses to its consultation on the timings and criteria for including shale gas production projects in the NSIP regime. This means the decision on a planning application would rest with the Secretary of State for Business, Energy & Industrial Strategy rather than local mineral planning authorities (MPAs).[2]
	Shale planning brokerage service	The broker aims to provide guidance to operators and MPAs on the planning process but has no role in decision-making or appeals.
	Planning performance agreements	These agreements between an MPA and an operator set out the plan for supporting development proposals against an agreed timeline.
	Shale support fund	Established in 2014-15, it supports MPAs' capacity and capability to determine shale gas planning applications.
Regulation	Shale Environmental Regulatory Group (SERG)	Launched in October 2018, SERG brings together the Environment Agency, Health and Safety Executive, and the Oil & Gas Authority as a virtual regulatory group.
Community Benefit and Engagement	Shale Wealth Fund	The fund will consist of up to 10% tax revenues arising from shale gas production. Government expects this to provide up to £1 billion of funding paid out to communities over 25 years. The fund will not replace or reduce existing local spending or community benefit schemes funded by operators.
	Shale Gas Commissioner	The commissioner for shale gas is intended to be a contact point for residents and provide accurate and timely information about shale gas extraction. The commissioner resigned from her position six months after her appointment. Ministers have not decided whether to replace her.
Taxation	Consultation on the fiscal regime for shale gas	In 2013, HM Treasury consulted on aspects of the fiscal regime for shale gas operators. The tax regime for shale gas is the same as that which applies to all onshore oil and gas operations.

Notes

1 In this context, this entails the drilling of boreholes to take core samples for testing.

2 Mineral planning authorities are either county councils, unitary authorities or national park authorities. They are responsible for deciding on planning applications for shale gas developments.

Source: National Audit Office analysis

Figure 10

Duration for processing planning applications for shale gas

The time taken to determine shale gas applications rose significantly after the fracking-induced earthquakes in 2011, but more recent applications have been determined more quickly

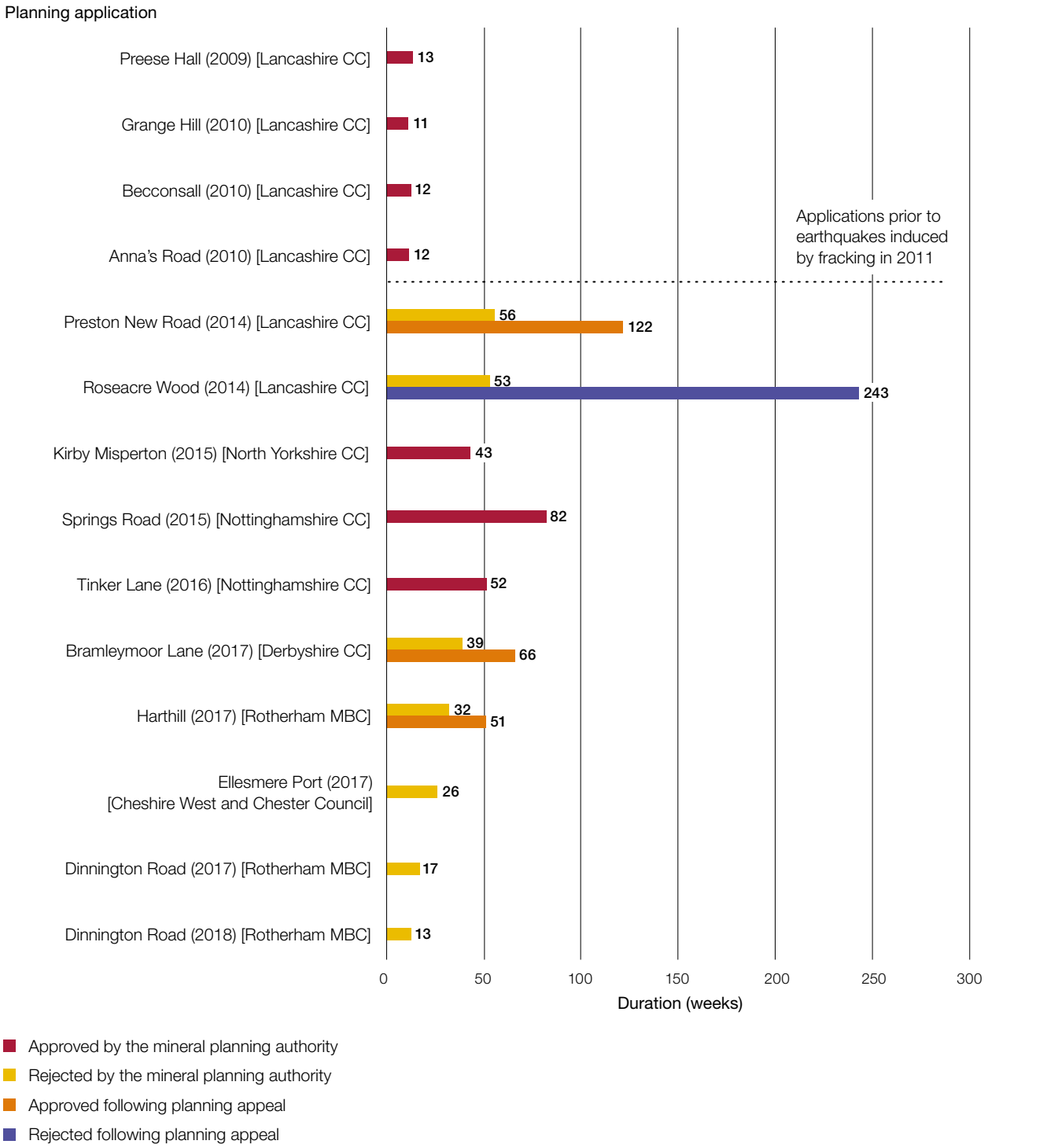


Figure 10 *continued*
Duration for processing planning applications for shale gas

Notes

1 Mineral planning authorities (MPAs) are required to determine planning applications within statutory timeframes of 13 weeks (or 16 weeks if an environmental impact assessment is required) unless an extension is agreed with the applicant.

2 The time taken by a MPA to determine an application is calculated from the date a valid application is accepted by the MPA to the date the decision is issued. For planning appeals, the duration is calculated between the date the application is accepted by the MPA and the date a decision is taken by planning inspectors or the Secretary of State.

3 Data in the chart exclude judicial reviews of applications.

4 Roseacre Wood planning appeal included a decision by the Secretary of State to re-open a public inquiry to consider further evidence on highway safety.

5 Following the rejection of the initial Dinnington Road planning application in 2017, the operator submitted another planning application in 2018, which the MPA also rejected.

6 As at October 2019, the planning inspectors are yet to decide on appeals of two applications (Ellesmere Port and Dinnington Road 2017).

7 Planning inspectors decided Bramleymoor Lane and Harthill applications following public inquiries after applicants appealed against non-determination. The MPAs disputed there was unreasonable delay. The local authority duration reflects the date the MPA's planning committee resolved to oppose applications before the public inquiry.

Source: National Audit Office analysis of Ministry of Housing, Communities & Local Government data

2.18 The Planning Inspectorate considers appeals to an MPA's decision. The inspectorate has approved two of the 10 approved shale gas applications to date. To support shale gas applications, government has asked the Planning Inspectorate to prioritise shale gas appeals. In 2019, we reported that the Planning Inspectorate is failing to meet statutory targets relating to timeliness for all planning applications it considers.[8]

2.19 In 2015, the government stated it would actively consider "calling-in" shale gas applications in cases where it deemed MPAs were "underperforming". This power, while not unique to shale gas, rests with the Secretary of State for Housing, Communities & Local Government and effectively involves taking the decision-making out of the hands of an MPA. The Secretary of State has not called in any shale gas applications to date. The Secretary of State can also 'recover' an appeal that has been submitted to the Planning Inspectorate and take the final decision. As at October 2019, the Secretary of State has 'recovered' four appeals, approving one and rejecting another in Lancashire, and two other appeals are under consideration.

8 Comptroller and Auditor General, *Planning for new homes*, Session 2017–2019, HC 1923, National Audit Office, February 2019.

Part Three

Managing the risks from fracking

3.1 This part of the report sets out the key risks and concerns attributed to shale gas development and hydraulic fracturing (fracking) activity, and the regulatory framework in place to mitigate these risks.

Regulating shale gas development

3.2 Shale gas development in England is regulated by three independent bodies: the Oil & Gas Authority (OGA), the Environment Agency (EA) and the Health and Safety Executive (HSE). They consult with other public bodies in carrying out their functions, including the British Geological Survey (BGS), Public Health England, the Coal Authority, and mineral planning authorities (MPAs). The regulatory regime for shale gas is based on an established system for regulating onshore oil and gas to protect the environment and public health. Regulations for fracking activity differ in three respects. In addition to gaining planning permissions, to frack, operators must:

- gain the OGA and EA's agreement of its hydraulic fracture plan, identifying how it will monitor and control the fracking process;
- satisfy 13 conditions set out in the Infrastructure Act 2015, in addition to a financial resilience test, before the Secretary of State for Business, Energy & Industrial Strategy can grant it consent to frack (hydraulic fracturing consent); and
- comply with a 'traffic light system', enforced by the OGA, which monitors earthquakes (induced seismicity) during fracking (**Figure 11** on pages 26 and 27).

3.3 In 2016, the Committee on Climate Change (CCC) reported that the regulatory regime for shale gas has the potential to be world-leading, but it was not yet assured and that a strong regulatory framework is needed for shale gas production at scale. EA, the regulator with the largest regulatory burden, has focused its work to date on the exploration phase of shale gas development and has recently started work to develop any additional regulatory guidance required for the production phase. Operators told us it could take as little as six months to produce shale gas after they determine the viability of a well. EA is confident it could respond at pace should the industry move quickly into production.

3.4 Once an operator considers that a well is no longer needed, the well must be plugged with cement at various points to prevent unintended emissions or contamination. The well is then cut off several metres below ground and the land restored. Before decommissioning activity begins, an operator must notify HSE and apply to the OGA for consent to abandon the well. EA must be satisfied that: operators have met the conditions of their permit; there is no ongoing environmental risk or further monitoring required; and the sites have been returned to a satisfactory condition before it allows an operator to surrender its environmental permit. After this, there is no requirement on any public body, regulator or operator to monitor wells for any leakages or emissions (**Figure 12** on page 28).

Risks from fracking

3.5 All oil and gas exploration and production present risks to the environment, including greenhouse gas emissions and groundwater pollution. For shale gas exploration, there is an additional risk of earthquakes brought on by the fracking process. Government is confident that the regulatory regime can manage these risks. In 2013, EA conducted a risk assessment for shale gas and concluded that the environmental risks from fracking are low.

3.6 The regulatory system mainly relies on statutory self-reporting by operators on the amount of methane in the air and groundwater and air pollution. This was a source of concern for several environmental groups we spoke to. EA inspects sites to check monitoring equipment and review operators' data. Since 2016, EA has conducted 71 visits to four sites with shale wells, 40 visits of which were to Preston New Road – the site of the most recent fracking activity. When we reviewed the regulatory framework for the packaging recycling obligation in 2018, we found that a self-reporting approach presented risks.[9]

Greenhouse gas emissions

3.7 Methane is the primary component of natural gas and produces carbon dioxide when combusted. It is a potent greenhouse gas, with a global warming potential 20 times greater than carbon dioxide. Methane can be emitted into the atmosphere through leaks in infrastructure at the surface; gases dissolved in fluids that have been returned to the surface if not stored in sealed containers; and the controlled venting of gas by the operator.

9 Comptroller and Auditor General, *The packaging recycling obligations*, Session 2017–2019, HC 1386, National Audit Office, July 2018. Available at: www.nao.org.uk/report/the-packaging-recycling-obligations/

Figure 11
Additional regulations to undertake fracking

Shale gas operators must meet additional regulatory requirements set out by a range of bodies before being allowed to frack

Arrangements required to obtain approval for fracking

Submit a hydraulic fracture plan

Hydraulic fracture plan	Regulator or public body
Sets out how the operator will control and monitor the fracking process, for example: • map seismic lines showing faults near the well; • techniques to be used, location of monitoring points; • measures to mitigate the risk of induced earthquakes; and • type and duration of monitoring and reporting during and after fracking.	Oil & Gas Authority (OGA) and the Environment Agency (EA) will agree independently. The Health and Safety Executive (HSE) can comment on the plan.

Acquire hydraulic fracturing consent from the Secretary of State

	Hydraulic fracturing consent conditions	Regulator or public body
1	The local planning authority has taken into account the environmental impact of the development.	Mineral planning authority (MPA)
2	Appropriate arrangements have been made for independent inspection of the integrity of the well.	HSE
3	The level of methane in groundwater has or will be monitored for 12 months before fracking begins.	EA
4	Appropriate arrangements are in place for monitoring methane emissions into the air.	EA
5	Fracking will not take place within protected groundwater source areas.	EA
6	Fracking will not take place within other protected areas.	MPA
7	The local authority has taken into account the cumulative effects of a) the application and b) other applications relating to exploitation of onshore petroleum by fracking.	MPA
8	The substances used, or expected to be used, in fracking are approved or are subject to approval by the environment regulator.	EA
9	The local authority has considered whether to impose a restoration condition in relation to the development.	MPA
10	The relevant water and sewerage company has been consulted before grant of the relevant planning permission.	MPA
11	The public was given notice of the application for the relevant planning permission.	MPA
12	Appropriate arrangements have been made for publication of the results of monitoring methane emissions (condition 4).	The operator
13	A scheme is in place to provide financial or other benefit for the local area.	The operator

Notes

1 The Secretary of State determines whether to issue a hydraulic fracturing consent following review of the 13 conditions and financial resilience test.

2 These regulations are in addition to those that all oil and gas operators must comply with.

3 The magnitude of earthquakes (ML) is measured on the Richter scale.

Source: National Audit Office analysis of Department for Business, Energy & Industrial Strategy documents

Arrangements during fracking

Undergo a financial resilience test

Financial resilience test	Regulator or public body
Before obtaining hydraulic fracturing consent, operators are subject to a financial health check to provide confidence they can meet their commitments, including decommissioning costs.	Infrastructure and Projects Authority undertook the first tranche of these tests at the request of the Secretary of State for Business, Energy & Industrial Strategy. The OGA is due to take on this responsibility.

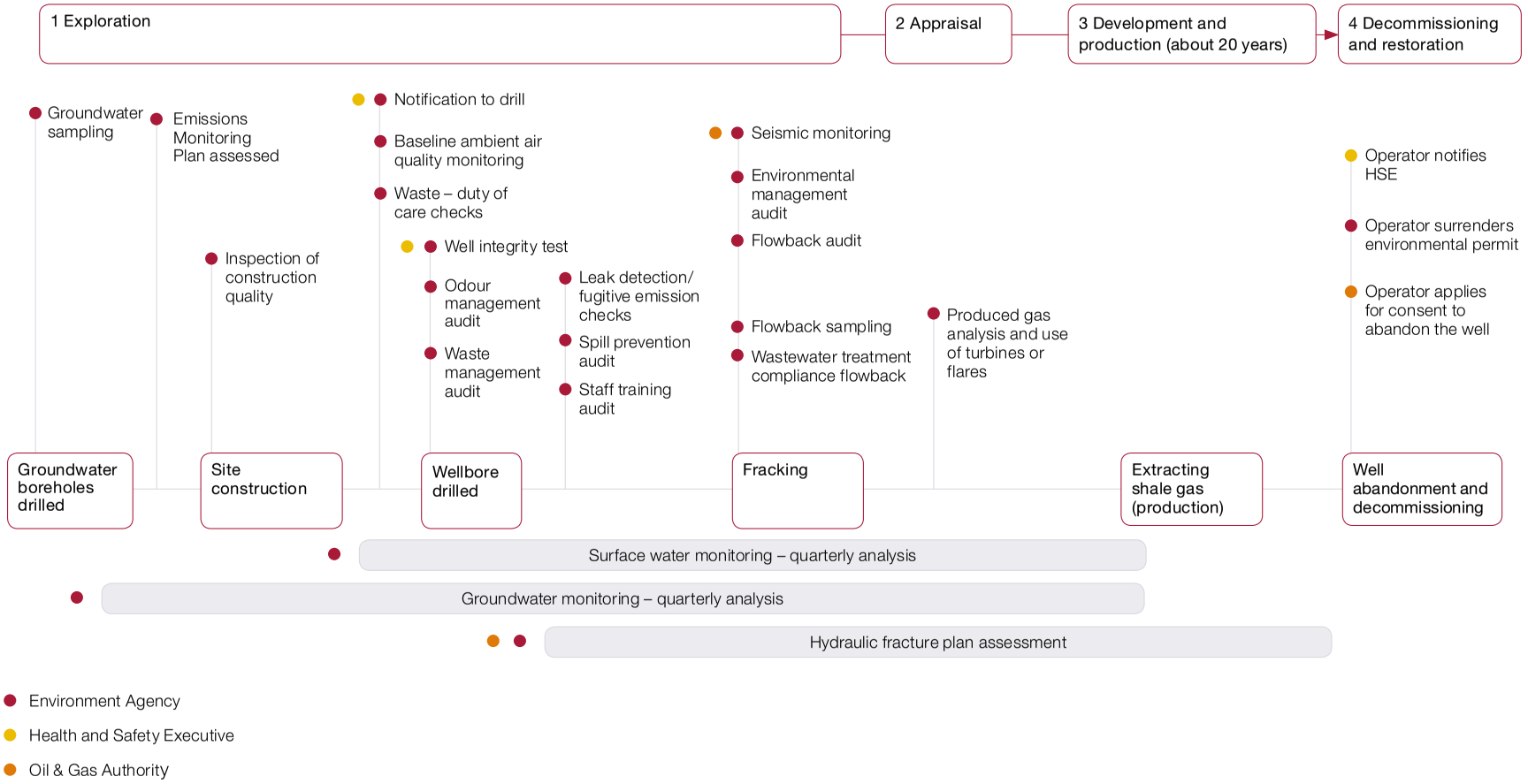
Abide by the traffic light monitoring system

Traffic light system	Regulator or public body
Real-time traffic light scheme for monitoring local seismicity so that operations can be paused and reviewed if unexpected levels of seismicity are detected: • less than 0.0 ML – injections for fracking proceed as planned; • between 0.0 ML and less than 0.5 ML – injections proceed with caution, possibly at reduced rates; monitoring is intensified; and • more than or equal to 0.5 ML – suspend operations, reduce pressure and monitor seismicity and ground motion for any further events before potentially resuming.	OGA

Figure 12

Roles of regulators in the different stages of shale gas

Regulators have so far focused on developing regulatory guidance for the exploratory stage



Note

1 The Environment Agency says monitoring, inspections and audits will continue during production and throughout the lifetime of the permit. At this stage, it has not provided guidance to operators during production as it has for the exploration phase.

Source: National Audit Office analysis

3.8 EA is responsible for regulating the unintended (fugitive) emissions from natural gas. Operators must carry out baseline monitoring in the air and groundwater around their sites for at least three months before starting exploratory drilling and throughout the operational life of the well. Where practical, operators are required to burn (flare) methane to dispose of it, a process that produces carbon dioxide. They cannot vent waste gas into the atmosphere except for safety reasons or where EA agrees it is not feasible to flare. EA does not mandate that operators should reuse methane for the exploration phase because it believes it is not practical for operators to do so.

3.9 In February 2019, EA issued Cuadrilla Bowland Limited (Cuadrilla) with a warning for breaching its permit conditions. It found that up to 6.8 tonnes of methane had been vented after the operator was unable to flare the gas.

Air quality

3.10 EA has identified three risks that could affect air quality: the release of gas from wells containing volatile organic compounds and naturally occurring radioactive gases; exhaust emissions from equipment and vehicles; and dust released from handling the sand used in the fracking fluid. The regulatory responsibility to safeguard against these risks sits across EA, HSE and the MPA.

3.11 As part of their environmental permits, operators must set out how they will monitor air pollutants around the site. EA sets limits for each pollutant and can take enforcement action if these are breached. Operators must also minimise the levels of dust from the sand they use.

3.12 In 2018, the independent Air Quality Expert Group, which advises the Department for Environment, Food & Rural Affairs, published a review of evidence associated with the impact of air emissions from shale gas development. It found that the impacts on local and regional air quality could be substantially higher than national-level impacts, as shale gas wells are likely to be highly clustered. Environmental groups we spoke to said this was a concern.

Protecting water

Groundwater

3.13 Environmental groups have raised concerns about the contamination of groundwater by the fluid used to frack. There are three main ways that the fluid could reach groundwater: leakages during storage or transport; a well leaking into an aquifer; and if fractures in the fracked rock were to link into nearby aquifers. In 2012, the Royal Society and the Royal Academy of Engineering concluded that the risk of water contamination is very low provided shale gas extraction occurs at least 1,000 metres below the surface. Aquifers and water sources are typically found at depths of up to 250 metres.

3.14 Before fracking, an operator must agree a hydraulic fracture plan with regulators, apply for a groundwater activity permit and HSE inspects the well design to ensure its safety and that it complies with recognised industry standards. Operators must also: submit a groundwater risk assessment; disclose publicly what non-hazardous to groundwater chemicals they will use; install an impermeable membrane beneath the site before drilling; store chemicals and used fluids in sealed tanks with a retaining wall; and ensure they only frack at depths greater than 1,000 metres below the surface.

Waste water

3.15 To drill a well, drilling fluid is used to control pressure and clean the drill head. This fluid returns to the surface, along with waste. For shale gas, fracking fluid also returns to the surface after fracking stops. EA has identified environmental risks associated with these fluids, including: the leakage of chemicals to the environment; methane emissions; and the accumulation of naturally occurring radioactive material at the surface.

3.16 EA regulates the storage, transport and treatment of waste water from shale sites. EA does not allow shale gas operators to dispose of waste water by reinjecting it back into the rock. Operators must apply for a radioactive substance permit before fracking. Before acquiring their permits, operators must show that they have arrangements in place with a permitted waste site. EA told us six sites currently hold the necessary permits to treat waste water, and that this was enough capacity for the current stage of the shale gas industry.

Impact on water supply

3.17 An operator can retrieve the water it needs for fracking from the ground or local water mains or reuse fracking fluid from the well. EA has recognised that there is a potential risk of strain to local water resources from fracking as fracking a well can use up to 30,000 cubic metres of water. It relies on industry figures that suggest that shale gas production would use less than 1% of total water use nationally. As wells are likely to be clustered, the impact on local water supplies is likely to be more significant. EA says the regulations that cover water abstraction prevent operators from retrieving water if the EA considers it will have an impact on local places.

Earthquakes (induced seismicity)

3.18 The fracking process stimulates shale rock to release the shale gas held within it. It does this by creating new fissures in the rock or through expanding naturally occurring fractures in the rock. The process is therefore usually accompanied by movements in the rock bed, referred to as earthquakes (induced seismicity), which are usually too small to be felt. BGS states that earthquakes with less than 2 magnitude (ML) are not usually felt at the surface (see **Figure 13**).

3.19 On 1 April 2011 and 27 May 2011, fracking by Cuadrilla in Lancashire resulted in earthquakes measuring 2.3 ML and 1.5 ML respectively. The operator reported that the most likely cause was the injection of fracking fluid into an unidentified fault that released energy several orders of magnitude greater than usually associated with fracking. Local residents reported feeling these earthquakes.

Figure 13
The approach for managing fracking-induced earthquakes

Operators must pause fracking activity if it induces earthquakes of 0.5 magnitude (ML) or more

The traffic light system

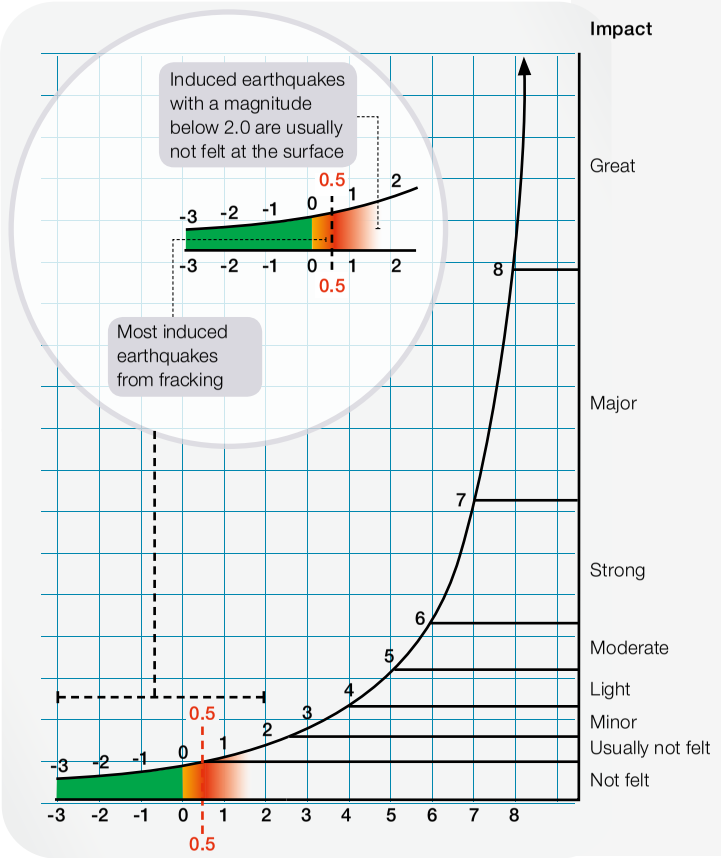
ML of 0.5 or more
Operator must suspend the injection of fracking fluid, reduce pressure and monitor for induced earthquakes and ground motion before potentially resuming fracking activity.

ML greater or equal to 0.0 but less than 0.5

Injection of fracking fluid proceeds with caution, possibly at reduced rates. Monitoring by the operator is intensified.

ML less than 0.0

Injection of fracking fluid proceeds as planned.



9.0 or more Near total destruction, severe damage or collapse to all buildings. Heavy damage and shaking extends to distant locations. Permanent changes in ground topography.

8.0–8.9 Major damage to buildings, structures likely to be destroyed. Damaging in large areas. Felt in extremely large regions.

7.0–7.9 Causes damage to most buildings, some to partially or completely collapse. Felt across great distances.

6.0–6.9 Strong to violent shaking in epicentre. Damage to moderate number of structures. Felt in wider areas; up to hundreds of miles from the epicentre.

5.0–5.9 Felt by everyone. Can damage poorly constructed buildings, none to slight damage to other buildings.

4.0–4.9 Noticeable shaking of indoor objects and rattling noises. Felt by most people in affected area. None to minimal damage.

3.0–3.9 Often felt by people but rarely causes structural damage. Shaking of indoor objects noticeable.

2.0–2.9 Felt slightly by some people. No structural damage to buildings.

Less than 2.0 Microearthquakes, not felt, or rarely felt. Earthquakes less than 1 can only be detected by seismographs.

Notes

1 The Richter scale for recording earthquake (seismic) magnitudes is a logarithmic scale. Each increase of one unit on the Richter scale represents a 10-fold increase in the magnitude of an earthquake.

2 Fracking fluid is a mixture of water, sand and chemicals that is injected at high pressure through a well that has been typically drilled first vertically then horizontally into the ground.

Source: National Audit Office analysis of Department for Business, Energy & Industrial Strategy and Oil & Gas Authority information

3.20 In response, a report commissioned by Cuadrilla recommended that future fracking operations should be suspended if fracking-induced earthquakes reach a threshold of 1.7 ML. In 2012, the then Department of Energy & Climate Change set the threshold at 0.5 ML after commissioning three academics to determine a safe precautionary level to mitigate this risk and holding a public consultation. The OGA is responsible for ensuring operators manage this risk and that they adhere to the 'traffic light monitoring system' while fracking is taking place. If fracking activity triggers earthquakes of 0.5 ML or above, a 'red light' is triggered and the operator must pause fracking while it works with the OGA to determine whether it is safe to restart (Figure 13). Cuadrilla suspended its fracking operation in August 2019 after fracking-induced earthquakes of up to 2.9 ML, which released 4,000 times more energy than the 0.5 ML threshold (**Figure 14**).

3.21 Operators have asked government to revise the traffic light system and raise the 0.5 ML threshold as they argue that it is far below the levels used internationally or likely to be felt at the surface. Operators told us that the current threshold hinders their ability to determine the viability of shale gas in their sites. In 2012, the then Secretary of State said the level could be adjusted upwards as knowledge of fracking operations increased. In May 2019, ministers said the government had no intention of reviewing the traffic light monitoring system (**Figure 15** on page 34).

Other concerns

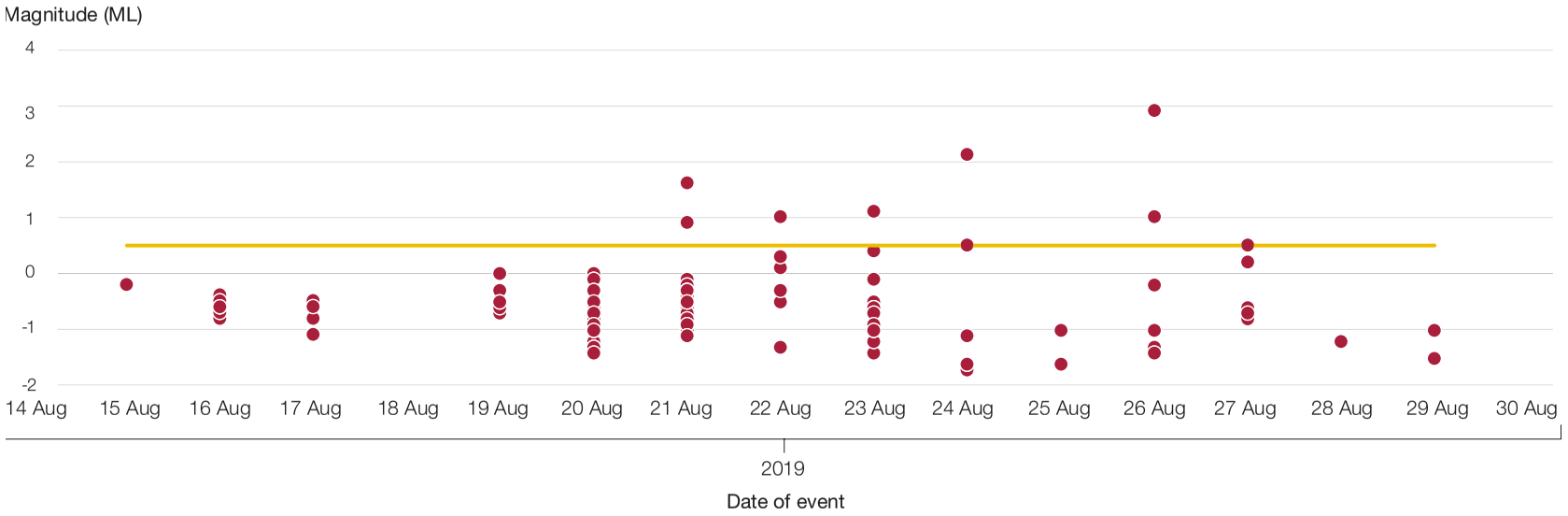
3.22 Stakeholders and members of the public told us that increased truck movements to shale gas sites contributed to local congestion and noise. As part of its planning application, operators usually provide an assessment of how and when traffic will access the sites. MPAs are then responsible for monitoring this. As an indication, the road traffic plan for a site in North Yorkshire estimated 18 truck movements a day for six weeks in exploration; an average of four truck movements a day during production for 10 years; and six truck movements a day for six weeks during decommissioning and site restoration.

3.23 In 2014, Public Health England, an executive agency of the Department of Health & Social Care, published a report examining the potential health impacts of exposure to pollutants resulting from shale gas extraction. It found that if shale gas operations are properly run and regulated, the potential risk to public health is low. It warned against inferring from the public health impacts that shale gas extraction has had in other countries because of the differences in the regulatory environment and underlying geology compared with that of the UK.

Figure 14

Fracking induced earthquakes reported in August 2019

On 26 August 2019, the British Geological Survey (BGS) reported the largest fracking-induced earthquake in the UK to date



Notes

1 BGS has put in place a high number of temporary seismic stations near the Preston New Road site that enable it to detect smaller or micro events.

2 Modern equipment (called seismographs) can detect seismic waves even smaller than those originally chosen for zero magnitude on the Richter scale. It is therefore possible to measure earthquakes that have negative magnitudes.

3 Between 21 August and 27 August 2019, nine induced earthquakes of magnitudes ranging from 0.5 ML to 2.9 ML occurred after the operator paused its fracking activity (called 'trailing events').

4 In August 2019, BGS recorded 124 events. Due to recordings of similar values on the same day, the figure above does not show all 124 events.

Source: National Audit Office analysis of British Geological Survey data as at 30 September 2019

Figure 15

Earthquake thresholds in North America and the UK

The UK has a lower seismic threshold for fracking than the USA or Canada

	UK	USA	Canada
Seismic threshold at which operators must suspend fracking activity (magnitude on Richter scale)	0.5	Examples: Ohio: 1.0 California: 2.7 Illinois: 4.0 Colorado: 4.5	Examples: British Columbia: 4.0 Alberta: 4.0

Note

1 Thresholds are set at state level in the USA and Canada.

Source: National Audit Office analysis

Part Four

Costs to taxpayers

4.1 This part of the report sets out the public expenditure to support shale gas development to date, and the future costs, including decommissioning costs once a well stops producing shale gas.

Costs to date

Central government spending

4.2 The Department for Business, Energy & Industrial Strategy (the Department) will have spent a total of £8.4 million, excluding staff costs and expenses, on supporting shale gas between April 2012 and March 2020. Most of this expenditure has been to support environmental monitoring and research. **Figure 16** sets out the Department's expenditure.[10]

Figure 16

The Department for Business, Energy & Industrial Strategy's costs to support shale gas development between April 2012 and March 2020

Most of the expenditure has been in support of environmental monitoring and research

Expenditure item	Amount (£000s)
Grant to the British Geological Survey (BGS) for environmental monitoring of shale sites[1]	5,824
Budget transfer to the Environment Agency in support of community engagement	1,530
National College for Onshore Oil and Gas	750
Funding for research projects	212
The commissioner for shale gas[2]	88
Development of shale gas road map and environmental risk assessment	45
Total	**8,449**

Notes

1 BGS has an environmental monitoring programme in place in Fylde, Lancashire. In 2015, the Department asked it to expand this and monitor the Vale of Pickering, Yorkshire.

2 The commissioner for shale gas was appointed in October 2018 and resigned in April 2019. She has not been replaced.

Source: National Audit Office analysis of the Department for Business, Energy & Industrial Strategy's data

10 The Department was unable to provide financial costs before April 2012.

4.3 Since 2015, the Environment Agency (EA) has annually received £1.5 million in grant-in-aid from the Department for the Environment, Food & Rural Affairs to manage the regulation of the onshore oil and gas industry, including shale gas. The regulator also recovers costs through charges to operators. In 2018-19, income from these charges totalled £400,000. EA forecasts that this will increase to approximately £1.4 million in 2020-21 mainly due to changes in the charge rates that came into effect in October 2018.

4.4 The Health and Safety Executive (HSE) has an annual budget of £0.5 million between 2015-16 and 2019-20 to spend on increasing its regulatory capability and engage with the public, industry and mineral planning authorities (MPAs) on shale gas issues. It also spent £67,000 between 2011-12 and 2018-19 on frontline regulatory activities, such as reviewing shale well designs and site inspections. It was able to recover £40,000 from shale gas operators over the same period. HSE can also recover the cost of breaches, for which there have been none for shale gas, and assessing borehole notifications. HSE and EA told us that public interest in shale gas and hydraulic fracturing (fracking) has extended to conventional oil and gas sites, leading to an increase in the amount of time staff spent responding to complaints and requests for information.

Costs to local public bodies

Costs to local authorities

4.5 In considering planning applications, MPAs need to consult a wide range of consultees and respond to representations made to them by the public. All local authorities we spoke to said planning applications for fracking generated unprecedented public interest. For example, North Yorkshire County Council received more than 4,000 representations in its consultation on a shale gas application, compared with nearly 450 representations it received for what it considered a contentious application for a waste recovery park. Lancashire County Council reported receiving about 36,000 representations from the public in relation to two fracking applications.

4.6 The cost to MPAs of determining shale gas applications exceeds the planning application fees operators pay, which are set nationally. Local authorities we spoke to received between £3,000 and £10,000 per application. The Ministry of Housing, Communities & Local Government estimates that determining a planning application for fracking costs an MPA around £300,000, excluding the costs of judicial challenges and appeals. Lancashire County Council incurred additional costs of £330,000 for a public inquiry against two planning decisions.

4.7 The government created the shale support fund to support and build capacity and capability in MPAs to deal with shale gas applications, making available £5.2 million between 2015-16 and 2019-20. Local authorities can apply for up to £250,000 for each shale planning application but they cannot claim for planning appeal costs. As of July 2019, around £820,000 has been paid out to five local authorities. This spend is less than budgeted because the progress of shale gas development, and therefore the number of applications, has been lower than expected.

Costs to other local bodies

4.8 Local bodies, including local police forces and local highway authorities, have absorbed other costs related to shale gas applications and activities. These have related to managing protests around the sites and the subsequent traffic disruption, and ensuring the safety of the public. Government is unable to provide an estimate of the total cost to local bodies. Three police forces in areas with shale gas development have published the costs incurred:

- Lancashire Constabulary report that, daily, between 25 and 100 officers were directly involved in the policing of fracking sites between January 2017 and June 2019 at a cost of £11.8 million. The Home Office reimbursed £5.8 million of these costs.
- North Yorkshire Police incurred a total of £740,000 for policing a fracking site, of which £660,000 was between September 2017 and July 2018. The Home Office reimbursed £614,000.
- Nottinghamshire Police has spent £900,000 on policing anti-fracking protests between January 2018 and April 2019. It has not sought cost reimbursement as the costs did not exceed 1% of its operating budget – the threshold set by the Home Office to qualify for special grant funding.

Potential future costs

4.9 A range of infrastructure would need to be in place to support a shale gas industry producing at scale. Examples include the building of grid connections to enable shale gas to flow to domestic or industrial users from shale gas wells, water treatment plants and other waste management facilities. The UK has an established gas transmission and distribution system, and industry expects the need for additional pipeline infrastructure is limited. The Department has not estimated the extent of the infrastructure required or what public investment may be required because it is still unclear what the size of any future industry would be.

Decommissioning and site restoration

4.10 Operators are responsible for decommissioning their shale gas assets when they reach the end of production. The operator must:

- plug the well with cement at various points to prevent unintended emissions or contamination;
- cut the well off several meters below the ground;
- remove all infrastructure; and
- restore the land to its original state.

4.11 The Department estimates the costs of decommissioning an onshore well, including a shale gas well, at between £195,000 and £1 million depending on the design and depth of the well. To date, only one fracked well at Preese Hall in Lancashire has been decommissioned and the site restored.

4.12 We reported in January 2019 that, under the Petroleum Act 1998, the government is liable for decommissioning offshore oil and gas assets if the operator or any previous operators are unable to pay for decommissioning, for example due to insolvency. The Department discloses the risk that it will be required to meet this cost in its financial statements as an unquantifiable remote contingent liability. In contrast, there is no equivalent legislation for decommissioning onshore wells. Therefore, the Department does not recognise any responsibility for decommissioning onshore wells, including shale gas wells, and does not include a contingent liability in its financial statements.

4.13 In March 2019, the Committee of Public Accounts (the Committee) recommended that the Department set out its arrangements for safeguarding taxpayers from meeting the costs of decommissioning shale gas assets. The Department assures itself of an operator's ability to fund decommissioning costs through point-in-time assessments, including:

- financial checks that the Oil & Gas Authority may take before issuing a licence for exploration or at other points in the production cycle; and
- a financial resilience test commissioned by the Secretary of State for Business, Energy & Industrial Strategy, before issuing a consent to frack.

4.14 MPAs can ask operators to submit detailed site restoration and aftercare plans before granting planning permission. MPAs can also enforce orders for the restoration and aftercare of land and recoup its costs for doing so. They may also request financial security from the operator to cover these costs. For example, North Yorkshire County Council required that Third Energy put £160,000 in a bond to cover restoration and aftercare costs. The Department recognises that there has been no consistent approach to MPAs doing this.

Operator insolvency

4.15 Meeting the costs of decommissioning onshore oil and gas assets, including shale gas, would be more challenging should an operator be unable to because of insolvency, for example. This could also occur where a decommissioned well is found to need further restoration after an operator has surrendered its environmental permit. In May 2019, the Department wrote to the Committee and asserted that, in these cases, EA had the ability to pursue former operators for the cost of damages under the Environmental Liability Directive and that it was possible for the EA to pursue landowners under the Environmental Damage Regulations but noted that these measures were "relatively untested". In October 2019, EA told us that it has since considered the extent of these powers and determined that it is unable to use them to pursue either insolvent operators or landowners, directly contradicting the Department's earlier assertions to the Committee. EA may be able to pursue landowners under other statutory powers, but these would have limitations and are untested in the oil and gas sector.

4.16 Some landowners may take out insurance as part of their lease negotiations with operators, but the Department recognises that it is possible that landowners may not fully understand the liability they are taking on. The Department was unable to explain who would meet decommissioning costs if the landowners were unable to do so. This contrasts with the offshore oil and gas sector where former operators have a statutory liability to decommission assets and government is the decommissioner of last resort. Operators told us they consider the current arrangements for onshore oil and gas, including shale gas, to be an obstacle to the industry's development. Other stakeholders, including landowners' associations, told us that legal advice they have received shows that landowners' liability is unclear, especially in relation to restoring the ground under the surface.

4.17 The Department is considering options to mitigate the risks of landowners becoming liable for decommissioning costs should an operator become insolvent. One option is to work with industry to set up appropriate insurance and finance mechanisms. Operators and the industry trade body, UK Onshore Oil and Gas, told us that, currently, these finance mechanisms are immature. Other options would create a contingent liability for government, which the Department has so far resisted. These include government signing insurance policies as a counter-party or introducing a new statutory onshore decommissioning regime to mirror the offshore regime.

Appendix One

Our approach

Scope

1 This report sets out the facts surrounding the government's plans to support shale gas development in England. It covers:

- an overview of hydraulic fracturing (fracking), and what activity has taken place to date (Part One);
- government's objectives (Part Two);
- managing the risks from fracking (Part Three); and
- the costs to taxpayers (Part Four).

Methods

2 In examining these issues, we collected evidence between July and August 2019 and drew on a variety of sources:

- We interviewed staff across government and stakeholders as to the policy objectives, including compatibility with climate change and energy policy; the roles and responsibilities of departments; forecast and actual shale gas activity to date; the potential costs and benefits of developing shale gas industry; government's understanding of the risks from shale gas and fracking and how these were being mitigated; the regulatory regime; and measures to support the industry.
- We interviewed:
    - officials from the Department for Business, Energy & Industrial Strategy; the Department for Environment, Food & Rural Affairs; the Ministry of Housing, Communities & Local Government; and HM Treasury;
    - the regulators of the onshore shale gas industry: The Oil & Gas Authority; the Environment Agency; and the Health and Safety Executive;
    - other public bodies: the Committee for Climate Change; the Infrastructure & Projects Authority; and the British Geological Survey;

- local authorities: Cheshire West and Chester Council; Derbyshire County Council; Lancashire County Council; and North Yorkshire County Council. We also spoke to the Local Government Association and Lancashire Constabulary;
- shale gas operators: Aurora Energy Resources Limited; Cuadrilla Bowland Limited; IGas Energy; Ineos Shale; and Third Energy. We also spoke to the trade body United Kingdom Onshore Oil and Gas;
- academics from: Imperial College London; the University of Manchester; Newcastle University; Warwick Business School; and the UK Energy Research Centre; and
- other stakeholders: Campaign to Protect Rural England; Concerned Health Professionals of the UK; Country Land and Business Association; Frack Free United; Friends of the Earth; and the former commissioner for shale gas.

3 We reviewed:

- a range of documents from departments and regulators including ministerial submissions, working groups' minutes, regulatory guidance, regulatory processes, operational information, consultations, business cases, and government commissioned research;
- financial cost information from departments and regulators;
- planning application information from central government and local authorities;
- evidence and reviews from other groups, including industry and academia; and.
- more than 30 submissions we received from the public.

4 An independent panel of academics reviewed the report. They are:

- Professor Richard Davies, Newcastle University;
- Professor Jim Watson, University College London and UK Energy Research Centre;
- Professor Michael Bradshaw, Warwick Business School; and
- Chris Stark and Aaron Goater, the Committee on Climate Change.

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