



Gas Generation Call for Evidence
DECC (Area 4E)
3 Whitehall Place
London SW1A 2AW

28 June 2012

Dear Sir / Madam,

RE: Response to DECC's Call for Evidence on the role of gas generation in the electricity market

Thank you for the opportunity to respond to your Call for Evidence. As a major European generation technology manufacturer, Wärtsilä has proactively participated in the energy policy debate in the UK as well as in Europe more widely. We welcome this consultation, and hope that greater clarity on the UK Government's position on the role of gas generation can emerge as a result. Our responses to the individual consultation questions are contained below, and a 'viewpoint' from Wärtsilä is contained at Annex A.

In our view, gas generation can play a significant role in the UK energy system both in the medium and the longer term. Gas generation offers the flexibility to maintain security of electricity supply on a dynamic basis, with capability to immediately start/stop and ramp up/down rapidly to ensure maximum renewable output. It is critical that this role for unabated flexible gas generation (among other sources of flexibility) is maintained for the long-term. To deliver the required long-term investment, electricity market arrangements must appropriately reward flexibility such that its future value can be realistically and confidently predicted by potential investors.

Kind regards,

Responses to consultation 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?

Gas generation can play a significant role in the UK energy system both in the medium and the longer term.

Most fundamentally, as the energy mix moves towards greater amounts of inflexible generation (nuclear, gas and coal with CCS) and a higher penetration of intermittent renewables, gas generation offers the flexibility to maintain security of electricity supply on a dynamic basis. In the medium to longer term, flexible gas generation can play a 'wind-following' role, with capability to immediately start / stop and ramp up and down rapidly to ensure maximum renewable output. It is critical that this role for unabated flexible gas generation (among other sources of flexibility) is maintained both in the medium and the long-term.

In the long term to 2050, gas generation with CCS can make a significant contribution to the full decarbonisation of the baseload and mid-merit segments of the market.

In addition, we would note the following:

- Gas generation technology is well-established and mature, with the technology risks well understood and financeable. Construction time is relatively short, meaning that capacity can be added quickly in response to an identified need.
- We understand concerns about the exposure to volatile global gas prices, however we note that Great Britain (GB) has a liquid and competitive gas market. While there may be a need for increased fast-cycling storage in future to allow gas generation to provide the required rapid flexibility, GB has access to an increasingly large and diverse range of import sources. The increased availability and use of LNG import facilities (with LNG coming from a wide variety of countries), interconnection with Europe, and the longer term potential for coal bed methane and shale gas mean that GB is well-positioned from a security of supply perspective. That said, we can see the merit in undertaking a review of the long-term risks to gas security of supply, to ensure that market arrangements remain fit for purpose in future.
- The location of gas generation is more flexible than renewables (and to a certain extent nuclear) reducing the required investment in new grid infrastructure. There is also extensive gas transmission infrastructure that can be utilised at low incremental cost.

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

The key role for gas generation in future will be in providing much-needed flexibility to the system.

The UK Government's decarbonisation and renewables agenda will radically change the generation mix, leading in particular to a much greater level of intermittency on the system. Our analysis indicates that statistically 'known' wind variability could be significant in 2020 – ranging from around 4 GW one hour ahead of real-time, to around 12 GW three-hours ahead. At the same time the existing supply of flexible capacity is expected to fall significantly in the period to 2020, by up to 15 GW over a 3 hour response period.

The flexible capacity required to fill this gap and manage intermittency will need to come from a variety of sources, including new supply-side capacity, Demand Side Response (DSR), interconnectors and storage. While DSR and interconnectors could go some way to meeting the flexibility gap, it is clear that there will still be an increased need for new supply-side flexibility in the period to 2020. The challenge is to establish market arrangements that promote the emergence of an efficient portfolio of flexible technologies that can meet the intermittency challenge at least cost to consumers.

Given the relative reliability and security of gas generation, we would anticipate an enduring role in the long term also, both in terms of providing flexibility and in facilitating decarbonisation (i.e. gas with CCS).

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 short-medium term investment in gas generation is the current and expected capacity margin, which in turn drives spark spreads (inversely).

In the longer term there are a new set of market risks for gas generation. Injecting such large amounts of low marginal cost energy into the electricity market is likely to have a significant impact on wholesale electricity prices, which will affect the investment fundamentals in new gas generation. Large amounts of variable wind power on the system will depress prices overall, increase price volatility and reduce load factors for conventional thermal plant. As such, the investment case for new thermal plant will be increasingly dependent on price spikes during periods of low wind. This is only expected to increase as the penetration of wind generation in the UK capacity mix increases.

In addition, for new investment in gas generation to provide flexibility, electricity market arrangements must appropriately reward flexibility in balancing resources such that its future value can be realistically and confidently predicted by potential investors.

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?

At present there is an excess of capacity on the system, due to the recessionary peak demand and the recent addition of new plant. Therefore spark spreads are not likely to be high enough to support new investment.

In the medium to longer term, investment is being constrained by a perceived lack of political commitment to the sector, combined with a lack of policy certainty under EMR:

- **Political commitment:** One concern of the financing community when looking at investment opportunities in new gas generation in the UK is that there has to date been mixed messages from Government on the long term role of gas generation. While the outcome of this Call for Evidence should provide greater clarity in this respect, there may still be ongoing uncertainty over the future generation mix (e.g. nuclear, CCS) that holds back investors.
- **Policy uncertainty:** Given the evolving dynamics described above, the proposal for a capacity mechanism is a welcome step in the right direction. However there is still a huge amount of detail that remains unclear. In addition, a capacity mechanism focused on resource adequacy may not deliver the right type of flexible capacity needed to manage the intermittency challenge.

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

As stated above, while DECC's preferred form of capacity mechanism may increase the GB capacity margin and reduce risks to security of supply, it may not deliver the right mix of flexible capacity at least cost to consumers.

The role of price signals in the GB market will therefore remain critical going forward. This underlines the importance of Ofgem's Electricity Cash-out Significant Code Review (SCR) and the wider European drive for harmonisation of electricity balancing arrangements. In our view the current cash-out arrangements do not provide the appropriate price signals, and therefore may actually present barriers to the emergence of an efficient mix of flexible technologies. We consider that new approaches to balancing and reserve procurement are required (e.g. a day-ahead reserve market), and given the importance of flexibility to the renewables and decarbonisation agenda we would urge DECC and Ofgem to work together to deliver an efficient solution.

One area that creates significant uncertainty – in terms of the likely capacity mix and the demand for additional capacity in the 2016-2023 time-frame – is the UK Government's position both on new nuclear build

and on the retirements of the existing nuclear fleet. To the extent that the existing plants may be extended, this will significantly affect the market fundamentals on which investment in new gas generation will be based.

In addition, more work need to be done to create a credible decarbonisation strategy for the gas sector. Mid-merit gas generation with CCS has the potential to play a key long term role in a decarbonised capacity mix.

- 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?**

With increasing short term fluctuations in gas demand from flexible gas generation used to manage intermittency, significant localised short term storage will be needed. However, lower gas prices caused by a slump in demand and increased supply from unconventional sources in the US is potentially masking signals for such flexible investment. As with electricity, the gas market arrangements need to ensure that the long-term value of flexibility is revealed so as to stimulate the required investment.

Annex: A viewpoint from Wärtsilä

The power sector is key to overall European decarbonisation goals

The European decarbonisation agenda is radically changing the capacity mix for power generation. This sector is widely viewed as the critical first step on a longer term pathway, both because there is a wide range of abatement options, and because low carbon electricity provides an ideal route for subsequent decarbonisation of heat and transport.

Renewables deployment is critical

In that context, delivering new low carbon generation efficiently will be key. Nuclear options face huge political and cost challenges after Fukushima, and the potential of Carbon Capture and Storage (CCS) remains to be proven technically and commercially. In that context, large scale renewables deployment is essential, with wind and solar (depending on resource levels within different countries) forming the majority of new plant.

Complementary flexibility is needed

Wind and solar are both intermittent, with output at any time dependent on the weather. Levels of generation will therefore fluctuate in a volatile manner, and will have an inherent forecast uncertainty. In order to accommodate a high volume of renewables output, there will therefore be a corresponding need for significant investment in flexible capacity, both to handle the predictable variations in the supply-demand balance, as well as to manage the unpredictable fluctuations in output from renewables (as well as demand swings and outages in conventional generation as currently).

Conventional sources of flexibility are set to reduce

At the same time, the impact of EU Directives on other emissions (SO_x, NO_x and particulates) is leading to the closure of a significant amount of older coal, oil and gas plant in some markets that currently provides a lot of the flexibility needed at the system level.

Different types of flexibility are needed

To ensure that renewables can be deployed efficiently, and at lowest cost to consumers, it is important first that the flexibility is available, and second, that it is provided in the most efficient way. Without it, the system could become unable to manage the intermittency, leading to a constraint on new build, and the potential need to curtail wind or solar output at certain times. But the mix must also be right. While it is likely that demand-side response, increased interconnection and storage will all have important roles to play, generation flexibility will remain essential.

Box 1: The 'flexibility gap' in GB

The UK Government's decarbonisation and renewables agenda will radically change the generation mix, leading in particular to a much greater level of intermittency on the system. Our analysis indicates that statistically 'known' wind variability in GB could be significant in 2020 – ranging from around 4 GW one hour ahead of real-time, to around 12 GW three-hours ahead. At the same time the existing supply of flexible capacity is expected to fall significantly in the period to 2020, by up to 15 GW over a 3 hour response period.

The flexible capacity required to fill this gap and manage intermittency will need to come from a variety of sources, including new supply-side capacity, Demand Side Response (DSR), interconnectors and storage. All up, we estimate that DSR and interconnectors could provide between 2 GW and around 13 GW of flexibility over a three-hour period in 2020. While this would go some way to meeting the flexibility gap, there is significant uncertainty in these estimates. It is thus clear that there will still be an increased need for supply-side flexibility to manage the wind variability.

The importance of truly dynamic supply-side flexibility

Flexibility provision can be thought of as having two dimensions – the response time (within seconds, minutes or hours), and the time over which the response can be sustained (minutes, hours or days). A very fast response capability must be preserved at all times, so following an incident or variation from forecast which draws on this, other (slower) capability is used to relieve it and make it available for future use.

Different technologies will have different technical capabilities and costs of providing different forms of flexibility, so typically the most efficient overall solution will be met through a number of different means. These include, for example, automatic response from plant that are in any case running, holding plant synchronised and able to ramp quickly ('spinning reserve'), and through plant that can very quickly start up, synchronise and ramp. As intermittent capacity increases, it is likely that this latter form will become more important. This is because providers of spinning reserve will produce some minimum level of output which will not only have associated fuel costs and carbon emissions, but may also be displacing renewables output in windy and/or sunny conditions. These costs can be avoided where it is possible for quick response plant to start from zero output. This is explained further in Box 2 below.

Box 2: Part-loaded plant

Most Combined Cycle Gas Turbines (CCGTs) and coal plants are not optimally designed for the extreme operating regime that is likely in future. The highest efficiencies for these plants are likely to be achieved by running baseload or mid-merit, rather than in the 0 to 3 hour window. Even for plants that appear technically capable of providing responsiveness within the last hour, it may not be efficient for them to fulfil this function.

As a result, such plants would need to run 'part-loaded' at their stable export level (typically 50%-70% of capacity) in readiness for dispatch, which would in turn add costs to the system in terms of fuel and carbon costs, wear and tear, and maintenance costs. It could also lead to lost renewables output, to the extent that part-loading the CCGTs leads to wind curtailment. Finally,

part-loading these plant at their Stable Export Level (50-70%) means that there is less capacity available from these plants for flexibility purposes (i.e. only the upper half of the total name-plate capacity can be used).

Responsible parties

In determining how flexibility is delivered, this complex physical picture must be overlaid with the roles of the different commercial entities involved. This includes:

- The role of the System Operator, ultimately responsible for preserving overall balance on the system.
- Forecasting and information provision by suppliers (on behalf of their customers) and generators,
- Accuracy of dispatch and plant reliability by generators, and
- The roles suppliers and generators play in balancing their own portfolios as forecasts change.

The roles and incentives of different parties currently vary country-by-country, as does the mix of markets and mechanisms available through which to buy and sell flexible services. These range from the use of spot energy markets, to balancing markets/mechanisms in which generators and suppliers can offer to increase or decrease output/load for System Operator actions, to reserve procurement auctions, tenders or bilateral contracts managed by the System Operator. The onus and incentives on market participants to balance their own portfolios, and the timing over which they do so compared to the centralised role of the System Operator, also vary, with wind in particular often being treated differently.

Amidst all this complexity it is often far from clear whether key economic principles are being adhered to, which will be critical in ensuring an efficient mix of flexibility in the long run. In particular, there needs to be appropriate cost targeting for market participants – in other words that parties that create balancing requirements on the system ultimately bear the costs – and appropriate incentives for System Operators to ensure that they procure and utilise balancing services in an efficient way.

Market arrangements

Electricity market arrangements must appropriately reward flexibility in balancing resources such that the future value of this flexibility can be realistically and confidently predicted by potential investors.

Whilst there are different potential approaches to these challenging issues, we believe that two principles will be key in delivering an appropriate solution for Europe. First, a consistent and harmonised approach across countries, as envisaged in the Third Package, will be important. Second, transparent and liquid markets for balancing products can provide both tools for those needing flexibility (including suppliers, generators and System Operators), as well as clear price signals for those with the potential to offer flexibility from an existing portfolio, or to invest in future new flexibility.

In Box 3 below we set out a brief overview of the current debate on market design in GB.

Box 3: GB market design

As part of its Electricity Market Reform (EMR) process, DECC has decided to implement a 'market-wide' capacity mechanism in GB, which will be in the form of a forward capacity auction with availability incentives and penalties. The rationale for intervention is to deal with the so-called 'missing money' problem brought about by increasingly uncertain market-based revenues for thermal plant. Our understanding is that the capacity mechanism will be technology-neutral (subject to meeting technical availability requirements), focused on ensuring overall capacity adequacy rather than on securing certain types of capacity. In our view, while this form of capacity mechanism may increase the GB capacity margin and reduce risks to security of supply, it may not deliver the right mix of flexible capacity at least cost to consumers.

The role of price signals in the GB market will therefore remain critical to rewarding flexibility in GB going forward. This underlines the importance of Ofgem's review of the electricity balancing arrangements (the 'Electricity Cash-out Significant Code Review'). Under the GB market design, the electricity cash-out arrangements provide important incentives on markets participants to balance their own position, taking into account known variations in the supply-demand balance. The cash-out arrangements should provide the right price signals to facilitate the emergence of an efficient mix of flexible technologies, recognising the different technical characteristics provided by different flexibility products.

In our view the current cash-out arrangements may not facilitate the emergence of an optimal mix of flexible technologies. Firstly, they may under-value (or not transparently reveal the value of) different flexibility products in price signals; and secondly, they are complex and unpredictable, which can act as a barrier to entry for flexibility providers, and can encourage 'internalisation' of cash-out risk within the Vertically Integrated Utilities (VIUs).

We believe that the emergence of an efficient flexibility mix will be best facilitated via transparent market-based solutions that encourage maximum participation and efficient price discovery. In our view, Ofgem needs to consider new approaches to balancing, such as a day-ahead reserve market, which can reveal the true value of flexibility and deliver the required investment.