Carlton POWER

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Area 4E
Department of Energy and Climate Change,
3 Whitehall Place,
London,
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Dear Sirs,

DECC call for evidence on the role of gas in the electricity market

Carlton Power Limited is a UK independent power station developer and has managed projects in the UK and Europe since the company was founded in 1995. To date, we have been involved with the construction of over 1800MWs of installed electrical capacity and a further 2380MW of consented plants in the UK. As a long-standing and committed investor into the UK generation sector we take a keen interest in the debate over the long term role of different sources of generation, including gas, and we welcome DECC's call for evidence on this issue.

The role of any generation technology is to contribute to a secure, affordable and low-carbon electricity sector. Therefore we will first answer your question about the role that gas can play and then use our answer to your question about the main strengths and weaknesses of gas to focus in on some relevant details.

Q2. What role can gas fired generation play in the future and what level of gas generation capacity is desirable?

Role of gas

Combined Cycle Gas Turbine ("CCGT") based gas generation produces the lowest CO2 emissions and has the lowest construction cost of any proven thermal technology. It is the best solution for ensuring the availability of secure, low cost energy supplies whilst supporting the long term switch to renewables and other low carbon generation capacity.

In the short and medium term, the desirable level of gas capacity is that level which is sufficient to ensure that the UK can have secure generation supplies during a period when technical and environmental constraints will require the closure of coal and nuclear capacity.

Given its cost advantages, reliability and flexibility, gas fired generation has a very important role to play in ensuring the affordability and security of supply of electricity for UK consumers in the medium term at the very least. We cannot know what the future holds in terms of

- electricity storage and interconnection,
- the efficiency, flexibility and costs of existing generation technologies,
- the emergence of new low carbon technologies,
- the level of electricity demand and
- the extent to which the availability and security of gas supplies will be affected by new sources of shale gas.

In light of these uncertainties it is essential that we encourage gas generation to play a significant role in the foreseeable future, since the alternative would endanger security of supply and affordability in the electricity sector without clear long-term decarbonisation benefits.

In terms of reducing carbon emissions, gas can play an important role by enabling coal to gas switching with significant decarbonisation benefits in the short term. Furthermore, gas generation enables the deployment of intermittent renewables such as wind and marine technologies by a) reducing the impact of decarbonisation on consumer bills and the draw on already weak corporate balance sheets, leaving enough financial headroom in the sector for investment into these technologies and b) ensuring system stability once these intermittent sources of generation come on-line.

In the longer term the desirable level of installed gas capacity will in part depend on the pace of introduction of wind and solar generation. However, these cannot be considered as reliable capacity and CCGT will continue to be required to provide secure power supplies alongside these renewables but the load factors of installed gas plant, and therefore the associated aggregate carbon emissions from them, will reduce significantly. In our view trying to determine the desirable level of future gas penetration, beyond acknowledging its role alongside renewables, is misplaced and the level of that future penetration would be better addressed through market mechanisms.

In some forums nuclear generation has been presented as the alternative to gas Whilst it is true that large scale introduction of nuclear would impact upon the viability of gas fired investment, nuclear generation is a very different commercial proposition due to its much longer development timescales and many times higher cost to construct.

There is also a need for an open and transparent debate about the desirability of wide-spread nuclear deployment in the UK and its desirability in terms of fairness between the generations, decarbonisation, security of supply and affordability. Significant nuclear deployment would

- saddle future consumers with high clean-up costs and long-lived toxic waste,
- have adverse security of supply implications, since nuclear is an inflexible generation source which would not be able to balance demand and supply in the same way as CCGTs are,
- not be flexible and so would push both gas and offshore wind out of the despatch curve - this inflexibility has already lead to the need for operating wind farms to disconnected from the national grid - while offering few long-term decarbonisation benefits relative to a gas CCS technology and renewables pathway. This is especially the case once the significant adverse life-cycle carbon impacts of nuclear generation are taken account of. Nuclear generation relies on carbon intensive uranium mining, and significant raw materials are absorbed in the construction and management of nuclear plants and spent fuel storage facilities.

Desirability

For the foreseeable future it will be desirable for there to be a significant level of gas generation which is consistent with security of supply in both the gas and electricity sectors and with a cost effective decarbonisation of the electricity sector in the medium to long-term.

Government actions relating to the UK electricity market should avoid seeking to centrally plan the desired level of future gas generation. As noted above, there is considerable uncertainty surrounding the outcomes of innovation in terms of the future of electricity storage, the future efficiency, flexibility and costs of existing generation technologies and the emergence of new low carbon technologies. Similarly, the level of future electricity demand, the future availability of lower cost gas supplies and other key factors have a significant effect on the wide range of plausible potential scenarios.

A further source of uncertainty for investors is the fact that the electricity sector faces significant political and associated asset stranding risks which are only likely to intensify in the future. These risks are caused by shifting political priorities between the, at times conflicting, aims of security and affordability on the one hand and speedy decarbonisation on the other.

These numerous uncertainties result in a situation in which trying to forecast the future desired extent of gas generation, compatible with security of supply, affordability and decarbonisation, results in a wide range of future gas generation scenarios. Rather than trying to determine the future generation mix, DECC in our view should focus its efforts on ensuring the following:

The electricity market needs to be made fully competitive. As outlined in our submission on the capacity mechanism and the RMR (attached for your reference), we believe that this is currently not the case.

The question of the future role and quantity of gas in the UK generation mix would be best left to effective competition in the electricity and gas markets. This means that DECC should a) undertake genuine market reforms aimed at improving competitiveness and transparency in electricity wholesale and retail markets and b) accept uncertainty over exactly what the role of gas generation (and all other generation technologies) in such markets will be.

We would argue that to achieve cost effective decarbonisation, effective energy markets are more important than ever. Markets have a superior ability to incentivise innovation and to adapt under conditions of uncertainty: the big strength of competition lies in its ability to allow new and economically valuable information to emerge and to be effectively used. Competition is also the best driver for innovation – it makes innovation, rather than rent seeking from government, an essential part of every market participant's business strategy.

However, high levels of vertical integration combined with bilateral (rather than pool based) trading rules have resulted in a situation in the UK electricity sector in which non-vertically integrated entry into wholesale and retail markets is effectively foreclosed. The EMR does not remedy this situation. It proposes over-lapping, complex and non-transparent reforms which will a) reduce market functioning further and b) make the ability to seek rents from government the key success criterion for companies, at the expense of customers and potential investors who are not part of the "Big 6."

As we outlined in our RMR response, the degree to which the vertically integrated Big 6 companies dominate the UK electricity market from generation to wholesale to retail is a structural problem for the market and ultimately for consumers. Market structure is at the root of the competitive problems Ofgem has identified. We believe there is a need to directly address vertical integration in the sector if a lasting solution to the existing competitive problems is to be found. The alternative, behavioural regulation, becomes more and more complex and tends to show limited success over time. We are concerned that Ofgem's proposals will fail to facilitate genuinely competitive, liquid and transparent wholesale markets.

The European Union Emissions Trading Scheme ("EUETS") needs to provide all market participants with an effective carbon price signal.

Both the Commission and Member States have contributed to weakening the impact of the EUETS, usually through "green" policies and over-lapping policy development. Examples include the UK carbon price floor, EU renewable energy targets, the nuclear energy and coal policies aimed at supporting various national champions, the proposed Energy Efficiency Directive and others. Taken together, these measures either directly depress the carbon price, or increase the extent to which there is an over-allocation of allowances; the carbon market is distorted and related markets are frequently insufficiently competitive or excessively politicised. The functioning of the EUETS can be improved upon and we welcome the effort which the UK and DECC are undertaking to enhance the functioning of the EUETS.

Innovation in the development and deployment of low carbon technologies needs to be facilitated.

Markets are good at incentivising choices between existing alternatives, but can struggle to commercialise new options, especially if they are at least initially more expensive. There is hence an additional need for Government policies which create demand for low carbon innovation and help its diffusion, while ensuring that the measures taken facilitate and enhance competitive processes rather than replace them.

Governments can take steps to remove obstacles to innovation and support low-carbon R&D directly where needed. For example, in a climate of capital constraints and high levels of risk aversion, governments might make available finance in, for example, co-investment vehicles which effectively act as venture capital type seed money for early stage R&D. We would suggest that the Green Investment Bank is potentially a useful vehicle in this context. It is, of course, important to remain technology neutral and to enable competition in R&D, not to substitute for it. The current proposals for wide ranging CfD support of low carbon generation must not be allowed to become a route for companies to lock in highly profitable returns with inherently non-competitive technologies. Large scale implementation of the CfD mechanism must be subject to transparent auctions between comparable, but not necessarily identical, technologies.

DECC has also been playing a very active and helpful role in trying to limit the government-induced barriers to the deployment of low carbon technologies through its support of e.g. appropriate planning reforms.

Q1. 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?

Gas generation has many strengths that can help deliver a secure affordable route to decarbonisation in the UK. We will discuss these below under the headings of Security, Affordability and Decarbonisation.

Security

There are two relevant aspects of security of supply in this context: a) the security of supply implications of gas fired generation for electricity supplies and also the security of supply of gas itself as a primary fuel.

Gas generation technology has significant benefits for short-term security of supply and the operational stability of the electricity sector. It has an excellent availability and reliability record. Furthermore it is highly flexible and is hence essential in ensuring that demand and supply balance at all times. This security of supply benefit of gas generation is going to become increasingly important as the UK increases its deployment of intermittent generation.

CCGTs are also able to ensure security of supply in the medium term. They are a trusted and proven technology, which is quick to construct. The UK has a number of existing consented projects which are substantially ready for construction, which means that gas can respond to a need for capacity quickly and is the only technology which can reliably and quickly fill the UK's looming generation gap.

As for the security of supply of gas itself, we believe that developments in transport capability and technology such as LNG and shale gas extraction have significantly increased world-wide availability. The location of the UK in terms of both proximity to gas reserves and ability to import LNG assures the long term security of this critical energy source. As we note in our response to question 6, financial investors and banks do not perceive future gas supplies as a particular risk factor.

Affordability

On a per MWh of electricity generated basis, CCGTs are the cheapest forms of generation, even for a very wide range of realistic assumptions about future gas prices, due to the relatively low build and maintenance costs associated with CCGT technology (see Table 1.) (For Gas CCS, Coal CCS, and Wind Offshore Phase 3 the figures in this table include significant anticipated cost savings over which, of course, these is still a fair degree of uncertainty.)

Table 1: Technology O&M Fixed Cost and Construction Cost Assumptions

Technology	"O&M Fixed Costs (£/MW/yr) Medium - nth of a kind"	"Total Capital Costs (£/MW) Medium - nth of a kind"	Source	PB name
CCGT	23,182	668,900	PB	CCGT
Gas CCS	33,000	1,313,800	PB	CCGT with CCS
Coal unabated	35,000	1,642,700	PB	Coal ASC with FGD
Coal CCS	59,600	2,876,000	PB	Coal ASC with FGD and CCS
Nuclear	60,000	3,029,500	PB	Nuclear PWR (multiple units)
Wind Onshore	13,703	1,520,000	Mott MacDonald	
Wind Offshore	50,243	2,840,000	Mott MacDonald	
Wind Offshore Phase 3	68,514	3,087,000	Mott MacDonald	

Souces:
Mott MacDonald Report http://www.decc.gov.uk/assets/decc/statistics/projections/71-uk-electricity-generation-costs-update-.pdf
PB Report http://www.pbworld.com/pdfs/regional/uk_europe/decc_2153-electricity-generation-cost-model-2011.pdf

CCGTs have significant cost advantages when compared with other forms of generation. For instance, in comparison with offshore wind generation where the build cost estimates range from £3,094,000 per MW for Phase 2 to £ 3,606,000 per MW for Phase 3. Furthermore, offshore wind faces very high O&M costs once deployed (see Table 1.) However, in contrast with nuclear, wind energy and other renewable technologies offer the genuine prospect for cost reductions over time as well as zero fuel costs, no uninsurable risks and no back-end costs and waste.

The main source of cost uncertainty for CCGTs is fuel price risk originating from the uncertainty of future gas prices. This risk is, however, one that CCGT operators are experienced in managing and hedging, provided they operate in a competitive gas and electricity market which provides them both with price signals which reflect fundamentals and the products and tools needed to respond to these signals effectively.

The barriers to investment currently faced by CCGTs are discussed in our answer to Question 4.

Decarbonisation

Historically, coal to gas switching has played the single most important role in enabling the UK to decarbonise its electricity sector. If the lights are to stay on, this coal to gas switching will have to continue in the near future, especially in response to the plant closures precipitated by the LCPD. While essential from a security of supply perspective, this is also not an undesirable outcome in terms of decarbonisation. Gas is the lowest carbon fossil fuel source available. As outlined above, gas generation enables the deployment of intermittent renewables such as wind and marine

technologies and in the medium term, if gas prices remain favourable relative to coal prices, there will be a significant incentive to develop gas CCS technologies, which will decarbonise gas generation. There is accordingly no reason to presume that gas is only a transition fuel.

The long-term life-cycle decarbonisation benefits of nuclear on the other hand are questionable, especially once the carbon impact of the construction of the plant itself, the storage of nuclear waste and the mining of the uranium ore that fuels it is taken account of.

Whilst modern efficient CCGT generation represents a lower carbon alternative to other means of thermal generation and has a major role to play in the move towards a decarbonised economy, we of course acknowledge that it emits CO2. However nlike wind and solar based technologies, there is a fuel cost with gas generation. This fact along with the long standing subsidised support of renewables technologies, means that whenever they are available to run, installed renewable plant that rely upon a zero cost fuel will always run in preference to gas in the merit order.. As a result, the yearly carbon emissions from any installed gas fired plant will automatically reduce as the renewable, zero carbon capacity increases

2020 and 2050

Using this analysis of strengths and weaknesses of CCGTs in terms of security of supply, affordability and decarbonisation, we briefly summarise below the role that CCGT generation can play in delivering a secure and affordable route to decarbonisation through to 2020 and then 2050:

Table 2: Summary of benefits of gas-fired generation to the UK

2020	• Shortest delay between investment decision and operation; best able to ensure sufficient capacity and security of supply in the medium term
	• Lowest cost of energy with comparatively low total carbon emissions/MWhr
	• Reliable, flexible and predictable technology with well understood costs
	• Facilitates the deployment of renewables technologies by reducing the call on balance sheets/the overall financing envelope and ensuring short-term security of supply

2050	• Ideal technology to ensure long term security of supply and support to intermittent renewable and inflexible nuclear generation
	• Can be used at high load factors when required
	• Can provide fast reliable response to back up wind powered and solar generation
	• CCGT's potential for carbon lock is very limited as its high fuel cost v low initial capital cost will ensure that gas fired plant only runs when required and CfD supported renewables are not available
	• Potential for long-term decarbonisation of gas-fired technologies through development of CCS technology

Q3. What are the key factors driving the economics of investing in new gas-fired power generation and how are these factors likely to change?

Certainty is a key factor for investment in new gas plant as it is with most other forms of investment. There are a number of issues upon which investors in gas generation will require a degree of certainty. The regulatory issues will be discussed in response to question 4 below.

The pace and scale of introduction of CfD supported generation capacity will strongly influence the load factor and revenue which can be achieved for new CCGT. Because of the financial profile of most renewable plant (high initial capital costs and low or zero fuel costs) most CfD supported plant will always run when available. As a result, gas plant will only run and enter the wholesale market when the demand exceeds the available CFD supported plant. This is not a bar to investment in new gas generation but investors will not be able to rely upon plant running continually at base load to make a return.

The long term price of gas is a fundamental driver for the economics of CCGT but, of course, there can only be limited certainty about future prices. In place of certainty about prices, investors rely upon the operation of effective markets. Therefore for investors in non-vertically integrated generation it is essential that the wholesale electricity markets are sufficiently transparent and liquid to reflect the true cost of generation. In this way, if in future gas plants run with low base loads to supplement renewable generation, the price obtained for the limited electricity output should reflect a necessary return for investors. Of course, this requirement could be offset by judicious deployment of an appropriately designed Capacity Mechanism.

The current uncertainty over future market size means that it will be difficult for investors and financiers to make a realistic assessment of "merchant" risk and this is having the effect of limiting investment to those plants with long term tolling agreements. In practice, project finance banks currently require such tolling agreements to be in place before they consider a project. Such long term tolling agreements are not generally available in the UK market at present due to the dominance of the vertically integrated companies. This is another compelling reason for seeking truly transparent and liquid markets.

Q4. 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?

There are a number of regulatory uncertainties which currently form barriers to investment in new gas generation plants in UK.

As explained above, as a greater volume of renewable generation is introduced into the UK, CCGT will be required to support security of supply but the load factors of that CCGT will inevitably decrease over time. Investors will be concerned about the resulting reduction in income and return from new gas investment. An appropriately designed Capacity Mechanism can have an important role to play in supporting the required investment in new gas generating infrastructure. At this point in time however, the lack of clarity regarding the final design and actual implementation of that Capacity Mechanism is a significant barrier to investment decisions. Furthermore, we are concerned that market-wide mechanism as per current proposals is likely to end up supporting and extending the operational life of existing high CO2 producing coal and inefficient gas plants and would inevitably reduce investment in new gas generation.

Similarly investors need to be confident that the UK will continue to maintain its commitment to the planned closures of polluting plant under the Large Combustion Plant Directive, and the implementation at the proposed levels of a carbon price floor. Investment decisions in new gas generating plant will need to assume that current high polluting plant which is planned for closure will indeed close on schedule rather than be given life extensions when generation margins tighten in the short-term.

The level of CfD support for the development of renewables, and in particular the development of new nuclear generating capacity, will also have a bearing on investment decisions. Clarity is required over the scope and level of such support. Significant support for nuclear would depress investment in new gas generating capacity, as the inflexible nature of nuclear will inevitably lead to lower load factors for gas, while doing nothing to enhance security of supply alongside intermittent renewables.

Q5. Are there any other policy issues that need to be addressed beyond the Government's proposals for the capacity mechanism and the EPS?

As noted above, we believe that urgent reform is essential to create a liquid and transparent wholesale electricity market. This reform needs to extend to both the generation and supply sides of the wholesale market for that market to become genuinely competitive and open. We gave more details of our views and proposals in this area in our response to the RMR process (copy attached.) It is important that the EMR and market reform issues are considered together in a co-ordinated approach so that they together assist the market deliver the required investment for appropriate assets.

We are concerned that the Government's market-based proposals for the capacity mechanism may subsidise, or represent windfall payments to, existing generating plant. As such, these proposals could prove expensive and end up supporting older, high CO2 producing, and polluting infrastructure. We would favour a mechanism more targeted to supporting new efficient plant producing less CO2. In this way, the scheme should be cheaper and will result in efficient plant coming forward which can support renewable generation in the medium to long-term as well as the short-term.

Q6. 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?

In the current market, we do not see gas supply and related infrastructure as a barrier to investment in new gas-fired generation. The UK is comparatively close to large gas resources and has also recently developed significant liquid natural gas (LNG) import capability. Given current levels of gas consumption, the available infrastructure is sufficient for further investment in gas generation. Future investment in gas storage capacity may be of benefit in relation to securing security of supply in exceptional circumstances but is not an area of major concern to investors.

If additional infrastructure is required in the future, we consider that any truly open and competitive gas market would provide the necessary investment as required. As the volume of renewables on the

system increases, the load factor of CCGT plant will fall with commensurate reductions in the requirements for gas import capability.

The outlook for unconventional gas is currently too uncertain to have a major impact on investment in gas generation and supporting infrastructure. If in the future substantial reserves of shale gas in the UK are identified and developed, we would expect this development to have a positive impact on both the price of gas and lower our requirement to import that gas. However, the case for new gas development to enhance security of supply in an affordable and flexible manner does not rely upon the identification and development of unconventional gas in any meaningful quantity. The development of unconventional gas production would further support the case for gas against other thermal generation but will not affect the balance between gas and most renewable generation due to the zero fuel costs of wind and solar plant.

Yours faithfully,

For and on behalf of Carlton Power Limited

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Attachments

1. Carlton Power's response of 8 May 2012 to Ofgem's Consultation on Retail Market Review: Intervention to enhance liquidity in the GB power market

2. Carlton Power's response of 4 October 2011 to DECC's Consultation on possible models for a Capacity Mechanism arising from "Planning our electric future: a White Paper for secure, affordable and low carbon electricity"

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