

A CALL FOR EVIDENCE ON THE ROLE OF GAS IN THE ELECTRICITY MARKET

RESPONSE FROM FRIENDS OF THE EARTH ENGLAND, WALES & NORTHERN IRELAND

Friends of the Earth welcomes the opportunity to contribute to this extremely important consultation. We believe that ensuring the right role for gas in future electricity generation is critical to achieving power sector decarbonisation and meeting our legally-binding climate change targets.

Our views in summary are:

- Gas does have a role in the future generation of electricity, but this must be clearly defined and limited to balancing a system where the majority of electricity is produced from renewable sources.
- A greater role for gas brings many serious risks:
 - It jeopardises meeting carbon budgets
 - It risks further big household bill increases
 - It involves major energy security risks
- Shale gas and other unconventional gas is a dangerous distraction, not an energy solution.
- The gas-fired capacity currently on the system plus that already given consent is more than sufficient to fulfil the role of gas in electricity generation to 2030. The Government should say enough is enough: there is no case for further gas-fired power station capacity to be consented.
- The answer to the UK's energy problems is clean British Energy, using our vast potential for wind, wave and solar power. This is also popular with the public: a recent poll shows 85% of people want to see more energy produced from renewable sources and two-thirds said they wanted renewables to be providing more of their electricity in 10 years, compared to 2% for gasⁱ.

All these points are covered in more detail below.

A) WHAT ARE THE MAIN STRENGTHS AND WEAKNESSES OF GAS GENERATION IN HELPING DELIVER A SECURE, AFFORDABLE ROUTE TO DECARBONISATION THROUGH TO 2020 AND THEN BY 2050?

Friends of the Earth believes that gas generation has few strengths in delivering secure and affordable decarbonisation, and many weaknesses.

A1 Strengths

The gas industry and its advocates claim that the strengths of gas generation are that:

- *'It is cheaper than offshore wind'*
Section A2.3 below shows that the anticipated levelised costs of gas generation will continue to rise into the 2020s, whilst the cost of offshore and onshore wind will continue to decline, to levels below those of gas.
- *'It can provide back-up for renewables'*
Friends of the Earth accepts that there is a role for gas in providing back-up for renewables, but as Section B below explains, this role must be clearly defined and limited. Also gas generation is not the only way of providing back-up to renewables – demand-side responses, electricity storage options and greater interconnection must also be considered.

- *'It can rely on cheap UK shale gas'*
Section F2 below explains that shale gas is unlikely to be cheap and there are real uncertainties over how much shale gas there is under the UK.
- *'It is compatible with decarbonisation'*
Redpoint's analysis for the Committee on Climate Change, referred to in Section B below, shows that its scenario with a low gas price and a low carbon price, and no nuclear build leading to more unabated gas CCGT plant, has an emissions intensity of 230gCO₂/kWh in 203. This is clearly incompatible with the Committee on Climate Change's recommended 2030 decarbonisation target – but it remains a real risk.
- *'In build terms, it is cheaper and quicker than nuclear'*
This is certainly the case but that doesn't mean that we should build more gas generation, even if nuclear does not deliver as the Government hopes because, as explained above, it will lead to an emissions intensity much higher than that needed.

A2 Weaknesses

The weaknesses of gas generation are well summed up in the Government's own words: an increasing reliance on gas would *"leave us with less diversity, and with energy security and affordability implications as we would be more exposed to price volatility as well, as being less able to meet our climate change objectives"*ⁱⁱ. We address these weaknesses under three headings:

- climate change
- supply and security
- prices and affordability

A2.1 Climate change

Friends of the Earth believes the most significant weakness of gas generation is that, as a fossil fuel, gas contributes to climate change.

At the global level, the International Energy Agency's projections of a new 'Golden Age of Gas' would put global temperatures on course to rise by 3.5 degrees centigrade, far above the 2 degrees rise which the Government says is the maximum if we want to avoid the worst impacts of climate change. The IEA admits the problems such a rise would cause: *"we are not saying that it will be a golden age for humanity - we are saying it will be a golden age for gas"*ⁱⁱⁱ.

As stated above, Friends of the Earth believes the role for gas in electricity generation to 2030 must be limited and clearly defined. The Committee on Climate Change has said that a second dash for gas, taking its 2030 contribution beyond 10%, would not be compatible with our legislated carbon budgets^{iv}. We agree – and explain why in more detail in section B.

The case made for a shift to gas depends in large part on it having a lower climate impact than coal, as burning gas produces less carbon dioxide than burning coal. However peer-reviewed scientific research has found that this might not be so straightforward:

- The US National Center for Atmospheric Research (NCAR) has found that a greater reliance on gas rather than coal would fail to significantly slow down climate change. This is because burning coal releases comparatively large amounts of sulfates and other particles that cool the planet by blocking incoming sunlight. Indeed, a partial global shift from coal to natural gas could slightly accelerate climate change to 2050^v.
- Researchers from Carnegie Mellon University have found that in the US a gas mix for electricity generation with just 20% LNG has lifecycle emissions 21% higher than those for combustion alone, due to liquefaction, transport and re-gasification, bringing maximum lifecycle emissions for gas close to minimum

coal lifecycle emissions. The researchers conclude *“if emissions at the combustion stage of the lifecycle could not be controlled, natural gas would not be a much better alternative to coal in terms of greenhouse gas emissions”*^{vi}.

- There is strong evidence that the overall climate change impact of shale gas could be as great as coal. This is covered in more detail in our response to question (f).

The industry’s claims for a future role for gas in electricity generation rely on the success of Carbon Capture & Storage (CCS) and the Government places great emphasis on its potential. The Secretary of State, launching the Government’s most recent CCS competition, said: *“the potential rewards from Carbon Capture and Storage are immense: a technology that can decarbonise coal and gas-fired power stations and large industrial emitters, allowing them to play a crucial part in the UK’s low carbon future”*^{vii}.

Friends of the Earth believes that CCS is a vital part of the UK’s energy future, both for power stations and for energy-intensive industry. However we believe that placing blind faith in the ability of industry to deliver CCS which works at scale and which is cost-effective, is extremely risky. This is because:

- CCS has not yet been demonstrated at scale anywhere in the world and there is no certainty that it will work. This view is shared by at least some of the utilities: Ian Marchant, Chief Executive of SSE, recently told the House of Commons Energy & Climate Change Committee *“we do not know that this technology will work”*^{viii}.
- Despite the UK Government’s recent announcement, global progress developing CCS is slowing.^{ix}
- The proposals in the current draft Energy Bill to grandfather permitted carbon emissions to 2045 reduce or eliminate the incentive to fit CCS, and a loophole remains with proposals to exempt CCS demonstration plants from the Emissions Performance Standard.
- Proposed new gas plants currently being consented are required to be CCS-ready, but questions remain around whether these plants are actually located close to sites suitable for geological storage.

In short, the uncertainty surrounding the feasibility and governance of CCS, coupled with the potential for a second dash for gas, poses a huge risk to the UK meeting its carbon targets and effectively tackling climate change.

A2.2 Supply and security

Friends of the Earth believes that a role for gas greater than balancing the system means either

- relying on imports of pipeline gas and LNG, which carries big security and cost risks; or
- pinning one’s hopes on unconventional gas, which is uncertain, likely to be costly, and involves significant local environmental problems.

Over the last decade, the UK’s gas balance has shifted significantly from being a net exporter to a net importer of gas. By 2020, imports could meet up to 80% of forecast UK demand.

In recent years, LNG has played an increasing role in imports, representing just under half of total gas imports in 2011^x. The vast majority of imported LNG is from Qatar, representing 85% of total LNG imports in 2011^{xi}, up from 79% in 2010, All but two LNG cargoes arriving in the UK in 2011 came from Qatar^{xii}.

Such a degree of dependence brings major risks. One of these is starting to become manifest: LNG exports can be switched much more easily than pipeline exports and, without firm UK contracts for Qatari gas, these cargoes are being diverted to Asia, and particularly Japan (where demand has risen since the shutdown of the country’s nuclear power plants – up 16.8% in May 2012 compared to May 2011^{xiii}), as they are willing to pay higher prices^{xiv}.

Dependence on Qatar also brings potentially major geopolitical risks. All Qatari LNG exports pass through the Strait of Hormuz, as does a significant amount of oil. LNG passing through the Strait represents almost half of the UK's gas imports and interruptions to supply would lead to sharp falls in UK gas supplies^{xv}.

Closure of the Strait of Hormuz could draw the UK into military action to protect supplies. Defence Secretary Philip Hammond has said that such an action *"would threaten regional and global economic growth. Any attempt by Iran to do this would be illegal and unsuccessful"*^{xvi}. In a recent research paper for Friends of the Earth, gas security expert Professor Michael Bradshaw wrote that *"as closure of the Strait would also debilitate a significant percentage of global oil supply such a situation is unlikely to last for long without military intervention"*^{xvii}. The threat has also been highlighted in a recent Chatham House paper^{xviii} which says there are no alternative maritime routes.

Supply problems can be caused by non-geopolitical factors. In his research for Friends of the Earth, Professor Bradshaw lists several other occasions which have caused supply crises in recent years. These include:

- an explosion on a Centrica 'Bravo' gas platform in the North Sea in 2006
- a lengthy maintenance programme run by Qatari LNG manufacturers in 2010,
- a fire at the Bacton import terminal in 2008

All these instances led to interruptions of gas supplies and, in some cases, to higher prices. The recent gas leak at Total's Elgin gas field has highlighted that such concerns are still around. The Government has said the system is robust enough to handle such problems, but Professor Bradshaw believes that *"only a true test will tell"*^{xix}

A2.3 Prices and affordability

Friends of the Earth believes that a continuing role for gas greater than just balancing the system would

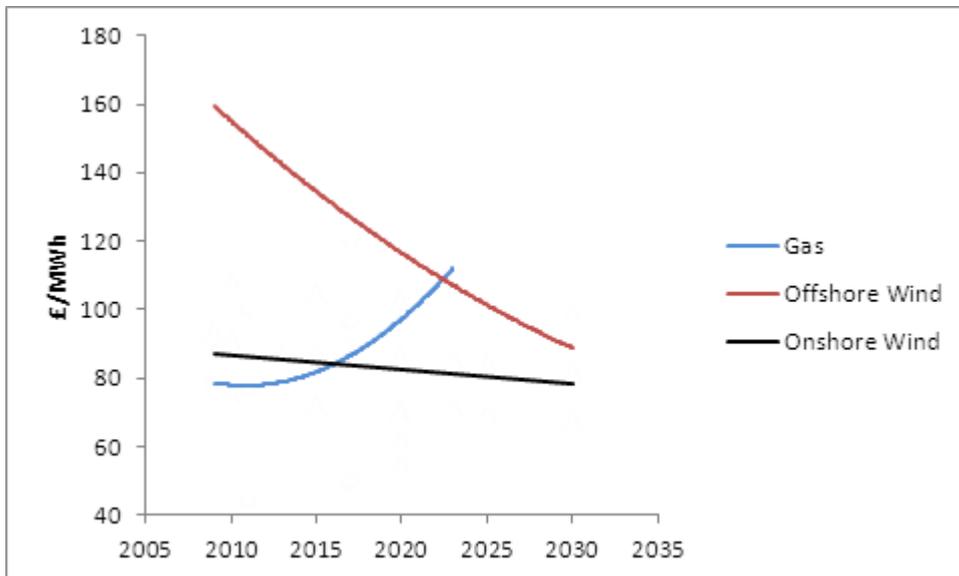
- Take us off the most economic path to meeting the 2050 carbon reduction target;
- Continue to expose households and businesses to rising and volatile gas prices;
- Impact on our balance of payments.

As has been explained above and in section B, a continuing role for gas jeopardises power sector decarbonisation by 2030. Yet early decarbonisation of the power sector is also the most cost-effective way of meeting our carbon budgets. The Committee on Climate Change has said that *"the costs of reducing carbon-intensity in the power sector are generally lower than doing so in other sectors, and the least-cost path towards 2050 is therefore likely to involve early decarbonisation of electricity supply"*^{xx}. Further, MARKAL's modelling for DECC says *"In order to minimise welfare loss associated with the long term low carbon transition, the 4th budget period would be characterised by ... extremely rapid decarbonisation of grid electricity"*^{xxi}. In other words, delayed decarbonisation of the power sector would mean a costlier transition.

It is now generally accepted that rises in household energy bills in recent years are mainly as a result of rising gas prices. For example, the Committee on Climate Change has concluded that *"the average dual-fuel energy bill for a typical household increased from around £605 in 2004 to £1,060 in 2010. Of the total £455 increase (i.e. 75%, compared to general price inflation of 16% over the same period), by far the largest contributor was the increase in the wholesale price of gas, which added around £290 to bills"*^{xxii}. Thus gas price increases accounted for almost two-thirds of household energy bill increases.

Rising gas prices look set to continue. As former Energy Secretary Chris Huhne commented *"If you are asking me to predict what is going to happen to world fossil fuel prices then the Government's prediction – and the prediction of virtually everybody else – is that indeed that in the medium run those prices are going to go up"*^{xxiii}. The Government's most recent 'central' projection predicts gas prices 11% higher than 2011 in both

2020 and 2030; the ‘high’ projection has prices 51% higher in 2020 and 59% higher in 2030. The central projection figures are, if anything, lower than those produced by other experts^{xxiv}. A review of recent literature by Greenpeace – summarised in the graph below – shows that anticipated levelised costs of gas generation will continue to rise into the 2020s, whilst the cost of offshore and onshore wind will continue to decline. This means that UK households and businesses will continue to be exposed to high and volatile gas prices in years to come^{xxv}.



Levelised costs of gas, onshore wind and offshore wind^{xxvi}.

Higher gas prices do not just impact on energy bills – they also have an economy-wide impact. Recent research for DECC concluded that *“high and volatile energy prices have a negative effect on the economy of an oil and gas importing country such as the UK”* and that *“compared to an oil or coal price shock, a shock to gas prices has a greater impact at the whole economy level and across all sectors other than transport. This reflects the importance of gas-fuelled power stations in electricity generation and the relatively large share of electricity in energy inputs”*^{xxvii}. The researchers conclude that a ‘supply shock’ increasing oil and gas prices by 50% would reduce UK GDP by 0.9% in 2020 under a business as usual scenario, and by 0.7% under a low carbon scenario (under which gas demand in 2020 is 10% lower than in 2010).

B) WHAT ROLE CAN GAS FIRED GENERATION PLAY IN THE FUTURE AND WHAT LEVEL OF GAS GENERATION CAPACITY IS DESIRABLE?

The future role for gas-fired generation must be seen within the context of overall energy policy. Friends of the Earth believes that the Government must commit to decarbonisation of the power sector by 2030 as recommended by the Committee on Climate Change.

The draft Energy Bill refers to the need for *“the electricity sector to be largely decarbonised during the 2030s”*^{xxviii}, and models for a power sector carbon intensity of 100g/kWh by 2030. However the Committee on Climate Change has repeatedly made clear that a carbon intensity of 50gCO₂e/kWh by 2030 is needed, most recently stating that *“It is important now that a clear carbon objective is set for the EMR i.e. to achieve carbon intensity of the order of 50 gCO₂/kWh in 2030”*^{xxix}. This view has been supported by the Energy & Climate Change Select Committee^{xxx}.

Analysis for the CCC by Redpoint shows that an emissions intensity of 50g/kWh by 2030 is both achievable and desirable^{xxxi}. However some of Redpoint’s scenarios show the danger of a dash for gas: the Low Gas scenario

with a low gas price has an emissions intensity in 2030 of 125gCO₂/kWh and the Low Gas Carbon scenario with a low gas price alongside a low carbon price leads to an emissions intensity in 2030 of 230gCO₂/kWh^{xxxii}.

Not meeting the 50g/kWh 2030 electricity target would mean that greater action would be required in other sectors such as housing, transport and industry if the economy-wide carbon budgets were to be met. It would also mean the household and transport sector's transition away from oil and gas to electricity would have higher emissions (as these will be increasingly dependent on electricity). The Government itself cites the CCC as saying that the economy-wide targets are "*achieved most cost-effectively*"^{xxxiii} by meeting the 50g 2030 target. The CCC also sets out a series of risks of doing less than its "medium scenario" (which includes the 50g target), including "*It could therefore necessitate scrapping of high-carbon assets...and ...would leave a need for very challenging and expensive emissions reductions beyond 2030*"^{xxxiv}.

Within this overall need for decarbonisation of the power sector by 2030, Friends of the Earth believes that gas still has a role to play in electricity generation. However this role must be clearly set out and limited to balancing the system, as argued by the CCC^{xxxv}. The CCC has said "*the share of unabated gas generation in the total [for 2030] should be no more than 10%*"^{xxxvi}.

Friends of the Earth has used DECC's 2050 Pathways Calculator to generate an electricity mix^{xxxvii} that meets the 50g/kWh target recommended by the Committee on Climate Change. Electricity is generated as follows:

- 74% from renewable sources
- 13% from unabated fossil fuels, mainly gas
- 11% from gas with CCS
- 2% from nuclear

We fear that failures to deliver in other areas of Government energy policy, such as energy efficiency and new nuclear, could mean the UK sliding back into a greater role for gas by default rather than by design. Of greatest concern here is the expectation that nuclear power will generate 40% of the UK's electricity by 2030. This now looks highly unlikely, despite the recent life extensions for existing nuclear plants. There are strong economic arguments against new nuclear plant construction^{xxxviii}, huge delays in those being constructed^{xxxix} and real uncertainties about the desire of companies to build them^{xl}. Failure to deliver new nuclear capacity (though Friends of the Earth does not believe this to be the right course) must not lead by default to a greater role for gas. As David Kennedy, Chief Executive of the CCC, has stated^{xli} a Plan B is needed.

How much gas capacity is needed?

DECC statistics say that there is currently 32GW of CCGT gas capacity on the grid^{xlii}. According to the Government's most recent estimates, published in DECC's Updated Emissions Projections in October 2011^{xliii}, an additional 4.9 gigawatts (GW) of new gas-fired electricity generation capacity is projected to come online by 2020. Of this, 4.1GW is projected by 2016.

However, analysis by Friends of the Earth^{xliv} shows that:

- 3.3GW of new capacity is currently under construction^{xlv}
- 9.7GW of new capacity has been approved and is seemingly going ahead^{xlvi}
- 3.2GW of new capacity has been approved but is currently delayed or on hold^{xlvii}

We note the Government's comment that "*despite the considerable sum of capacity in the pipeline, there is still uncertainty over if and when it will be built*"^{xlviii} but analysis from Bloomberg New Energy Finance concludes that 11GW of new gas plants could be built in 2012 – 2016^{xlix}. National Grid has estimated that there will be 45.3GW of gas capacity on the system by 2018^l - 13GW more than currently. The Redpoint

analysis for the Committee on Climate Change assumes in its Core Scenario that by 2030 “*there is around 12 GW of new unabated gas plant, which is predominantly built before 2020*”^{li}.

Unpublished Redpoint modelling of meeting the 50g CO₂/kWh decarbonisation target commissioned by DECC for the Electricity Market Reform White Paper seen by Friends of the Earth shows that the maximum gas-fired power generation capacity needed peaks at just under 39GW between 2012 and 2016, and then declines to 35GW by 2021 and under 30GW by 2028. This capacity is used at a declining rate, with generation peaking in 2018 and then declining constantly to 52TWh/year by 2030.

This would indicate that there will be a huge amount of excess gas-fired capacity on the system, which will either have to be retired early or have CCS retrofitted (if this indeed is possible).

Friends of the Earth believes that this shows that the gas-fired capacity currently on the system, plus that already given consent (even if not all of this is built), with an allowance for possible plant retirement (Redpoint’s analysis for the Committee on Climate Change shows a very small amount of gas capacity retiring before 2021^{liii}) is more than sufficient to fulfil the role of gas in electricity generation to 2030. We believe that the Government should say enough is enough: there is no case for further gas-fired power station capacity to be consented.

C) WHAT ARE THE KEY FACTORS DRIVING THE ECONOMICS OF INVESTING IN NEW GAS-FIRED POWER GENERATION AND HOW ARE THESE FACTORS LIKELY TO CHANGE?

D) WHAT BARRIERS DO INVESTORS FACE IN BUILDING NEW GAS GENERATION PLANTS IN THE UK? WHAT ARE THE KEY REGULATORY UNCERTAINTIES THAT MAY PREVENT DEBT AND EQUITY INVESTORS MAKING A FINAL INVESTMENT DECISION IN GAS GENERATION AND SUPPLY INFRASTRUCTURE?

Friends of the Earth believes that the Government is asking the wrong question. The issue should not be ‘what barriers do investors face in building new gas plant?’ but ‘what are the right levels of gas capacity and gas generation and how can we ensure these are delivered?’

Friends of the Earth believes that the analysis presented above shows that no further gas-fired power station capacity needs to be consented.

E) ARE THERE ANY OTHER POLICY ISSUES THAT NEED TO BE ADDRESSED BEYOND THE GOVERNMENT’S PROPOSALS FOR THE CAPACITY MECHANISM AND THE EPS?

Friends of the Earth believes that the EPS and the capacity mechanism both need clarifying and strengthening, and that the Government’s should accept the Committee on Climate Change’s recommended target for power sector decarbonisation.

Friends of the Earth’s evidence to the House of Commons Energy & Climate Change Committee’s pre-legislative scrutiny of the Energy Bill contains detailed critiques of the EPS and the Capacity Mechanism. Key points are outlined below.

EPS

Friends of the Earth believes that an EPS should be designed to play its part in ensuring that the power sector is decarbonised by 2030. This should permit some grandfathering of emissions, maybe to the early 2020s,

followed by a rapid decline in permitted emissions in line with decarbonisation by 2030. This is in line with the Energy & Climate Change Select Committee's recommendation that *"if the Government is to introduce an Emissions Performance Standard, it should be used to provide an early indication of the desired emissions intensity trajectory for the power sector, in line with recommendations from the Committee on Climate Change"*^{liii}.

Capacity mechanism

Friends of the Earth believes that the Government's proposals in its draft Energy Bill for a Capacity Mechanism must be clarified and strengthened in several ways.

It must ensure that provisions such as demand-side response (DSR), storage and interconnectors are able to play the *"increasingly large role in managing supply and demand"* that the Government identifies as being important. There are no mechanisms in the draft Energy Bill to make sure this happens. In a report on DSR in forward capacity markets in the US, the Regulatory Assistance Project^{liv} notes that two capacity markets covering Eastern and North Eastern states designed along very similar lines to that proposed by DECC have been able to bring forward demand side capacity. The report states that *"Early experience in the United States (US) suggests that these markets have the potential to play a supporting role in delivering capacity from low-carbon, demand-side resources, including energy efficiency."* But it goes on to say *"However, auction results to date also suggest that these markets encourage the construction or continued operation of high-emitting supply-side resources to meet reliability targets."*

The implications for carbon emissions and decarbonisation objectives of failing to bring forward sufficient non-fossil fuel generation capacity and DSR have not been adequately considered or guarded against in the Bill. We therefore recommend that significant improvements will be required to the Bill, and supporting policies, to deliver investment in innovation in storage and DSR technologies with the aim of decarbonisation (i.e. giving priority to low-carbon sources of energy).

DECC has decided to put in place the legislative framework for a Capacity Market even though the evidence is far from conclusive and when it does not know if and when it will be used or how it will work.

Support for the chosen option is unclear: DECC's consultation on the issue of which capacity mechanism to choose was inconclusive with 35% supporting a Capacity Market, 25% preferring a Strategic Reserve, 25% didn't express a preference and 20% didn't think any kind of capacity mechanism was needed^{lv}.

A Capacity Market supposedly gives lower cost to consumers but the Impact Assessment states: *"these figures are to be treated with caution, and impacts could be higher as a result of inefficient design resulting in overpayment for capacity or an inaccurate prediction of the capacity requirement resulting in unnecessary over-procurement"*^{lvi}.

F) GIVEN A CONTINUING ROLE FOR GAS AND THE POTENTIAL FOR INCREASED VOLATILITY IN GAS DEMAND, TO WHAT EXTENT IS GAS SUPPLY AND RELATED INFRASTRUCTURE A BARRIER TO INVESTMENT IN GAS FIRED GENERATION? WHAT IMPACT WILL UNCONVENTIONAL GAS HAVE ON THE CASE FOR INVESTING IN GAS GENERATION AND THE SUPPORTING INFRASTRUCTURE?

F1 Gas supply issues

Friends of the Earth believes that gas supply presents problems which add to the case for limiting the role of gas in future electricity generation. Professor Michael Bradshaw's research for Friends of the Earth compares three scenarios for different energy futures^{lvii}:

- Green – reflecting the thinking behind Friends of the Earth’s view of the future electricity generation mix (see above) and WWF’s Positive Energy report^{lviii} with big energy efficiency improvements and major electrification of the economy. Renewable energy provides the bulk of power generation and there is no new nuclear power. The only role for gas is as a back-up and much of that gas capacity is fitted with CCS. Shale gas is not developed in the UK because of its negative environmental impacts.
- Carbon Plan – reflecting National Grid’s ‘Gone Green’ scenario: the Government’s strategy to meet the 4th Carbon Budget is achieved and the UK is on the path to cut emissions by 80% by 2050. Post-2020, this future assumes new nuclear and the commercial deployment of CCS. The role of gas is dependent on the pace of deployment of low carbon electricity generation and the development of CCS. Shale gas plays a modest role beyond 2020.
- Second dash for gas – this reflects the consequences of failure to make big improvements in energy efficiency and demand reduction and not developing enough low carbon electricity generation. This leads to higher gas demand, not only providing back up, but also a significant amount of base load. This could be the consequence, for example, of failure to deliver estimated nuclear new-build. Shale gas might contribute to UK gas production, but this is not significant until well into the 2020s.

Professor Bradshaw assesses these scenarios against four dimensions of gas security:

- Physical: avoiding involuntary interruptions of supply.
- Price: providing energy at reasonable prices to consumers.
- Geopolitical: ensuring the UK retains independence in its foreign policy through avoiding dependence on particular nations.
- Environmental: achieving the emission reduction targets in the UK Carbon Budget, while minimising the negative environmental impacts of energy production, transmission and consumption

The headline assessments are:

	Physical	Price	Geopolitical	Environmental
Green	✓	?	✓	✓
Carbon Plan	?	?	?	✓
Second Dash for Gas	?	?	X	X

(Note: ✓ = positive, ? = uncertain, X = negative)

The dimensions most relevant to this question are physical and geopolitical.

On physical security:

- The Green scenario is assessed as positive because *“the amount of gas that needs to be secured is low and the existing infrastructure, with the possible exception of storage, is adequate. The level of import dependence in this scenario is also lower simply because less gas is required”*.
- The Carbon Plan scenario is assessed as uncertain because the level of gas imports is still relatively high and there is a high degree of reliance on LNG to satisfy demand.
- The Second Dash for Gas scenario is also assessed as uncertain as higher levels of dependence on gas imports leaves the UK more exposed to the uncertainties surrounding future global gas supplies and the impact of UK and European shale gas production is unclear.

On geopolitical security:

- The Green scenario is again assessed as positive because of the low dependence on imported gas
- The Carbon Plan scenario is again assessed as uncertain because of the relatively high level of import dependence

- The Second Dash for Gas scenario is assessed as negative because *“the UK will have a much higher level of dependence on gas exporting states and it will also be more vulnerable to the possible supply interruptions and choke points associated with the LNG trade”*.

Friends of the Earth believes that this assessment demonstrates the supply risks associated with a role for gas greater than that of system balancing: a greater role for gas involves potential physical and geopolitical security risks. The Green scenario also scores positively for environmental security, whereas the Second Dash for Gas is assessed as negative under this heading.

Professor Bradshaw concludes 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”^{lix}*. Friends of the Earth agrees.

F2 Unconventional gas

Friends of the Earth believes that the potential presence of reserves of shale gas under the UK is underpinning the second dash for gas. In the eyes of the industry and the Government, it provides a readily-accessible, secure and cheap supply of gas. If the British Geological Survey increases its estimates of UK shale gas reserves as has been indicated^{lx}, this pressure is likely to increase.

However Friends of the Earth believes that shale gas is not the answer to the UK’s energy problems as is often claimed. Instead it is a dangerous and highly polluting distraction.

F2.1 The numbers and impact

Estimates of shale gas reserves are notoriously volatile:

- the US Energy Information Administration recently reduced its estimate of reserves in the Marcellus Shale (the largest US shale field) by 65% and of total US shale reserves by 41%^{lxi}.
- the Polish Geological Institute has recently cut estimates of Polish gas reserves by up to 90%^{lxii}.

Many commentators believe that shale gas will not be a game changer in the UK and the rest of Europe:

- Nick Winsor, Executive Director of National Grid said that the company does not expect shale gas to have a major impact in Europe this decade, *“if ever”^{lxiii}*.
- Deutsche Bank has said *“Those waiting for a shale-gas ‘revolution’ outside the US will likely be disappointed, in terms of both price and the speed at which high-volume production can be achieved”*. It attributes this to factors including population density, mineral rights laws and well costs^{lxiv}.
- Pöyry’s research for OFGEM found that even under its ‘Boom’ scenario, unconventional gas accounts for only a fifth of total UK gas production in 2030^{lxv}.

F2.2 Costs and prices

The consensus of opinion is that shale gas drilling will be more expensive in Europe than in the US. In Pöyry’s words *“there will remain a premium for the European cost base”^{lxvi}*. The reasons for this include:

- the need to meet tougher environmental and health & safety regulations (though Friends of the Earth believes these are still not strong enough in the UK)
- longer planning and licensing processes
- the lack of an established onshore drilling industry with many drilling rigs available
- the lack of geological information
- higher labour costs

The industry claims that shale gas will cut UK energy prices. For example Mark Millar of Cuadrilla has said “*you could see energy prices turn the corner and go down, as a result of having your own supply in your own country*”^{lxvii}. If proximity to supplies meant lower prices, then Aberdeen would have the lowest petrol and diesel prices in Europe. In addition:

- Pöyry’s research for OFGEM found that only a ‘Boom’ scenario of shale gas development in Europe would have a significant impact on UK gas prices. This scenario involves “strong political and local support in multiple countries” which is currently far from the case, so it is no surprise that Pöyry consider the Boom scenario to be ‘unlikely’^{lxviii}.
- Deutsche Bank has concluded that “*we do not expect the impact of shale-gas production on EU gas prices to be anywhere near as great as has been the case with US shale-gas production on Henry Hub prices*”^{lxix}.
- Although shale gas drilling has cut gas prices in the US in recent years, many analysts expect prices to rise significantly in the next few years: Shell believes prices will double by 2015^{lxx} and global energy expert and investor Tim Guinness predicts a 300% rise within 5 years^{lxxi}.

F2.3 Energy security

Shale gas is put forward as a solution to energy security concerns, but at least one commentator has said the opposite might be the case. Ernst & Young has concluded that a “*shale gas boom in Europe could, in practice, weaken energy security in Europe through over-reliance on a single energy source*”^{lxxii}.

F2.4 Climate change impacts

There is good peer-reviewed evidence that shale gas has a greater overall climate impact than conventional gas, and could be as damaging in climate terms as coal^{lxxiii}. The issue is the rate of methane leakage compared to overall methane production. It is estimated that fugitive methane emissions of 3 - 9% are sufficient to give shale gas a climate footprint as great as coal^{lxxiv}. Monitoring in the US has found average leakage rates are 4%^{lxxv}.

The US Environmental Protection Agency (EPA) has recently issued regulations designed to cut emissions, including methane, from shale gas drilling. However these will not have a great impact, according to leading experts in the area: Professors Anthony Ingraffea and Robert Howarth of Cornell University have concluded that “*even with the regulations, the greenhouse gas footprint of shale gas will remain larger than that of coal, when viewed over an integrated 20-year time period following emission to the atmosphere, because of the methane emissions (even though reduced)*”^{lxxvi}.

At best, the academic jury is still out. The recent Royal Society and the Royal Academy of Engineering report states “*Decisions are soon to be made about shale gas extraction continuing in the UK Decision making would benefit from research into the climate risks associated with both the extraction and use of shale gas*”^{lxxvii}. Friends of the Earth believes that this means that the research into climate impacts should be done before decisions are made.

At the global level, the dangers of increasing exploitation of unconventional gas resources have been shown by the International Energy Agency (IEA)’s Golden Age of Gas scenario. This shows that a rise in the share of gas in the global energy mix from the current level of 21% to 25% in 2035, mainly through the drilling and use of unconventional gas, would put global temperatures on course to rise by 3.5 degrees centigrade^{lxxviii}. This is far above the 2 degrees rise which the UK Government says is the maximum if we want to avoid the worst impacts of climate change. The IEA admits the problems such a rise would cause: “*we are not saying that it will be a golden age for humanity - we are saying it will be a golden age for gas*”^{lxxix}.

Even the IEA does not believe that an increase in unconventional gas would be the optimum path for global energy strategy. Fatih Birol, the IEA's Chief Economist, has said *"the optimum path would be to see more renewables, more efficiency and more low carbon technologies"*^{lxxx}.

F2.5 Local environmental impacts

Unconventional gas drilling is linked to many serious local environmental impacts:

- There is considerable evidence from the US, where shale gas has been produced for a decade, of fracking leading to contaminated water supplies in towns in Pennsylvania, Wyoming, Colorado and Texas. Causes include spills from wells, leaking wastewater pits and faulty well casings. Last year the US Environmental Protection Agency released a draft report concluding that fracking likely led to methane contamination of deep groundwater near the town Pavillion, Wyoming and that shallow groundwater contamination was likely due to surface spills of fracking wastewater^{lxxxii}.
- Studies in the US have linked fracking to increased air pollution and respiratory problems:
 - Monitoring in Texas has found levels of benzene, a known carcinogen, more than five times permitted limits near shale gas wells.
 - A hospital system in Texas serving six counties with intensive shale gas development reported asthma rates three times higher than the state's average.
 - Parts of rural Wyoming with a lot of drilling and fracking have recorded low level ozone pollution at concentrations above those in Los Angeles^{lxxxii}.
- Fracking triggered earthquakes in Lancashire last year. These shook houses on the surface but the greater concern is about the impacts underground: did it damage the integrity of the well? Structural damage to wells increases the chances of fracking fluid or methane escaping, with potential risks to water sources. Cuadrilla claim that well integrity was not affected but the evidence is inconclusive. Lancashire not the only place where fracking and related activities have triggered earth quakes: a US Geological Survey has found a 'remarkable' increase in earthquakes that are almost certainly man-made, with drilling or the injection of drilling waste water cited as a likely cause^{lxxxiii}.

The Royal Society / Royal Academy of Engineering review stated that *"strong regulation and robust monitoring systems must be put in place and best practice strictly enforced if the Government is to give the go-ahead to further exploration. In particular, we emphasise the need for further development and support of the UK's regulatory system, together with Environmental Risk Assessments for all shale gas operations and more extensive inspections and testing to ensure the integrity of every well"*^{lxxxiv}.

Friends of the Earth believes this should mean no further exploration with the current regulatory and monitoring regime. We believe that the UK Government should not allow any further drilling for unconventional gas or test-fracking, and should not award any further licences which could permit fracking, until a full scientific assessment of all the potential impacts of unconventional gas extraction on human health and the environment, including climate change, has been concluded.

This must:

- cover all the potential impacts of fracking and unconventional gas on the environment (both locally and globally^{lxxxv}) and human health;
- consider the adequacy of current legislation, regulations and enforcement;
- look at public acceptability of the risks involved (also recommended by the Royal Society and the Royal Academy of Engineering^{lxxxvi}); and
- be a public exercise, with the opportunity for all interested parties to make submissions.

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- ⁱ http://www.foe.co.uk/resource/press_releases/clean_british_energy_23042012.html
- ⁱⁱ HM Government [Draft Energy Bill](#) summary para 27
- ⁱⁱⁱ BBC [Campaigners' anger over agency's shale gas report](#) 29th May 2012
- ^{iv} Committee on Climate Change [Unabated gas-fired generation](#) 24th May 2012
- ^v NCAR [Switching from coal to natural gas would do little for the global climate, study indicates](#) 8th September 2011
- ^{vi} Jaramillo et al [Comparative Life Cycle Carbon Emissions of LNG Versus Coal and Gas for Electricity Generation](#)
- ^{vii} DECC press release [CCS competition launched as Government sets out long-term plans](#) 3rd April 2012
- ^{viii} ECC Select Committee [Pre-Legislative Scrutiny of the Draft Energy Bill](#) Q12 12th June 2012
- ^{ix} See for example The Guardian [Carbon capture progress has lost momentum, says energy agency](#) 22nd September 2011
- ^x DECC [Energy Trends March 2012](#) chart 4.4
- ^{xi} DECC [Energy Trends March 2012](#) chart 4.5
- ^{xii} Financial Times [UK warned over dependence on Qatar gas](#) 15th January 2012
- ^{xiii} Reuters [Japan energy imports jump on yr after reactor closures](#) 20th June 2012
- ^{xiv} Financial Times [Higher bills likely as LNG heads to Asia](#) 6th May 2012
- ^{xv} Financial Times [Military warns gas imports at risk](#) 15th January 2012
- ^{xvi} Financial Times [UK to warn Iran against closing Hormuz strait](#) 4th January 2012
- ^{xvii} Bradshaw [Time to take our foot off the gas? The role of gas in UK energy security](#) June 2012
- ^{xviii} Chatham House [Maritime Choke Points and the Global Energy System: Charting a Way Forward](#) January 2012
- ^{xix} Bradshaw *op cit* p24
- ^{xx} Committee on Climate Change, 2010. [4th Carbon budget report](#), p243
- ^{xxi} AEA, 2011. [Pathways to 2050 – key results](#) . markal key, p13
- ^{xxii} Committee on Climate Change 2011 [Household energy bills – impacts of meeting carbon budgets](#)
- ^{xxiii} Daily Telegraph [Gas prices will continue to rise, industry bosses warn](#) 17th October 2011
- ^{xxiv} DECC [DECC gas price projections](#) 2011
- ^{xxv} For more information, see Friends of the Earth [Gas prices: is the only way up?](#)
- ^{xxvi} Taken from Greenpeace literature review
- ^{xxvii} Oxford Economics [Fossil fuel price shocks and a low carbon economy](#)
- ^{xxviii} HM Government [Draft Energy Bill](#). p20 This appears to refer to Section B3.62 of Annex B to the Carbon Plan.
- ^{xxix} Committee on Climate Change [Meeting Carbon Budgets – 2012 Progress Report to Parliament](#) June 2012 p12
- ^{xxx} Energy & Climate Change Select Committee 2011 [4th Report. Electricity Market Reform. Volume 1](#)
- ^{xxxi} Redpoint Energy 'Modelling the trajectory of the UK power sector to 2030 under alternative assumptions' June 2012
- ^{xxxii} Redpoint *op cit* Figure 24
- ^{xxxiii} Energy & Climate Change Select Committee 2011 [6th Special Report – Electricity Market Reform: Government response to the Committee's 4th report](#)
- ^{xxxiv} Committee on Climate Change, 2010. [4th Carbon Budget Report](#). P 134. December.
- ^{xxxv} Committee on Climate Change [Unabated gas-fired generation](#) 24th May 2012
- ^{xxxvi} *ibid*
- ^{xxxvii} Friends of the Earth [What should the UK's electricity mix look like in 2030?](#) April 2012
- ^{xxxviii} See for example Tom Burke et al [Subsidising the Nuclear Industry](#) 26th March 2012
- ^{xxxix} See for example Tom Burke et al [Investing in Nuclear Power](#) 4th April 2012
- ^{xl} See for example Tom Burke et al [The New Nuclear Industry](#) 17th April 2012
- ^{xli} In comments at SMI 'Shale Gas Environmental Summit' conference 23rd May 2012
- ^{xlii} DECC [Digest of UK Energy Statistics 2011](#) table 5.7
- ^{xliiii} DECC [Updated Energy and Emissions Projections 2011](#)
- ^{xliiv} Friends of the Earth [Enough is enough](#) March 2012
- ^{xliiv} Includes RWE npower's Pembroke plant (2GW) and EDF's West Burton B plant (1.3GW) which are both expected to come online by the end of 2012
- ^{xliiv} Includes Acorn Power's Thorpe Marsh plant (1.5GW), Scottish Power's Cockerzie (1.2GW) and Damhead Creek 2 (1GW) plants, Centrica's Kings Lynn 2 plant (0.9GW) and SSE's Keadby 2 plant (0.9GW)
- ^{xliiv} Includes Eon's Seal Sands / Brine Field plant (1GW) and 2Co Energy / Shell's Don Valley plant (0.9GW)
- ^{xliiii} DECC [A call for evidence on the role of gas in the electricity market](#) para 3.1
- ^{xlix} Bloomberg New Energy Finance [Weak demand takes the bite out of the British capacity crunch](#) 29th February 2012
- ^l National Grid [National Electricity Transmission System Seven Year Statement](#) p4
- ^{li} Redpoint *op cit* section 4.2.1
- ^{lii} *Ibid* figure 8
- ^{liii} Energy & Climate Change Select Committee 2011 [4th Report. Electricity Market Reform. Volume 1](#). Para 215

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- lix Bradshaw *op cit* p34
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- lxvi Pöyry for OFGEM [The impact of unconventional gas on Europe](#)
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- lxx Financial Times [US natural gas prices to soar, says Shell](#) 19th May 2012
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- lxxiii For example Howarth et al [Venting and leaking of methane from shale gas development: response to Cathles et al](#) and Hughes [Lifecycle greenhouse gas emissions from shale gas compared to coal: an analysis of two conflicting studies](#)
- lxxiv Professor Paul Ekins, speaking at 2nd Shale Gas Environmental Summit, reported at [Top ten takeaways from UK shale gas summit](#) 29th May 2012
- lxxv Nature [Air sampling reveals high emissions from gas field](#) 7th February 2012
- lxxvi Physicians, Scientists & Engineers for Healthy Energy press release [Experts: EPA shale gas emission rules "too little too late"](#) 30th April 2012
- lxxvii The Royal Society & The Royal Academy of Engineering [Shale gas extraction in the UK: a review of hydraulic fracturing](#) June 2012
- lxxviii International Energy Agency [Golden Rules for a Golden Age of Gas](#) p91
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- lxxxi Food & Water Watch [Fracking: the new global water crisis](#)
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- lxxxvi The Royal Society & The Royal Academy of Engineering *op cit*