

# Briefing

## **Unconventional, unnecessary and unwanted**

### **Why fracking for shale gas is a gamble the UK does not need to take**

The Government gave the green light to fracking for shale gas in the UK in late 2012. Friends of the Earth believes that this is a misguided gamble that we do not need to take. Fracking for shale gas helps keep us hooked on fossil fuels instead of moving towards an energy system based on energy saving and renewable sources; brings serious risks to the local environment and people's health, and is unlikely to cut energy bills. Proposals for fracking are meeting strong opposition in the UK, as they have throughout the world. Shale gas is unconventional, unnecessary and unwanted.

For more than 40 years we've seen that the wellbeing of people and planet go hand in hand – and it's been the inspiration for our campaigns. Together with thousands of people like you we've secured safer food and water, defended wildlife and natural habitats, championed the move to clean energy and acted to keep our climate stable. Be a Friend of the Earth – see things differently.

*“Fracking may result in unavoidable environmental impacts even if unconventional gas is extracted properly, and more so if done inadequately. Furthermore, increased extraction and use of unconventional gas is likely to be detrimental to efforts to curb climate change”*

(UN Environment Program<sup>1</sup>)

## **Introduction**

In recent years, shale gas production in the United States has grown enormously, changing the US from being potentially a net importer of gas, to being the world’s largest gas producer. Shale gas advocates claim it has helped transform the US energy system and that the same could happen in the UK.

Initial findings from the one company that has drilled test wells show that the UK could have significant shale gas reserves providing, it is claimed, a secure supply of natural gas.

Reserves elsewhere in Europe could be even greater. With claims of lower greenhouse gas emissions than coal, shale gas is being touted as a transition fuel as we move to a low carbon economy, and as a source of energy security, reducing reliance on imported gas.

But many concerns have been raised by Friends of the Earth and others, such as:

- will burning shale gas jeopardise our climate targets?
- does shale gas extraction risk contaminating drinking water supplies?
- does shale gas drilling trigger earth tremors?
- will investment in shale gas take money away from renewable energy?

This briefing explains why we believe shale gas is not the answer to the UK’s energy problems.

## **What is shale gas?**

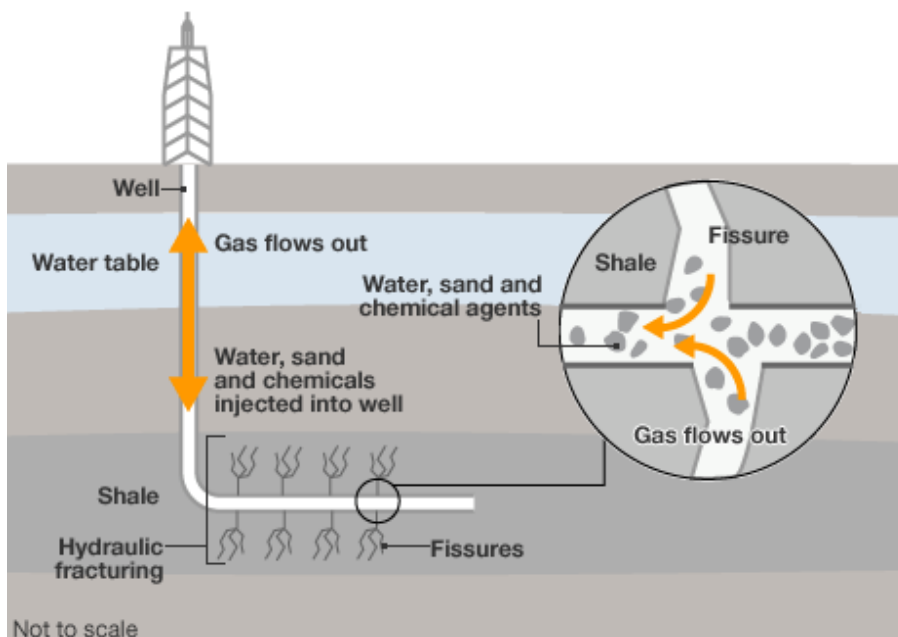
Shale gas is a form of ‘unconventional gas’ which is extracted from shale rock formations, usually located at depths of 1000 – 4000 metres. It is chemically effectively the same as natural gas, being mainly methane. ‘Unconventional’ refers to how the gas is extracted. Other forms of unconventional gas include coal-bed methane (which is extracted from intact coal seams), coal gasification (converting coal to a high-energy gas mixture) and methane hydrate (a type of ice containing methane found in deep oceans and in permafrost). This briefing focuses on shale gas.

## **How is shale gas extracted?**

Similarly to conventional gas, extraction is via a well. This is drilled vertically to above the shale, then the drill is steered until it is horizontal and drilling continues. This is because the reservoirs are wider than they are tall, so horizontal drilling accesses more of the reserve. To allow the gas to flow, fractures have to be created in the rock. This is done by hydraulic fracturing (fracking). Fluid (approximately 99-99.5% water and sand, 0.5-1% chemicals) is

injected down the well and into the shale gas rocks at high pressure. The sand props open the new fractures allowing the gas to flow into the well and be collected at the surface.

### Shale gas extraction



### How much gas do we use in the UK?

Natural gas from conventional sources currently plays a major role in the UK's energy system. Roughly one-third of the gas used in the UK is for electricity generation – this accounted for 41% of electricity generation in 2011 (though the 2012 figure is likely to be lower because of low coal prices relative to gas). Another third is for domestic use such as heating and cooking, and the remaining one-third of gas demand is from industry, energy industry, public buildings and commerce. UK gas production more than halved between 2000 and 2011, and imports rose significantly, so that the UK is now a net importer of gas. More than half of the gas imported comes via a pipeline from Norway, but a growing share – 46% of imports in 2011 – is in the form of Liquefied Natural Gas (LNG) imported by tankers, mainly from Qatar<sup>2</sup>.

### How much shale gas is there under the UK and where is it?

There are no agreed figures for either UK shale gas resources (the volume of gas underground) or reserves (the volume of gas that can be extracted, which depends on factors including technology and cost).

The British Geological Survey (BGS) has estimated UK reserves at 150 billion cubic metres (bcm) – about 1½ years' worth of current UK gas consumption. Cuadrilla, the company drilling in Lancashire, has estimated the resources in its licence area at around 5,660bcm, or around 56 years' worth of current UK gas consumption. Cuadrilla's CEO, Francis Egan, has said that they can supply a quarter of UK gas demand from its licence area alone<sup>3</sup>. DECC has estimated that this area could produce around 133bcm. The Government is expected to publish new BGS figures in the near future and there has been widespread speculation that the new estimates could be substantially higher<sup>4</sup>.

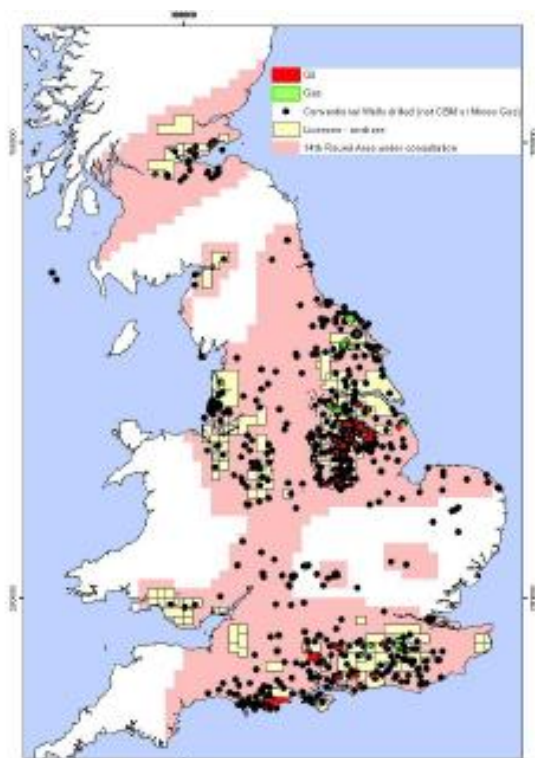
However experience elsewhere shows that any numbers are very volatile:

- Estimates of shale gas reserves in Poland were cut by 85% in 2012, based on analysis of data from wells drilled between the 1950s and 1980s<sup>5</sup>.
- The US Energy Department cut estimates of technically recoverable gas in the Marcellus Shale, one of the most mature shale gas plays, by 66% in January 2012, citing improved data on drilling and production<sup>6</sup>.

The prime areas for shale gas in the UK are considered to be the Upper Bowland Shale in Lancashire, and the Weald Basin running roughly from Kent, through Sussex to Hampshire. Many areas are either:

- currently licenced for hydrocarbon exploration and production, including shale gas. These are shown by the yellow squares in the map<sup>7</sup>
- being considered for future licencing for hydrocarbon exploration and production, including shale gas. These are the areas shaded in pink on the map.

The black dots represent places where conventional gas or oil wells have already been drilled – these will not have involved fracking.



Areas considered to have potential for coal-bed methane include South Yorkshire, the East Midlands and the central belt of Scotland.

It is important to point out that a company with a licence for exploration and production cannot drill for shale gas (or Coal Bed Methane) without first getting planning permission and approval from the appropriate regulators<sup>8</sup>.

## The current state of play in the UK

Although many areas of the UK are covered by licences (see above), not many of these have been taken to the stage of applying for planning permission, and fewer to drilling.

In **Lancashire**, Cuadrilla has drilled four wells in the Fylde and test-fracked one, triggering earthquakes. It has announced that it is looking for more drilling sites in Lancashire<sup>9</sup>. Cuadrilla has also announced plans to drill a shale oil exploration well in **Sussex**, but not to frack at this stage<sup>10</sup>.

Coastal Oil & Gas has planning permission for exploratory drilling near Sandwich in **Kent** and in the **Vale of Glamorgan** in south Wales<sup>11</sup>.

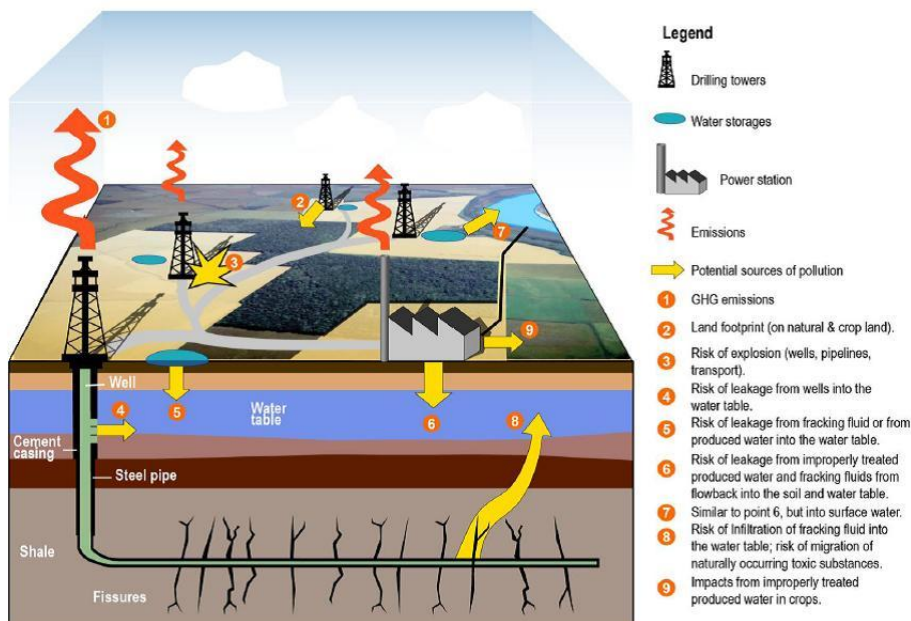
Some of the companies with licences (see above) have started to make positive noises about the prospects in their area, including Egdon Resources in the **East Midlands**<sup>12</sup> and IGas in **Salford**<sup>13</sup>.

In **Northern Ireland**, Tamboran Resources is interested in drilling in Fermanagh.

In addition to shale gas, there is considerable interest in coal bed methane, particularly in **Scotland**<sup>14</sup>.

## Potential environmental problems

Fracking brings many environmental risks, shown in the graphic below, produced by the UN Environment Program<sup>15</sup>.



These risks have recently been assessed in a report for the European Commission, which assessed the cumulative impact of fracking at several sites as having a high risk of causing

local environmental problems including groundwater contamination, surface water contamination, water resource use and air pollution<sup>16</sup>.

## Climate change

Exploiting shale gas poses major risks for climate change by perpetuating our dependence on fossil fuels rather than moving to low carbon alternatives. There are three key issues to consider:

- The comparative emissions of shale gas compared to conventional gas and other fossil fuels
- The impact on overall emissions of using shale gas
- The impact on investment in renewable energy

## Comparative emissions

Advocates say we should exploit shale gas because it has lower carbon emissions than conventional natural gas and coal. This is the subject of heated debate and the academic jury is still out.

The key issue is how much methane escapes during the exploration and production – these ‘fugitive emissions’ are critically important as methane, the main constituent of natural gas, contributes to climate change at a level 25 times greater than carbon dioxide over a 100-year timeframe (and over shorter timeframes methane’s impact is greater still). Opinion is still divided on methane emissions: the US EPA has recently significantly cut its estimates of methane leakage, but monitoring has shown that leakage could be up to 4% of total well production, and up to 9% in one gas field in Utah<sup>17</sup>.

On shale gas emissions compared to conventional natural gas, a report for the European Commission found that emissions from shale gas production were 1-8% higher than for conventional pipeline generation within Europe. It also found that shale gas emissions could be lower than for conventional gas from outside Europe or for LNG imports but that this depends on industry practices and “*where emissions from shale gas are uncontrolled, there may be no GHG emission benefits from utilising domestic shale gas resources over imports of conventional gas from outside the EU*”<sup>18</sup>. Other analysis supports this claim that using shale gas brings no carbon benefits<sup>19</sup>.

If shale gas does have a lower carbon impact than coal, any climate benefit depends on shale gas being used instead of coal rather than as well as coal. The industry points to shale gas replacing coal for electricity generation in the US, with emissions declining as a result. However this decline in emissions may be also down to greater use of renewables<sup>20</sup> and analysis by the Tyndall Centre shows that over half of the emissions benefit may have been lost as coal not used in the US was exported (coal use for electricity generation in the UK rose from 22.9% in the 3<sup>rd</sup> quarter of 2011 to 35.4% in the 3<sup>rd</sup> quarter of 2012<sup>21</sup>). In the absence of a global deal limiting carbon emissions, in a world with growing energy demand, shale gas will probably be used as *well as* coal, rather than *instead of* coal: there is great



interest in shale gas in Asia, notably China and India (see below) but coal imports into the Asia Pacific region are also expected to treble by 2030<sup>22</sup>.

### **Impact on overall emissions**

Burning shale gas could set the world on course for catastrophic climate change. It would also put at risk the UK's climate change targets by underpinning George Osborne's plans to continue using gas to generate electricity.

Recent modelling carried out by internationally-respected climate experts at the Tyndall Centre has found that burning just 20% of the gas that Cuadrilla claims to have found in its licence area in Lancashire (20% of 5,660 bcm = 1,132 bcm) would take up 14.5% of the UK's total carbon emissions budget to 2050, assuming that we want to stay within the carbon budget necessary to meet our legally-binding obligations under the Climate Change Act 2008<sup>23</sup>. The Tyndall estimates only count the carbon dioxide produced by burning the shale gas – no allowance is made for fugitive methane emissions (see above). Tyndall note that Cuadrilla's licence area represents only 5% of the Bowland Shale, considered to be the most promising shale gas formation in the UK. And, as their estimate is taken as representing the UK as a whole, it could be an underestimate.

Globally, the International Energy Agency (IEA) has calculated that a 'Golden Age of Gas' with *"an accelerated global expansion of gas supply from unconventional resources"* which more than triples to 2035<sup>24</sup>. This *"puts CO2 emissions on a long-term trajectory ... consistent with a probable temperature rise of more than 3.5 degrees Celsius in the long term"*<sup>25</sup>. This is well above the threshold for triggering catastrophic climate change: as the IEA admits *"we are not saying that it will be a golden age for humanity - we are saying it will be a golden age for gas"*<sup>26</sup>.

### **Impact on investment in renewable energy**

Exploitation of shale gas in the UK could have a major impact on the investment in renewable energy needed to decarbonize the energy sector. Energy expert Professor Paul Stevens of Chatham House has written that *"There is a real fear among many analysts that shale gas may substitute not for coal but for renewables"* and that *"the anticipation of cheap natural gas could inhibit investment in renewables. But again, if the revolution fails to deliver a lot of cheap gas, by the time this is realized it could well be too late to revert to a solution to climate change based upon renewables"*<sup>27</sup>.

The Government's official advisors, the Committee on Climate Change, have written of the dangers of a dash for gas: *"The apparently ambivalent position of the Government about whether it is trying to build a low-carbon or a gas-based power system weakens the signal provided by carbon budgets to investors [is] damaging prospects for required low-carbon investments"*<sup>28</sup>.

The Tyndall Centre has calculated that the cost of building shale gas generated electricity capacity in the UK (well costs plus power station costs) could provide the same electricity generation capacity from onshore and offshore wind<sup>29</sup>.

### **Water use**

Fracking is a water-intensive activity. The volume of water used for each frack varies depending on the location and the geology. In the US, water used has varied from 9,000 to 29,000 cubic metres (9 – 29 million litres or between 2 and 6.4 million gallons)<sup>30</sup>. At the one site fracked in the UK, Cuadrilla used 8,400 cubic metres (8.4 million litres or 1.85 million gallons) of water<sup>31</sup>.

The volume of water needed might not be significant at a national level: one report has found that “development of shale reserves at levels sufficient to deliver gas at a level equivalent to 10% of UK gas consumption would increase industrial water abstraction across England and Wales by up to 0.6%”<sup>32</sup>.

However there could be local and regional problems. For example, the Cuadrilla drilling near Blackpool is within the River Wyre catchment - the Environment Agency identifies that all zones in the catchment are classified as either ‘over licenced’, ‘over abstracted’ or ‘no water available’<sup>33</sup>. These problems could be worse in areas proposed for fracking that have suffered from drought, such as South East England, and could be further worsened by climate change.

The Chartered Institute of Water & Environmental Management has expressed concern about water use, stating that fracking “*must not be allowed to conflict with water use for public water supply or that needed to maintain a healthy environment*” and raising concerns about future water availability: “*Climate change scenarios predict less water availability in the future so whether this level of water use is appropriate in the long term to source energy requires further research*”<sup>34</sup>.

The Environment Agency, which is responsible for water resources in the UK, has said that it would not licence unsustainable abstraction<sup>35</sup>.

### **Water contamination**

There is considerable evidence of contamination from both methane and fracking chemicals. One study of aquifers overlying the Marcellus and Utica shales in the north-eastern US found “*systematic evidence of methane contamination of groundwater associated with shale gas extraction*”<sup>36</sup>.

The industry claims that fracking is a proven technology, widely used for 60 years. Although it is true that the first well was fracked in 1947, this involved a small volume of liquid pumped at relatively low pressure into a vertical well half a mile deep. The situation today is radically



different. The technology has changed hugely in the last decade with the development of horizontal drilling, using much greater volumes of fluid at much higher pressures and drilling several wells from one well-pad. Fracking as proposed in the UK is at best a decade old development based on new technologies that are still being refined.

How much of the water pumped down the well comes back to the surface (known as 'produced water' or 'waste water') can vary from 20% to 80%, depending on the local circumstances.

This means that 20-80% of the water also remains underground and "once underground, fracking fluid mixes with the naturally occurring brines and is subject to geological forces and chemical processes over the long term, from years to decades. How far and how fast this blend can travel, and how it might change chemically, is impossible to know and control"<sup>37</sup>.

Methane and fracking fluid may escape / contaminate water via a number of different routes:

- Migration down naturally occurring fractures in the rock or via extension of fractures created by fracking or via nearby abandoned wells
- Leaks via well-casings that have been inadequately completed or which have subsequently failed
- Leaks or spills of fracking fluid or 'produced water' above ground

If there is a risk of contamination, what chemicals could be involved? A major problem is that there is limited data on the chemicals that have been used for fracking. This is because US law excludes fracking from federal regulation by the Environmental Protection Agency<sup>38</sup>. However disclosure is required by some US states and some companies are posting the composition of the fracking fluid they are using online<sup>39</sup>. In the UK, companies will be required to publish the contents of fracking fluid.

An assessment<sup>40</sup> of 353 chemicals known to be used in fracking in the US found that:

- 25% could cause cancer
- 40 - 50% could affect the nervous system, immune and cardiovascular systems
- more than 75% could affect the skin, eyes and respiratory system.

The shale gas industry says that chemicals are a very small percentage of the liquid pumped underground, but given the enormous quantities of water used, this still represents a huge quantity of chemicals. Fracking a shale gas well takes approximately 4 million gallons (approximately 15 million litres) of water; if you assume that the chemicals are just 0.5% of the water used, then this means that each fracking operation involves 20,000 gallons (about 75,000 litres) of chemicals. If there are six wells per drilling pad (a typical number) and each well is fracked twice, then the total volume of chemicals used is almost a quarter of a million gallons. That equates to an Olympic swimming pool of chemicals for every three drilling pads.

In addition to the chemicals, fracking waste water may also contain substances from deep underground such as strontium, benzene, toluene and Naturally Occurring Radioactive Material (NORM) such as Radium 226<sup>41</sup>. An investigation by the New York Times found that

nearly three-quarters of the more than wells studied in the north east US produced waste water with high levels of radiation, including at least 116 wells with levels that were hundreds of times the US EPA's drinking water standard, and at least 15 wells with levels thousands of times the standard<sup>42</sup>.

### **Air pollution**

Fracking for shale gas has also been linked to increased levels of air pollution and associated health problems. Air pollution was identified as a 'high risk' by the European Commission study mentioned above.

Monitoring of air quality near fracking sites in western Colorado found over 50 non-methane hydrocarbons (NMHCs) near shale gas wells. Of these, 44 have health impacts including 35 which affect the brain and nervous system. Some of these were found at levels which could potentially harm children exposed pre-birth<sup>43</sup>. Although the pollution was not conclusively linked to the gas wells, there is little other industry and not much traffic in the area monitored.

Emissions from shale gas wells can also cause photochemical smog: levels of ozone in Sublette County in rural Wyoming where there is a high concentration of gas wells have been recorded as higher than Los Angeles<sup>44</sup>. And there is also evidence of health impacts: *"a Texas hospital serving six counties near drilling sites reported asthma rates three times higher than the state average; one quarter of young children in the community had asthma"*<sup>45</sup>

### **Earthquakes**

The recent huge rise in concern about fracking in the UK started when test-fracking by Cuadrilla in Lancashire triggered low-level earthquakes. The shale gas industry says that these tremors were far too weak to cause any damage to buildings or harm to people.

However a possibly even greater risk is to the integrity of the well-casings, typically made of steel and cemented in place, designed to reduce or eliminate the possibility of leaking methane or flowback water. Tony Grayling, Head of Climate Change at the Environment Agency, has acknowledged that this could be a problem. Referring to the Lancashire earthquakes, he said: *"we need to understand what is the maximum damage that might be done in such circumstances to a well and the integrity of the casing, whether it would increase the risk of a leak. If there is ground water in the vicinity, that could be a problem"*<sup>46</sup>

Evidence from the US shows that the Lancashire experience is not unique. Several US states have experienced seismic activity following shale gas drilling and fracking in areas where this has not previously happened. Although a clear causal link has not been proved in all cases, a close correlation between fracking and earth tremors can be seen<sup>47</sup>. There have also been problems in the US with earthquakes triggered by the injection underground of fracking waste water<sup>48</sup>. According to the US Geological Survey's Earthquake Science

Center, in the US *“the future probably holds a lot more in induced earthquakes as the gas boom expands”*<sup>49</sup>.

### **Will UK regulations be adequate?**

The Government believes that the shale gas industry in the UK can be safely regulated, pointing to the conclusions of a review of fracking by the Royal Society and the Royal Academy of Engineering, which concluded that *“the health, safety and environmental risks ... can be managed effectively in the UK as long as operational best practices are implemented and enforced through regulation”*<sup>50</sup>.

However others are unconvinced: the Chartered Institute of Water and Environmental Management has said that the UK should *“not encourage fracking as a part of our energy mix until there is more evidence that operations can be delivered safely, that environmental impacts are acceptable and that monitoring, reporting and mitigation requirements are comprehensive and effective”*<sup>51</sup>. And Mark Menzies, the Conservative MP whose constituency covers much of the area in Lancashire where Cuadrilla has been active, has said *“I do not believe that the regulatory system is robust or transparent enough to instill public confidence should permission be granted to the industry”*<sup>52</sup>.

Friends of the Earth believes that regulation can make fracking safer, but it cannot make it safe. As the United Nations Environment Programme has concluded *“Hydrologic fracking may result in unavoidable environmental impacts even if UG is extracted properly, and more so if done inadequately. Even if risk can be reduced theoretically, in practise many accidents from leaky or malfunctioning equipment as well as from bad practises are regularly occurring”*<sup>53</sup>.

### **Will shale gas cut energy bills?**

An oft-repeated claim by shale gas advocates is that it will lead to big cuts in gas prices, as it has done in the US. For example, Chancellor George Osborne has said that he wants to make sure that *“Britain is not left behind as gas prices tumble on the other side of the Atlantic”*<sup>54</sup>.

However there is great scepticism among experts that this will be the case. Former Energy Minister Charles Hendry has said that *“betting the farm on shale brings serious risks of future price rises”*<sup>55</sup>. A report by consultants Poyry for OFGEM concluded that only a shale gas boom in Europe would lead to significantly lower gas prices in the UK, and such a boom was a *“a low probability outcome”*<sup>56</sup>. Also, the impact on gas prices depends on what happens elsewhere in Europe: UK production is not significant in this respect.

Shale gas production costs in Europe are likely to be higher than in the US. Reasons for this include less promising geology, higher population density and associated problems of land availability, the lack of a competitive onshore drilling and services industry and tougher

environmental regulation<sup>57</sup>. Factors such as these led the International Energy Agency (IEA) to conclude that operating costs in Europe will be 30-50% higher than in the US<sup>58</sup>.

Although shale gas advocates point to the US as an example, gas prices there were so low that they had fallen below the cost of production, making drilling not economically viable. This led Rex Tillerson, CEO of Exxon to comment last year *"We are all losing our shirts today. We're making no money. It's all in the red."*<sup>59</sup>.

Claims of cheaper gas prices also ignore global market dynamics. Demand for gas is rising fast, particularly from China, India and other emerging economies. This growing demand is likely to soak up new gas supplies, potentially keeping supply constrained and prices high, meaning that *"UK households and industry would be tied to a highly unpredictable roller coaster of gas prices that are generally high and can spike higher due to volatility"*<sup>60</sup>.

Bloomberg New Energy Finance has estimated that *"the cost of shale gas extraction in the UK will be between \$7.10 and \$12.20/MMBtu... similar to the range of market prices for natural gas seen in the UK during the course of 2012"* and concluded that hopes that shale gas will lead to lower energy prices for the UK *"should be treated as wishful thinking"*<sup>61</sup>. The IEA's analysis shows that gas prices in Europe will be around 40% higher than today in both 2020 and 2035<sup>62</sup>.

### **Will shale gas improve energy security?**

Another claim from shale gas advocates is that shale gas will improve the UK's energy security, as we will not have to rely on gas supplies from unstable regions such as the Middle East, or be heavily dependent on countries such as Qatar.

Defining energy security as security of supply, DECC believes that *"It is still too early to come to firm conclusions on whether shale gas production in the UK or elsewhere in Europe is likely to have a significant effect on ... security of supply"*<sup>63</sup> and the House of Commons Energy and Climate Change Committee has recommended that *"the Government should not rely on shale gas contributing to the UK's energy system when making strategic plans for energy security"*<sup>64</sup>.

However Friends of the Earth believes energy security should be defined more broadly than just about supply and geopolitics, also including price security (providing energy at reasonable prices) and environmental security (achieving emissions targets and minimizing other impacts)<sup>65</sup>. In a report for Friends of the Earth, Professor Michael Bradshaw, an energy security expert, concluded that *"the best way to reduce the energy security risks associated with the UK's growing gas import dependence is to hold the course, promote renewable power generation, improve energy efficiency and reduce overall energy demand"*<sup>66</sup>.

## Jobs and local economy

The shale gas industry paints an overwhelmingly positive picture of its local economic impact through job creation. A report for Cuadrilla has claimed that shale gas production in Lancashire could create up to 6,500 full-time equivalent jobs (FTEs) in the UK as a whole, with 1,700 of these in Lancashire<sup>67</sup>.

However US experience shows that such claims should be treated with scepticism: numbers can be over-stated<sup>68</sup>; most employment is in the drilling phase, which only lasts around a year<sup>69</sup>; and many jobs go to transient workers who move from one well to another, with 70% of gas well drilling jobs in Pennsylvania going to people from out of state<sup>70</sup>.

Nor has any estimate been made of potential negative impacts on other economic sectors:

- Cuadrilla's drilling in the Lancashire is in an area where agriculture is an important sector. Experience in the US shows that fracking can create problems for local agriculture, including the loss of agricultural land and concerns about water resources<sup>71</sup>. Nationwide Mutual, the largest US farming insurance underwriter, announced last year that *"from an underwriting standpoint we do not have a comfort level with the unique risks associated with the fracking process to provide coverage at a reasonable price"*<sup>72</sup>.
- Tourism is the backbone of the economy of the area where Cuadrilla is proposing to drill, bringing in £200 million a year. What would be the impact on tourism of hundreds of shale gas wells and associated infrastructure? In Australia, local tourism bodies are among the opponents of unconventional gas development<sup>73</sup>.

Research from the US shows that investing \$1 million in renewable energy creates more than two to three times as many jobs as investing the same amount in gas<sup>74</sup>. Government figures show that 1,544 jobs were created in the renewables sector in the North West, and 20,848 in the UK as a whole between April 2011 and April 2012<sup>75</sup>. The renewable energy sector could support 400,000 jobs by 2020<sup>76</sup>.

Fracking could affect house prices. An estate agent in Poulton-le-Fylde, near one of Cuadrilla's drilling sites, told the Observer *"There are a lot of properties coming on to the market, and some of the owners are saying they want to get out before prices start dropping"*<sup>77</sup>. Other local estate agents have said sales have fallen through because properties are near a fracking site<sup>78</sup>.

## What the Government thinks

Energy Secretary Ed Davey announced<sup>79</sup> in December 2012 that fracking can resume in principle (though companies will still need planning permission and environmental permits). He said that *"there are already in place robust regulatory controls on all oil and gas activities"* and he has subsequently said that *"fracking is safe"*<sup>80</sup>.



However Mr Davey seems more sceptical about the potential of shale gas than the Chancellor of the Exchequer, George Osborne. Mr Davey has said that *“unconventional gas can make a difference, although perhaps not as big a difference as some sections of the press would have me believe”*<sup>81</sup>. He has said that shale gas production *“is likely to be some years away yet”*<sup>82</sup>. In his Budget speech in March 2013, the Chancellor said *“shale gas is the future and we will make it happen”*<sup>83</sup>.

The Prime Minister has said of shale gas *“There is a revolution under way. I want us to be part of that revolution”*<sup>84</sup>. He assured MPs that *“any future shale gas production would have to meet stringent safety and environmental standards, follow deep consultation with local communities and fit within our overall energy commitments”*<sup>85</sup>.

However there are doubts about the ‘deep consultation with local communities’ given the Governments proposals to classify shale gas production as ‘nationally significant infrastructure’ under the Planning Act 2008<sup>86</sup>. This would mean that decisions on applications for shale gas production would no longer be considered by County Councils as at present, with the opportunity for local residents to play a full part in the process, including the right to speak at a planning inquiry. Instead decisions could be taken by the Secretary of State for Communities & Local Government following consideration by the national Planning Inspectorate.

In the 2013 Budget, the Chancellor announced consultations on new tax breaks for the shale gas industry and on ‘community benefits’ – measures to encourage communities to accept fracking. These could include lower energy bills and, according to one leading industry figure, additional police officers or school teachers<sup>87</sup>.

### What is happening elsewhere?

Encouraged by developments over the last decade in the US, the shale gas industry is looking to expand across the world, with Europe, South Africa, India and China being prime focal points. In most of these places, the industry is facing stiff opposition. Below is a snapshot of the current state of play in some key countries, but please note that the situation changes from month to month: links are given for more information (in English where possible).

In Western Europe, the parliament in **France** has passed a law banning fracking<sup>88</sup>, despite the potential for considerable reserves. Public opposition is growing in **Spain**, with the Cantabria region coming out against fracking<sup>89</sup>. In **Germany**, the federal government is reported to be concerned<sup>90</sup>, and there is also concern in regions including North-Rhine Westphalia<sup>91</sup> and Thuringia. In **Holland**, fracking is on hold pending further studies, expected to start this year, and opposition is strong<sup>92</sup>. There is interest in fracking and a growing anti-fracking movement in **Ireland**<sup>93</sup> and **Sweden**<sup>94</sup>.

In Eastern Europe, **Poland** is being targeted as a key development area, but initial results have been disappointing<sup>95</sup>. Fracking was banned in **Bulgaria** in 2012 following widespread protests<sup>96</sup>. Proposals for fracking in **Romania** have faced widespread protests<sup>97</sup> and there are also considerable reserves in **Ukraine**<sup>98</sup>.

Opposition is still strong in North America with fracking banned in **Vermont** and moratoriums in place in **New York State** and **Quebec**.

And fracking is facing huge local opposition wherever it is proposed in the UK with local groups in Lancashire, Sussex, Somerset, South Wales and Northern Ireland<sup>99</sup>.

### What Friends of the Earth thinks

Friends of the Earth believes that shale gas is unconventional, unnecessary and unwanted.

To meet our legally-binding climate change targets, Friends of the Earth agrees with the Committee on Climate Change that we must cut carbon emissions almost completely from electricity generation by 2030. This is critical not just because electricity generation is a major source of carbon emissions, but because decarbonised electricity will help emissions reduction in heating and transport by allowing a shift from gas and oil respectively.

Friends of the Earth believes that we should move from generating roughly three-quarters of our electricity from fossil fuels currently, to generating three-quarters from renewable sources in 2030<sup>100</sup>. Within this, there is a role for gas (both conventional and unconventional) but this must be clearly defined and limited to backing up renewables.

In this context, seeking out new sources of fossil fuels is the wrong direction for UK energy policy. Given the inherent risks for the local environment and human health and major scepticism about its impact on energy prices, fracking for shale gas is a gamble we don't need to take.

### What you can do

For more information on what you can do to fight fracking, please go to [www.foe.co.uk/fracking](http://www.foe.co.uk/fracking)

<sup>1</sup> UNEP (2012) 'Gas fracking: can we safely squeeze the rocks?' [http://www.unep.org/pdf/UNEP-GEAS\\_NOV\\_2012.pdf](http://www.unep.org/pdf/UNEP-GEAS_NOV_2012.pdf)

<sup>2</sup> All figures from DECC UK Energy in Brief 2012 <http://www.decc.gov.uk/assets/decc/11/stats/publications/energy-in-brief/5942-uk-energy-in-brief-2012.pdf>

<sup>3</sup> Sunday Telegraph 1<sup>st</sup> December 2012 'Cuadrilla set to resume fracking as George Osborne backs UK shale gas' <http://www.telegraph.co.uk/finance/newsbysector/energy/9716558/Cuadrilla-set-to-resume-fracking-as-George-Osborne-backs-UK-shale-gas.html>

<sup>4</sup> Daily Telegraph 5<sup>th</sup> April 2013 'Shale gas 'could heat all homes for 100 years'' <http://www.telegraph.co.uk/earth/environment/9975652/Shale-gas-could-heat-all-homes-for-100-years.html>

<sup>5</sup> Bloomberg 26<sup>th</sup> March 2012 'Shale boom in Europe fades as Polish wells come up empty' <http://www.bloomberg.com/news/2012-03-26/shale-boom-in-europe-fades-as-polish-wells-come-up-empty-energy.html>

<sup>6</sup> Bloomberg 23<sup>rd</sup> January 2012 'US cuts estimate for Marcellus Shale gas reserves by 66%' <http://www.bloomberg.com/news/2012-01-23/u-s-reduces-marcellus-shale-gas-reserve-estimate-by-66-on-revised-data.html>

<sup>7</sup> DECC (2012) 'The unconventional hydrocarbon resources of Britain's onshore basins – shale gas' [https://www.og.decc.gov.uk/UKpromote/onshore\\_paper/UK\\_onshore\\_shalegas.pdf](https://www.og.decc.gov.uk/UKpromote/onshore_paper/UK_onshore_shalegas.pdf)

<sup>8</sup> The planning and regulatory system is outlined on the DECC website at [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/15710/3627-slide-describing-regulatory-interaction-onshore-ex.ppt](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/15710/3627-slide-describing-regulatory-interaction-onshore-ex.ppt)

- <sup>9</sup> Lancashire Evening Post 16<sup>th</sup> April 2013 'New frack sites within months' <http://www.lep.co.uk/news/business/new-frack-sites-within-months-1-5586372>
- <sup>10</sup> BBC 9<sup>th</sup> May 2013 'West Sussex site targeted for oil and gas test drilling' <http://www.bbc.co.uk/news/uk-england-sussex-22458716>
- <sup>11</sup> Groups opposing fracking in South Wales include The Vale Says No <http://thevalesaysno.com/>
- <sup>12</sup> See <http://www.pennenergy.com/articles/oqi/2013/01/egdon-touts-east-midlands-shale-gas-resource-estimate.html>
- <sup>13</sup> See <http://www.manchestereveningnews.co.uk/news/local-news/controversial-process-by-igas-is-set-to-begin-1215846>
- <sup>14</sup> For more information see <http://www.foe-scotland.org.uk/sites/files/Policy%20briefing%20oct%202012.pdf>
- <sup>15</sup> UNEP (2012) *op cit*
- <sup>16</sup> AEA Technology for the European Commission (2012) Support to the identification of potential risks for the environment and human health arising from hydrocarbons operations involving hydraulic fracturing in Europe' <http://ec.europa.eu/environment/integration/energy/pdf/fracking%20study.pdf>
- <sup>17</sup> Nature 2<sup>nd</sup> January 2013 'Methane leaks erode green credentials of natural gas' <http://www.nature.com/news/methane-leaks-erode-green-credentials-of-natural-gas-1.12123>
- <sup>18</sup> AEA for the European Commission (2012) 'Climate impact of potential shale gas production in the UK' [http://ec.europa.eu/clima/policies/eccp/docs/120815\\_final\\_report\\_en.pdf](http://ec.europa.eu/clima/policies/eccp/docs/120815_final_report_en.pdf)
- <sup>19</sup> Weber et al (2012) 'Life cycle carbon footprint of shale gas: review of evidence and implications' <http://pubs.acs.org/doi/abs/10.1021/es300375n>
- <sup>20</sup> Greenpeace (2012) 'How Harvard and the IEA got it wrong on impact of shale on US emissions' <http://www.greenpeace.org.uk/newsdesk/energy/investigations/how-iea-and-harvard-got-it-wrong-impact-shale-us-emissions>
- <sup>21</sup> DECC Energy Trends December 2012 [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/65906/7343-energy-trends-december-2012.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/65906/7343-energy-trends-december-2012.pdf)
- <sup>22</sup> See <http://www.bbc.co.uk/news/business-20002801>
- <sup>23</sup> Broderick et al (2011) 'Shale gas: an updated assessment of environmental and climate change impacts' <http://www.co-operative.coop/Corporate/Fracking/1/Shale%20gas%20update%20-%20full%20report.pdf>
- <sup>24</sup> International Energy Agency (2012) 'Golden Rules for a Golden Age of Gas' [http://www.worldenergyoutlook.org/media/weowebiste/2012/goldenrules/WEO2012\\_GoldenRulesReport.pdf](http://www.worldenergyoutlook.org/media/weowebiste/2012/goldenrules/WEO2012_GoldenRulesReport.pdf)
- <sup>25</sup> *ibid*
- <sup>26</sup> BBC [Campaigners' anger over agency's shale gas report](http://www.bbc.com/news/energy-2012-05-29) 29<sup>th</sup> May 2012
- <sup>27</sup> Chatham House (2012) 'The 'Shale Gas Revolution': Developments and Changes' [http://www.chathamhouse.org/sites/default/files/public/Research/Energy\\_%20Environment%20and%20Development/bp0812\\_stevens.pdf](http://www.chathamhouse.org/sites/default/files/public/Research/Energy_%20Environment%20and%20Development/bp0812_stevens.pdf)
- <sup>28</sup> Committee on Climate Change 13<sup>th</sup> September 2012 'The need for a carbon intensity target in the power sector' <http://www.theccc.org.uk/wp-content/uploads/2013/02/EMR-letter-September-12.pdf>
- <sup>29</sup> Broderick et al (2011) *op cit*
- <sup>30</sup> Broderick et al (2011) *op cit*
- <sup>31</sup> Cudrilla Resources 'Composition of components in Bowland Shale hydraulic fracturing fluid for Preese Hall-1 well' <http://www.cudrillaresources.com/wp-content/uploads/2012/02/Chemical-Disclosure-PH-1.jpg>
- <sup>32</sup> Tyndall Centre (2011) 'Shale gas: a provisional assessment of climate change and environmental impacts' [http://www.tyndall.ac.uk/sites/default/files/tyndall-coop\\_shale\\_gas\\_report\\_final.pdf](http://www.tyndall.ac.uk/sites/default/files/tyndall-coop_shale_gas_report_final.pdf) section 4.3
- <sup>33</sup> Environment Agency (2006) 'The Wyre Catchment Abstraction Management Strategy' <http://a0768b4a8a31e106d8b0-50dc802554eb38a24458b98ff72d550b.r19.cf3.rackcdn.com/genw0906bllq-e-e.pdf>
- <sup>34</sup> Both quotes from CIWEM (2012) 'Hydraulic Fracturing (Fracking) of Shale in the UK' [http://www.ciwem.org/media/624838/Fracking\\_Oct2012.pdf](http://www.ciwem.org/media/624838/Fracking_Oct2012.pdf)
- <sup>35</sup> House of Commons Energy & Climate Change Committee (2011) 'Shale Gas' <http://www.publications.parliament.uk/pa/cm201012/cmselect/cmenergy/795/795.pdf> para 124
- <sup>36</sup> Osborn et al (2011) 'Methane contamination of drinking water accompanying gas-well drilling and hydraulic fracturing' <http://www.pnas.org/content/early/2011/05/02/1100682108.full.pdf+html>
- <sup>37</sup> Food & Water Watch Fracking: the new global water crisis <http://documents.foodandwaterwatch.org/doc/FrackingCrisisUS.pdf>
- <sup>38</sup> This is known as the Halliburton loophole, after the company who were one of the early users of fracking. The loophole was negotiated by then US Vice President Dick Cheney, a former chief executive of Halliburton.
- <sup>39</sup> See <http://fracfocus.org>
- <sup>40</sup> Colborn et al (2011) 'Natural Gas Operations from a Public Health Perspective' <http://cce.cornell.edu/EnergyClimateChange/NaturalGasDev/Documents/PDFs/fracking%20chemicals%20from%20a%20public%20health%20perspective.pdf>
- <sup>41</sup> Food & Water Watch (2012) 'Fracking: the new global water crisis' <http://documents.foodandwaterwatch.org/doc/FrackingCrisisEU.pdf>
- <sup>42</sup> New York Times 26<sup>th</sup> February 2011 'Regulation Lax as Gas Wells' Tainted Water Hits Rivers' [http://www.nytimes.com/2011/02/27/us/27gas.html?pagewanted=all&\\_r=0](http://www.nytimes.com/2011/02/27/us/27gas.html?pagewanted=all&_r=0)
- <sup>43</sup> Colborn et al (2012) 'An Exploratory Study of Air Quality near Natural Gas Operations' <http://www.endocrinedisruption.com/files/HERA12-137NGAirQualityManuscriptforwebwithfigures.pdf>
- <sup>44</sup> Food & Water Watch 'The case for ban on gas fracking' <http://www.foodandwaterwatch.org/reports/the-case-for-a-ban-on-gas-fracking/> p8
- <sup>45</sup> *ibid*

- <sup>46</sup> The Times Feb 6<sup>th</sup> 2012 'Blackpool tremors reopen questions over fracking'  
<http://www.thetimes.co.uk/tto/business/industries/naturalresources/article3310081.ece>
- <sup>47</sup> See for example <http://stateimpact.npr.org/pennsylvania/2011/08/26/how-fracking-causes-earthquakes-but-not-the-one-in-virginia/>
- <sup>48</sup> Technology Review December 14<sup>th</sup> 2012 'Studies link earthquakes to wastewater from fracking'  
<http://www.technologyreview.com/news/508151/studies-link-earthquakes-to-wastewater-from-fracking/>
- <sup>49</sup> *ibid*
- <sup>50</sup> Royal Society / Royal Academy of Science (2012) 'Shale gas in the UK: a review of hydraulic fracturing'  
[http://royalsociety.org/uploadedFiles/Royal\\_Society\\_Content/policy/projects/shale-gas/2012-06-28-Shale-gas.pdf](http://royalsociety.org/uploadedFiles/Royal_Society_Content/policy/projects/shale-gas/2012-06-28-Shale-gas.pdf)
- <sup>51</sup> CIWEM (2012) 'Hydraulic Fracturing (Fracking) of Shale in the UK' *op cit*
- <sup>52</sup> House of Commons 24<sup>th</sup> October 2012  
<http://www.publications.parliament.uk/pa/cm201213/cmhansrd/cm121024/debtext/121024-0004.htm>
- <sup>53</sup> UNEP (2012) 'Gas fracking: can we safely squeeze the rocks?' *op cit*
- <sup>54</sup> The Guardian 8<sup>th</sup> October 2012 'Can George Osborne give shale gas a boost with a 'generous' tax regime?'  
<http://www.guardian.co.uk/environment/2012/oct/08/george-osborne-shale-gas-tax>
- <sup>55</sup> The Observer 21<sup>st</sup> October 2012 'Energy: we must mix to match future demands in Britain'  
<http://www.guardian.co.uk/commentisfree/2012/oct/21/energy-policy-david-cameron-shale-gas>
- <sup>56</sup> Poyry for OFGEM (2011) 'The impact of unconventional gas on Europe'  
[http://www.poyry.co.uk/sites/www.poyry.uk/files/The\\_Impact\\_of\\_Unconventional\\_Gas\\_on\\_Europe.pdf](http://www.poyry.co.uk/sites/www.poyry.uk/files/The_Impact_of_Unconventional_Gas_on_Europe.pdf)
- <sup>57</sup> Chatham House (2010) '#The shale gas revolution: hype and reality'  
[http://www.chathamhouse.org/sites/default/files/public/Research/Energy,%20Environment%20and%20Development/r\\_0910stevens.pdf](http://www.chathamhouse.org/sites/default/files/public/Research/Energy,%20Environment%20and%20Development/r_0910stevens.pdf)
- <sup>58</sup> International Energy Agency (2012) 'Golden Rules for a Golden Age of Gas' *op cit*
- <sup>59</sup> Wall Street Journal 27<sup>th</sup> June 2012 'Exxon: 'Losing Our Shirts' on Natural Gas'  
<http://online.wsj.com/article/SB10001424052702303561504577492501026260464.html>
- <sup>60</sup> Paul Ekins New Scientist 6<sup>th</sup> December 2012 'The UK's new dash for gas is a dangerous gamble'  
<http://www.newscientist.com/article/dn22594-the-uks-new-dash-for-gas-is-a-dangerous-gamble.html>
- <sup>61</sup> Bloomberg New Energy Finance 21<sup>st</sup> February 2013 'UK shale gas no "Get Out Of Jail Free" card'  
<http://about.bnef.com/press-releases/uk-shale-gas-no-get-out-of-jail-free-card/>
- <sup>62</sup> International Energy Agency (2012) 'Golden Rules for a Golden Age of Gas' *op cit*
- <sup>63</sup> House of Commons Energy & Climate Change Committee inquiry 'The impact of shale gas on energy markets' Evidence from DECC <http://www.publications.parliament.uk/pa/cm201213/cmselect/cmenergy/writv/isg/m01.htm>
- <sup>64</sup> House of Commons Energy & Climate Change Committee 'The impact of shale gas on energy markets'  
<http://www.publications.parliament.uk/pa/cm201213/cmselect/cmenergy/785/785.pdf> para 90
- <sup>65</sup> Friends of the Earth (2012) 'Why it's time to take our foot off the gas'  
[http://www.foe.co.uk/resource/briefings/why\\_its\\_time\\_to\\_take\\_our\\_f.pdf](http://www.foe.co.uk/resource/briefings/why_its_time_to_take_our_f.pdf)
- <sup>66</sup> *ibid*
- <sup>67</sup> Regeneris Consulting (2011) 'Economic Impact of Shale Gas Exploration & Production in Lancashire and the UK'  
[http://www.cuadrillaresources.com/wp-content/uploads/2012/02/Full\\_Report\\_Economic\\_Impact\\_of\\_Shale\\_Gas\\_14\\_Sept.pdf](http://www.cuadrillaresources.com/wp-content/uploads/2012/02/Full_Report_Economic_Impact_of_Shale_Gas_14_Sept.pdf)
- <sup>68</sup> See for example Industry Week August 11<sup>th</sup> 2011 [The great debate over shale gas employment figures](http://www.industryweek.com/news/2011/08/11/the-great-debate-over-shale-gas-employment-figures)
- <sup>69</sup> Research for Cuadrilla shows that the number of jobs created at around 1,600 in Lancashire and 5,600 in the UK for four years from 2016 to 2019, falling to under 200 from 2022 onwards. Regeneris Consulting [Economic impact of shale gas exploration & production in Lancashire and the UK](http://www.regenerisconsulting.com/industry/energy/shale-gas/economic-impact-of-shale-gas-exploration-and-production-in-lancashire-and-the-uk)
- <sup>70</sup> ENR New York March 7<sup>th</sup> 2011 'Hydrofracking offers Short-Term Boom, Long-Term Bust'  
[http://newyork.construction.com/opinions/viewpoint/2011/0307\\_HydrofrackingOffers.asp](http://newyork.construction.com/opinions/viewpoint/2011/0307_HydrofrackingOffers.asp)
- <sup>71</sup> Food & Water Watch 'Fracking and the food system' <http://documents.foodandwaterwatch.org/doc/FrackingFoodSystem.pdf>
- <sup>72</sup> Nationwide Mutual 13<sup>th</sup> July 2012 Nationwide statement regarding concerns about hydraulic fracturing  
<http://www.nationwide.com/newsroom/071312-FrackingStatement.jsp>
- <sup>73</sup> Northern Rivers Echo 31<sup>st</sup> May 2012 'Tourism joins calls to halt CSG' <http://www.echonews.com.au/news/tourism-joins-calls-to-halt-coal-seam-gas/1399596/>
- <sup>74</sup> Investing \$1 million dollars in gas creates 5 jobs compared to 13 for wind, 14 for solar and 17 for building retrofits from the same amount of investment. Political Economy Research Institute, University of Massachusetts 'The economic benefits of investing in clean energy'  
[http://www.peri.umass.edu/fileadmin/pdf/other\\_publication\\_types/green\\_economics/economic\\_benefits/economic\\_benefits.PDF](http://www.peri.umass.edu/fileadmin/pdf/other_publication_types/green_economics/economic_benefits/economic_benefits.PDF)
- <sup>75</sup> DECC [Renewables Investment and Jobs](http://www.decc.gov.uk/assets/decc/renewables/renewables_investment_and_jobs)
- <sup>76</sup> Renewable Energy Association (2012) 'Renewable energy: made in Britain' <http://www.r-e-a.net/resources/rea-publications>
- <sup>77</sup> The Observer June 23<sup>rd</sup> 2012 'Worry for homeowners who face the threat of fracking'  
<http://www.guardian.co.uk/money/2012/jun/23/fracking-undermine-value-home>
- <sup>78</sup> BBC website 13<sup>th</sup> December 2012 'Fylde fracking: The new Aberdeen or toxic gamble?' <http://www.bbc.co.uk/news/uk-england-lancashire-20627877>
- <sup>79</sup> Ministerial Statement 13<sup>th</sup> December 2012 'Exploration for shale gas' <https://www.gov.uk/government/speeches/written-ministerial-statement-by-edward-davey-exploration-for-shale-gas>
- <sup>80</sup> Interview with BBC Radio Lancashire 1<sup>st</sup> February 2013
- <sup>81</sup> The Guardian 11<sup>th</sup> September 2012 'Shale gas potential for UK overhyped, says Ed Davey'  
<http://www.guardian.co.uk/environment/2012/sep/11/shale-gas-potential-uk-ed-davey>
- <sup>82</sup> Ministerial statement 13<sup>th</sup> December 2012 *op cit*

---

<sup>83</sup> House of Commons 20<sup>th</sup> March 2013

<http://www.publications.parliament.uk/pa/cm201213/cmhansrd/cm130320/debtext/130320-0001.htm#13032055000002>

<sup>84</sup> House of Commons Liaison Committee 11<sup>th</sup> December 2012

<http://www.publications.parliament.uk/pa/cm201213/cmselect/cmliaisn/uc484-ii/uc48401.htm> q35

<sup>85</sup> House of Commons 12<sup>th</sup> September 2012

<http://www.publications.parliament.uk/pa/cm201213/cmhansrd/cm120912/debtext/120912-0001.htm#12091223000008>

<sup>86</sup> DCLG (2012) 'Nationally significant infrastructure planning: extending the regime to business and commercial projects'

[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/15333/extending\\_the\\_regime\\_to\\_business.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/15333/extending_the_regime_to_business.pdf)  
Annex A

<sup>87</sup> Daily Telegraph 9<sup>th</sup> May 2013 'Reward fracking communities with extra police officers, says IGas'

<http://www.telegraph.co.uk/finance/newsbysector/energy/oilandgas/10047396/Reward-fracking-communities-with-extra-police-officers-says-IGas.html>

<sup>88</sup> <http://www.assemblee-nationale.fr/13/propositions/pion3301.asp>

<sup>89</sup> See <http://www.boe.es/boe/dias/2013/05/09/pdfs/BOE-A-2013-4828.pdf>

<sup>90</sup> Spiegel Online 5<sup>th</sup> July 2012 'German Government to oppose fracking' <http://www.spiegel.de/international/germany/germany-rejects-fracking-to-tap-natural-gas-a-831764-druck.html>

<sup>91</sup> See [www.bund-nrw.de/fracking](http://www.bund-nrw.de/fracking)

<sup>92</sup> See <http://www.schaliegasvrij.nl/>

<sup>93</sup> See <http://frackingfreeireland.org/>

<sup>94</sup> See <http://heavenorshell.se>

<sup>95</sup> Financial Times 8<sup>th</sup> May 2013 'Blow to Poland's shale ambitions as Talisman and Marathon pull out'

<http://blogs.ft.com/beyond-brics/2013/05/08/blow-to-polands-shale-ambitions-as-talisman-and-marathon-pull-out/#axzz2SnrYMXQ6>

<sup>96</sup> Natural Gas Europe 16<sup>th</sup> January 2012 'Bulgaria to "postpone" shale gas development'

<http://www.naturalgaseurope.com/bulgaria-temporary-shale-gas-moratorium>

<sup>97</sup> See <http://www.facebook.com/#!/groups/frackoffromania/>

<sup>98</sup> See <http://epl.org.ua/en/environment/shale-gas/>

<sup>99</sup> See [www.foe.co.uk/fracking](http://www.foe.co.uk/fracking)

<sup>100</sup> See Friends of the Earth September 2012 A plan for Clean British Energy

[http://www.foe.co.uk/resource/briefings/plan\\_cbe\\_report.pdf](http://www.foe.co.uk/resource/briefings/plan_cbe_report.pdf)