DEPARTMENT OF ENERGY AND CLIMATE CHANGE

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

28th June 2012

Summary

Drax believes that the EMR package of measures should be implemented as soon as possible. Once this has been done, there is no reason for further intervention in favour of gas generation, and the market should be allowed to determine the role for electricity generation from gas.

The EMR package provides:

1. Security of Supply - the Capacity Mechanism will provide the capability to ensure there is the right mix of generation technologies to manage security of supply;

2. progressive decarbonisation of electricity generation – the CfD FIT will provides the financial incentives to bring forward new low carbon projects; and the Carbon Floor Price is designed to promote lower carbon generation technologies over higher ones; and

3. reduced regulatory uncertainty - the 'grandfathered' EPS and the earlier CCS Readiness Requirement provide greater clarity of the required emissions performance.

Further intervention, particularly if promoting a particular technology like gas generation, would distort the market and could deliver a more expensive outcome or overdependence on a single fuel source.

However, DECC will affect the role for electricity generation by gas through two key areas of EMR implementation: (1) awarding of CfD contracts and (2) capacity mechanism auctions.

Awarding of CfD Contracts

DECC's decisions on awarding CfD contracts will encourage the growth of electricity from 'intermittent' (eg. wind) and inflexible (eg. nuclear) low carbon technologies, which will need to be balanced on the system. There are many solutions, other than new gas plant, that can provide the complementary flexibility needed to manage the system e.g. existing fossil plant, other new flexible generating technologies (CCS and biomass), Demand Side Response and energy storage. But, the timescale for

the implementation or innovations needed for many of these other solutions may mean they are not available in time if there is a rapid growth of ‘intermittent’ and less flexible technologies. So, DECC should consider a strategy for managing the rate of penetration of the low carbon technologies at a pace that is commensurate with a range of cost-effective complementary measures becoming available to the market.

If the pace of development of intermittent and inflexible low carbon technologies is too rapid the market may decide that the only complementary technology over the medium term is new gas plant. But, this creates a risk of:

- High dependency on a single imported fuel, which raises concern about security of supply,
- Price volatility, which creates uncertainty for business and can threaten economic growth.
- The need for additional infrastructure in future to manage large ‘swings’ in gas supply for electricity generation.
- Locking the UK into a higher level of carbon emissions until Carbon Capture & Storage for gas plant is demonstrated as viable.
- Dissuading the development of other, more sustainable, solutions to balance the ‘intermittent’ and less flexible generation.

Capacity Mechanism

The design and timing of the capacity mechanism auctions will have a fundamental effect on the role of electricity generation from gas. For example, if the auctions are implemented too late, other existing fossil plant may have already been forced to retire due to uncertainty over investment to meet ever tougher emissions standards. If the auctions are implemented as soon as possible and designed not to discriminate by technology or age of plant then the market will have the best chance to determine the need for capacity and deliver the most economic and cost-effective outcome.

As well as implementing the auctions as soon as possible, Government will also need to ensure that the projections used to determine the capacity acquired under the auctions are transparent with the underlying models and assumptions open to public scrutiny and subject to industry consultation. This will help create investotr confidence in the robustness of the process.

About Drax

1. Drax is predominantly an independent power generation business responsible for meeting some 7-8% of the UK's electricity demand. It also owns Haven Power, an electricity supplier serving the needs of business customers.

2. Drax is the owner and operator of the 4,000MW Drax Power Station in North Yorkshire, which is the largest, cleanest and most efficient coal-fired power station in the UK. It comprises six 660MW coal-fired generating units; the largest and most flexible in the country. This capability means that Drax is one of the most significant providers of flexible generation and system support services in the UK.

3. Drax is also highly active in the Balancing Mechanism (BM), providing National Grid with real-time balancing options (via BM Bids and Offers) throughout the year. In addition, the Black Start capability of the plant ensures further network resilience should the UK's electricity supply be interrupted. It should also be noted that Drax currently has the capability of storing over two million tonnes of fuel on site. All of these factors highlight the significant, strategic role that Drax currently plays, and can continue to play, in ensuring the UK's security of supply at least cost to consumers.

4. Drax is also committed to playing its part in reducing its carbon footprint and that of UK power generation. To this end, in summer 2010 the largest biomass co-firing facility in the world was commissioned at the power station. With the capability to produce 12.5% of the station's output from sustainable biomass – equivalent to the output of over 700 2MW wind turbines – Drax is by some distance the largest renewable generating facility in the UK. In 2011, Drax produced around 8% of the UK's renewable power, more than twice that of the next largest renewable facility.

5. Drax is pleased to have the opportunity to respond to the call for evidence on the role of gas in electricity generation. As one of the most significant providers of system support services, Drax is well placed to comment.

QUESTIONS

1. **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?**

Strengths

The main strength of gas generation is that it is relatively quick to consent and build compared to other major generation technologies. This means that it can be deployed at relatively short notice if the development of other technologies are slowed down or cancelled. It can also be designed to operate flexibly to complement 'intermittent' or other less flexible technologies.

Weaknesses

There are three significant weaknesses of gas generation:

1) Increases the reliance on imported gas
2) The volatility of gas prices
3) The emission of CO_2

1. Increases reliance on imported gas

As the production from the UK Continental Shelf continues to decline there will be an increased dependency on imported gas. Figure 1 illustrates the increased import dependency even with aggressive assumptions to reduce gas demand through insulation and the roll-out of heat pumps.

This analysis by NGC assumes a comparatively small role for electricity produced from gas by 2030 of around 50TWh (30TWh unabated and 20TWh fitted with CCS). This would be broadly consistent with an average electricity generation intensity of 50gm CO_2/kWh. DECC[1] projects a much higher volume (~130TWh) which would place additional reliance on imports.

[1] Updated Emissions and Energy Projections, DECC, October 2011

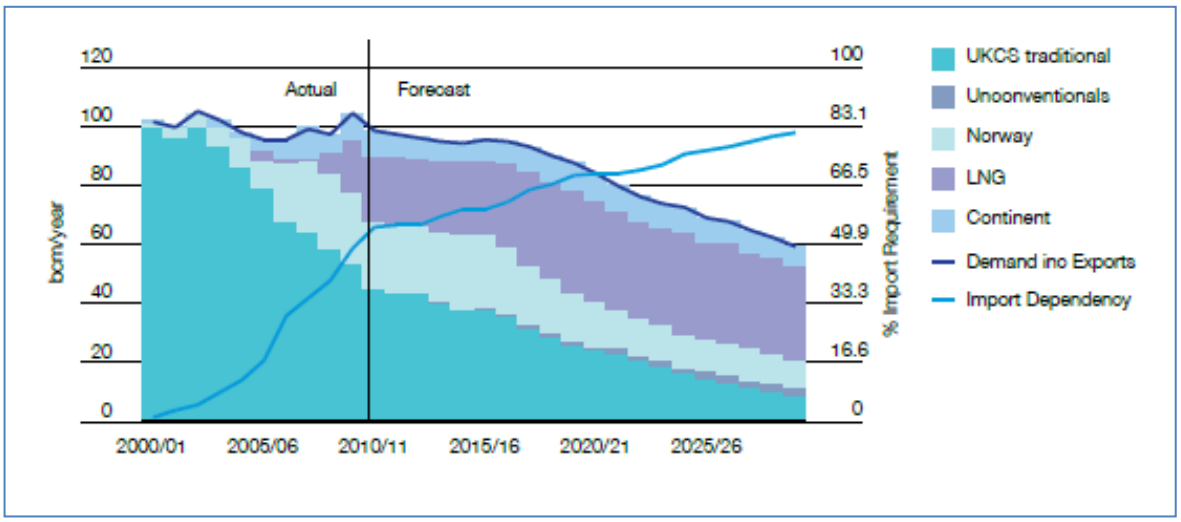

Figure 1: Annual Gas Supply Forecast for Gone Green Scenario
(Source: UK Future Energy Scenarios, National Grid)

The increased dependency on imported gas raises concerns about security of supply. In November 2011, DECC asked Ofgem to assess whether action is needed to ensure that medium to long term gas supplies remain secure. To date there is no definitive response but a recent presentation by Ofgem, Figure 2, highlighted risks to gas security of supply due to increasing imports from non-European sources.

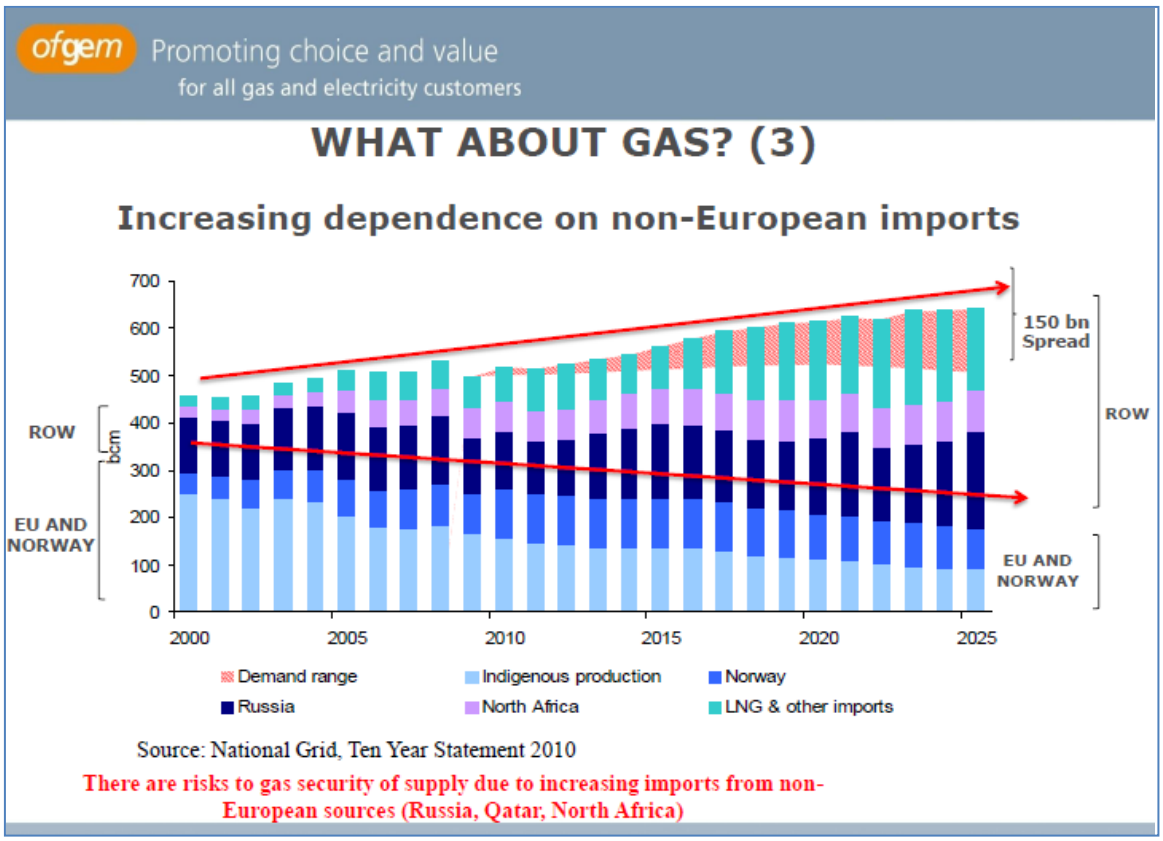

Figure 2: Alistair Buchanan at the UK Energy Summit on 03 May 2012
(Source: Ofgem)

2. Gas price volatility

The fluctuations in the price of gas over recent years have been attributed to a number of factors including changes in supply / demand (in the UK, Europe and worldwide) and linkages to oil price, as shown in Figure 3.

In the UK the gas price volatility creates uncertainty for business, which can influence both investment decisions and competitiveness and potentially lead to a negative impact on economic growth. The current diversity of electricity generating technologies has enabled fuel switching, which can serve to dampen the impact of gas volatility on electricity prices. In future this diversity may not be available if there is an over-reliance on gas generation.

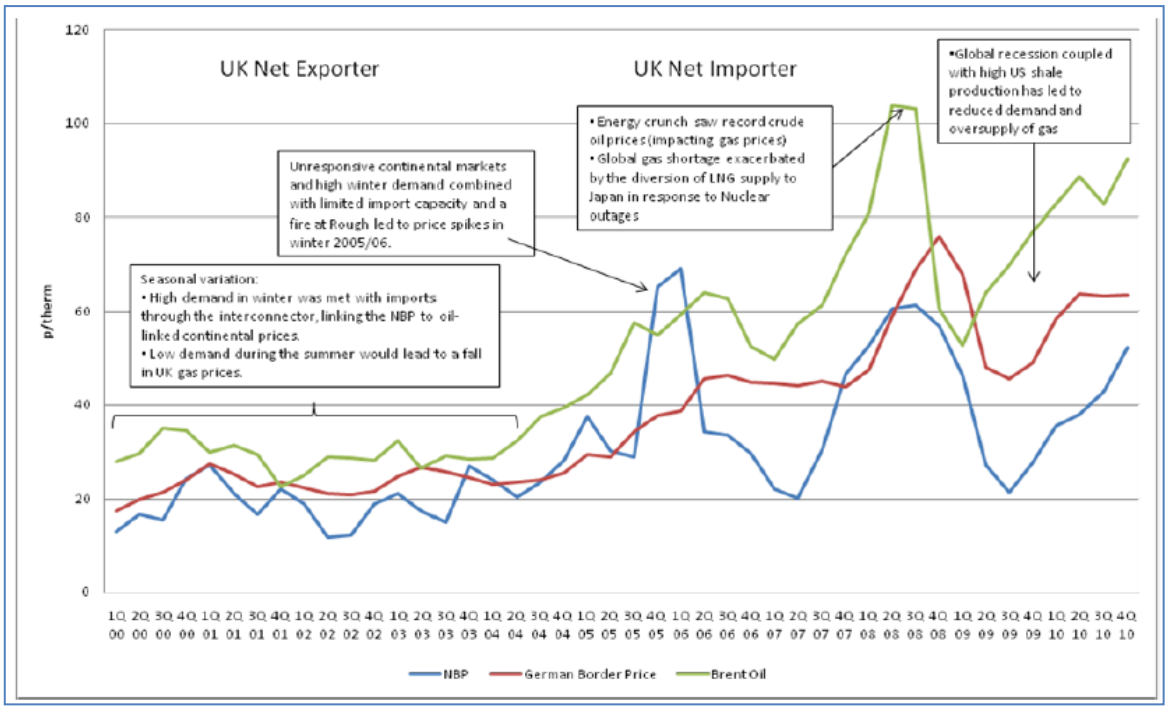

Figure 3: Comparison of NBP Gas Prices, Brent Oil Price and German Border Gas Price 2000 to 2010 (Source: DECC gas price projections, October 2011)

Whilst the historic volatility in gas prices may not be repeated the projected range of potential prices, shown in Figure 4 points to continued uncertainty

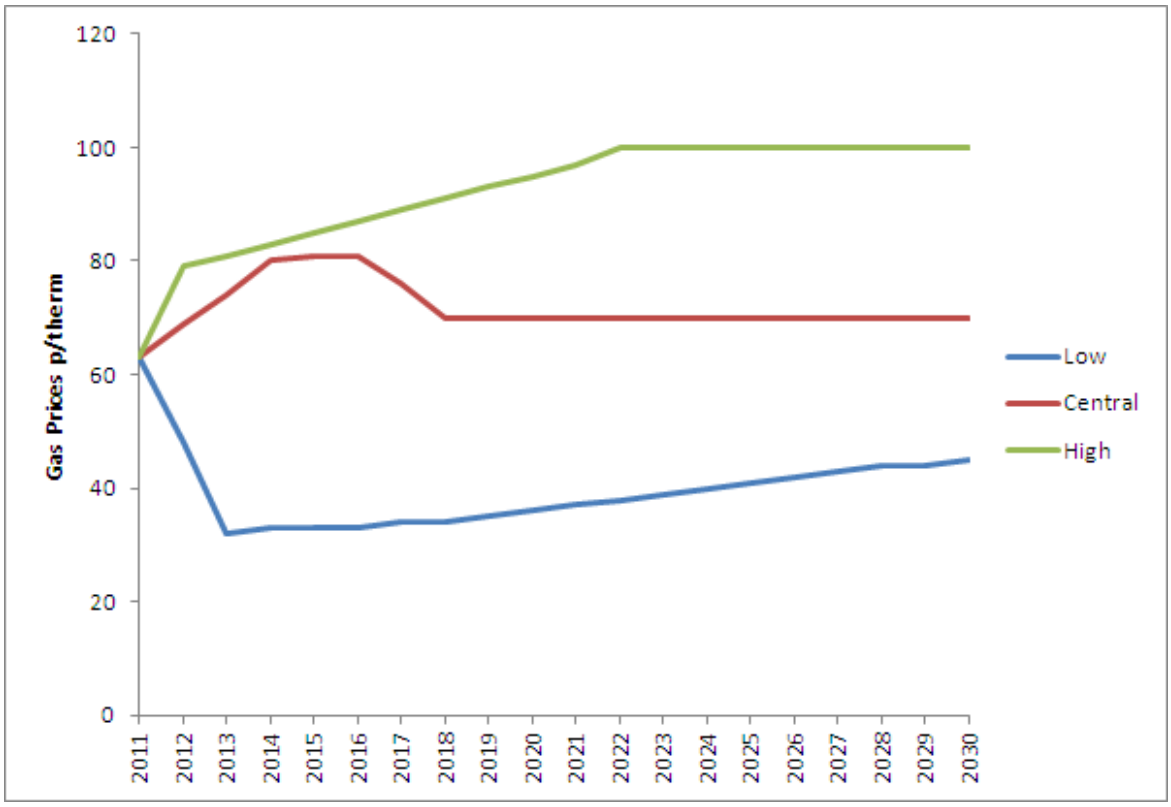

Figure 4: DECC assumed gas prices (2011 prices)
(Source: DECC gas price projections, October 2011)

3. Carbon emissions

The generation of electricity from gas produces relatively high CO_2 emissions. This is a significant weakness at a time when the UK is attempting to progressively decarbonise the electricity sector, particularly towards 2030 and beyond. Constructing more gas generating stations will lock the UK into CO_2 for the 20-30 years' life-time of these assets or until CCS is proven and can be retrofitted, which is unlikely to be economic. There are other lower carbon supply side technologies such as nuclear, wind, biomass and demand side measures, which can provide an alternative route to decarbonisation.

In this context it is important to note that the CO_2 emissions that are generally quoted for electricity from gas are just those emitted from the final combustion process. When comparing / contrasting the carbon emissions of different technologies, it is vital this is done on a full lifecycle carbon footprint basis. If such a basis is used, the actual CO_2 emissions attributable to electricity from gas generation are significantly higher, particularly for imported gas, as shown in Figure 5.

	Biomass co-firing[1]	Gas-fired generation (CCGT North Sea gas)[2]	Gas-fired generation (CCGT Middle East LNG)[2]	Gas-fired generation (CCGT Russian piped gas)[2]	Coal-fired generation (UK-mined coal average)[3]
Fuel life cycle emissions, gCO_2/MJ	20-75	122	183	193	280

Notes:
[1] Biomass co-fired at Drax Power Station
[2] Friends of the Earth
[3] Environment Agency
CCGT = combined cycle gas turbine
LNG = liquefied natural gas

Figure 5: Total lifecycle emissions of CO_2 from electricity generation
(Source: Biomass: the fourth energy source, Drax, November 2011)

2. What role can gas fired generation play in the future and what level of gas generation capacity is desirable?

Gas generation can technically provide baseload, flexible and peaking roles. However, in an increasingly carbon constrained electricity system the output from gas generation will need to gradually reduce until carbon capture and storage (CCS) is proven as technically and economically viable.

There should be no presumption or policy defining a specific role for gas or the level of capacity that is desirable (other than to ensure there is no over-reliance on gas). Once the EMR package of measures are developed and implemented the market should then be left to determine what the appropriate role is for gas fired generation. However, DECC will still affect the role for electricity generation by gas through two key areas of EMR implementation: (1) awarding of CfD contracts for low carbon generation and (2) capacity mechanism auctions.

Over the past twenty years the UK electricity system has broadly delivered the three objectives of affordability, emissions reduction and security of supply through a diversity of generating technologies. This diversity has enabled rapid switching between fuel sources in response to fuel price volatility e.g. switching to coal when gas price has been high; emissions reduction as gas replaced older coal-fired power stations and security of supply through additional infrastructure, new sources of fuel and often overlooked energy storage through coal stockpiled at power stations.

Over the next 20 years or so the mechanisms introduced by DECC e.g. the RO, FiT and the proposed CfDs are promoting the development of low carbon electricity generating technologies. Many of these technologies are either ‘intermittent’ as they rely on a primary energy source that is uncontrollable (wind and PV) or have limited flexibility in operation (nuclear). These technologies are being promoted at a time

when a number of flexible coal plants will be retiring, either because they are no longer economic, or in response to the LCPD and IED environmental requirements.

In addition to needing new capacity to replace retiring plant, these changes create a need for new means of providing flexibility and there is a general presumption that gas should provide the majority of this role. However, there are many other solutions that can also provide the complementary flexibility needed to manage the system e.g. other flexible generating technologies (CCS and biomass), demand side response and energy storage.

There are two potential problems with the presumption that gas will provide the complementary flexibility to compensate for the increase in intermittent or inflexible plant:

(1) It adds to CO_2 in the atmosphere.

As described in response to Question 1 about the emissions of CO_2 from electricity produced from gas, there are significant weaknesses in a reliance on gas (particularly from a lifecycle emissions basis) until CCS is proven. So, to remain within Carbon Budgets its production may have to be limited. Both the Committee on Climate Change and NGC have projected only a limited role for electricity produced from gas by 2030. For example, if the overall average CO_2 intensity of electricity generation is to remain below a target level of 50g/kWh CO_2 or even 100g/kWh by 2030 then the volume of electricity produced from gas will need to be considerably lower than the current projection by DECC, which is around 128TWh. Indeed if these levels are to be attained, then we estimate that the maximum output from gas fired generation will need to be no more than around 50TWh or 100TWh respectively.

2030	Gas Capacity (GW)	Unabated Gas Generation (TWh)	CCS Gas Generation (TWh)
The CCC[2]	22GW[3]	46[4]	
NGC[5]	38	30	20
DECC (Central Scenario)[6]	38.1	127.7	2.6

[2] 3rd Progress Report Supporting Data, The CCC, June 2011
[3] In addition there is 10GW of CCS (coal and gas) but the assumed capacity of each is not stated.
[4] Statement on The CCC web-site clarifying that by 2030 unabated gas generation should be no more than 10%
[5] UK Future Energy Scenarios, NGC, November 2011
[6] Updated Emissions and Energy Projections, DECC, October 2011

It is possible that open cycle gas turbines are more suited to a peaking role but their CO_2 and NOx emissions per unit of electricity produced are even higher so the production would need to be further restricted.

(2) The impact on short-term gas demand

If there is a large amount of intermittent plant on the electricity system there will be occasions when the gas plant will need to respond from near zero to full output over a short period of time. This could lead to a large 'swing' in the gas demand leading to increased storage/infrastructure costs and price volatility. For example, NGC[7] estimate that if gas was required to balance 30GW of wind on the system then on extreme days the gas demand could change by around 90 mcm/d, which could be around 30% of the flexible demand.

3. What are the key factors driving the economics of investing in new gas-fired power generation and how are these factors likely to change?

The key factor driving the economics of investing in gas-fired power stations is the clean spark spread and the projected load factor.

The clean spark spread will be influenced by the projected capacity margin, gas prices and carbon price.

The capacity margin is difficult to forecast for a number of reasons. The growth and shape of demand is unclear due to an uncertain economic outlook and the impact of energy efficiency measures and other demand side measures. On the supply side there is uncertainty over when existing fossil and nuclear plant will close and whether 'mothballed' plant (e.g. early, less efficient CCGT technology) will return to service.

The introduction of the Capacity Mechanism as part of the EMR package could remove some of the potential impact of these uncertainties for all technologies including gas.

The uncertainty around gas price is shown by the wide range of forecasts in Figure 4. The EU-ETS carbon price will be influenced by political decisions around the level of the cap on emissions and the state of economic growth across Europe. The carbon price support means there is a floor on the price of carbon in the UK but this does not affect total CO_2 emissions in Europe.

The projected load factor will be influenced by the economic merit order of different generating technologies, the amount of plant retired, and the rate that new low carbon generating technologies are brought onto the system. Even if the capacity margin could be reasonably estimated the 'intermittent' nature of some technologies

[7] TBE 2011: Development of Energy Scenarios, NGC, 14 July 2011

makes it difficult to predict when a new gas plant will operate and the market price for its output. For example, a gas generator may expect to run when there is peak demand on the system but if this coincides with high supply from 'intermittent' plant then the opportunity may not materialise. If the government implement a target for carbon intensity of electricity generation this could also affect the load factor for gas stations.

4. 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?

One of the biggest uncertainties for developers is undoubtedly predicting how the EMR capacity mechanism will affect plant margins (and hence returns) over the next decade or so. This needs to be addressed by ensuring that the capacity auctions are designed and implemented as soon as possible. Doing so should provide sufficient certainty of the regulatory framework to inform developer's and investors' decisions.

Over the past few years, the majority of CCGTs have been constructed in whole or part by one of the Big Six vertically integrated companies (eg. Pembroke, Staythorpe, West Burton, Severn Power, Langage and, Marchwood). Independent players have had only a limited role. So, it may be that even though independent generators have consented sites they have found it more difficult to secure the necessary financing in order to make the final investment decisions. Not having a 'sticky' residential supply business, and the lack of a transparent forward market price beyond 1-2 years are undoubtedly key factors which may help explain this.

Another key uncertainty or potential barrier relates to the new IPC planning process. Firstly, because it is new, that process is poorly understood by developers of all plant, including gas plant. Secondly, even though the new process is designed to give more certainty over timescales, anecdotal evidence suggests that the IPC may be adopting an overly inflexible interpretation of the rules. In particular, there have apparently been occasions when they have reset the process clock for what may have been relatively minor re-submissions of application data.

5. Are there any other policy issues that need to be addressed beyond the Government's proposals for the capacity mechanism and the EPS?

The only policy issue that needs to be addressed is how the growth in intermittent electricity generating technologies (ie. wind) is managed by DECC in line with the development of flexibility solutions that can help manage the variability of their output. To the extent that new gas plant has a role in this there may need to be an evaluation of the storage and pipeline capacity to ensure that enough gas is

available and can be delivered at the rate necessary for the associated electricity production.

6. **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?**

Infrastructure

The potential requirement for additional infrastructure and storage if gas is to have a role in managing the flexibility of the electricity system has been discussed in response to Question 2. The cost of the additional infrastructure and storage may have to be recovered from a relatively small volume of electricity if the role for generation from gas is restricted to meet Carbon Budgets.

Unconventional Gas

Drax does not have an assessment of the extent, quality and availability of unconventional gas. But, it is reasonable to assume that whatever its availability is in practice will be reflected in the market price for gas. This will feed through into the case for investing in gas generation. We have seen over recent years the volatility of gas prices due to events that impact on supply or demand. DECC's projected fossil fuel price indicate that there is significant uncertainty over future prices. The IEA highlight that there are still uncertainties around the extent and ability of companies to develop unconventional gas economically.

"The potential is there for unconventional gas supply to grow rapidly in the coming decades, but the speed at which this supply will grow is still highly uncertain. Outside North America, the unconventional gas business is in its formative years, with major questions still to be answered about the extent and quality of the resource base and the ability of companies to develop it economically." (Golden Rules for a Golden Age of Gas, World Energy Outlook – Special Report on Unconventional Gas, IEA 2012)