



Ole Johansson  
President & CEO

10th March 2011

Department of Energy and Climate Change  
3 Whitehall Place  
London SW1A 2AW  
United Kingdom

On behalf of Wärtsilä Corporation, I welcome the opportunity to participate in the Electricity Market Reform (EMR) consultation process launched by the Department of Energy and Climate Change. As providers of innovative power generation technologies on a global basis, we are keen to engage directly on the issues on which we feel most strongly, in particular the demand for and provision of efficient flexibility on all timescales.

The EMR proposals will lead to a greatly increased need for flexible capacity in line with low carbon deployment. However, much of the dispatchable plant in the UK will be retiring, and the true economic cost of providing flexibility from the current fleet of thermal plant under more demanding operating regimes is not well proven. Whilst this will create opportunities for new flexible technologies, we believe that ensuring an appropriate investment environment for such capacity is a critical part of EMR considerations.

The current proposals leave a great deal of uncertainty around the economic returns for most flexible plant, and consequently we believe there is a risk of insufficient investment. The Government has considered the role of capacity mechanisms, and we agree that additional intervention is required. We also agree that a universal mechanism, with 'capacity payments for all', does not create the right form of incentive.

We are however concerned that the Targeted Capacity Tender (TCT) mechanism alone may not fully address the investment 'gap'. We believe that the role of the proposed mechanism should be broadened, creating a centrally co-ordinated role for the procurement of flexibility across the spectrum of energy balancing and network management requirements. This should enable the efficiencies associated with treating requirements on a portfolio basis to be fully recognised, and technologies that can play a broad range of roles to be remunerated appropriately.

welcome the opportunity to meet and discuss these issues in more detail.



## **Electricity Market Reform**

### **A response to the Department of Energy and Climate Change Consultation**

Wärtsilä Corporation  
John Stenberginranta 2  
FI-00530 Helsinki  
Finland

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The contact for queries and questions on our response is:

[REDACTED]

[REDACTED]

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## 1 EXECUTIVE SUMMARY

1.1.1 We welcome the opportunity to participate in the Electricity Market Reform (EMR) consultation process launched by Department of Energy and Climate Change (DECC). We are fully supportive of the UK's ambitious decarbonisation objectives. As providers of innovative power generation technologies on a global basis, we are keen to engage directly with DECC, Ofgem and other stakeholders on the issues on which we feel most strongly, in particular the requirements for and provision of economic flexibility on all timescales. This will be a key enabler underlying the deployment of low carbon technologies, and hence forms a fundamental part of meeting the UK's challenging environmental goals.

1.1.2 Our key comments, conclusions and recommendations are as follows:

- ☐ We agree that now is the right time to consider the changes required to the UK electricity market to achieve a low carbon future.
- ☐ The EMR proposals will lead to a greatly increased need for flexible capacity in line with low carbon deployment.
- ☐ Whilst this creates opportunities for flexible technologies on both the supply and demand sides, ensuring that the appropriate investment environment exists should be a key consideration in EMR.
- ☐ Gas fired generation in general and flexible gas fired generation in particular has a critical and important role in helping to deliver the UK's low carbon energy policy through provision of a portfolio of services for operation of the system.
- ☐ Our analysis suggests that the net demand swing (taking into account both load and wind variations) is increasing during a period when much of the dispatchable thermal plant in the UK will be retiring.
- ☐ Further, the true economic cost of providing flexibility from the current fleet of thermal plant, with unit operating regimes increasingly diverging from design assumptions, is not proven.
- ☐ Yet, under current market arrangements, there is a great deal of uncertainty around economic returns from investment in new flexible capacity.
- ☐ This is due in part to dampened signals through lack of cost-reflectivity in the cash-out regime, in part due to the political risk of intervention to cap prices should they rise in response to genuine scarcity, and in part due to the inherent uncertainty in sources and levels of revenue.
- ☐ Consequently we believe there is a risk of the market not bringing forward sufficient investment in flexible capacity (a flexible investment „gap“).
- ☐ We believe that the Government needs to connect more directly the reform of the cash-out regime to the overall EMR process to ensure that this is addressed in a timely way.
- ☐ The Government has considered the role of capacity mechanisms; we agree that additional intervention is required to ensure a sufficient level of investment in flexible capacity.

- Similarly, we agree that a central body should have responsibility for procurement; that a volume-based approach is appropriate; and that a market-wide mechanism, with „capacity payments for all“, does not create the right form of incentive.
- However, we are concerned that the Targeted Capacity Tender (TCT) mechanism alone may not fully address the „gap“ that the market is expected to invest against, between the System Operator's STOR contracts and the „last resort“ TCT plant.
- There is also a concern that the TCT, as proposed, will have a distorting effect on prices in the wholesale and imbalance markets given the very significant design challenges of a TCT.
- Therefore, we think that the role of the proposed mechanism should be broadened, creating a centrally co-ordinated role for the procurement of flexibility across the spectrum of energy balancing and network management requirements.
- This should enable the efficiencies associated with treating requirements on a portfolio basis to be fully recognised, and ensure that technologies that can play a broad range of roles are remunerated appropriately.

## **2 INTRODUCTION**

### **2.1 Background and process to date**

- 2.1.1 We welcome the opportunity to participate in the consultation process launched by DECC. As a provider of innovative and new generation technology to the UK electricity market and with extensive experience in electricity markets around the world, our aim is to engage in the debate and offer constructive comment, raise specific issues to be considered further and suggest alternative solutions where possible, supported by evidence of their potential effectiveness.
- 2.1.2 We welcome the detailed documentation available as part of this consultation process.
- 2.1.3 We also encourage DECC to engage with both existing players and new entrants to the UK market in open meetings where concerns can be aired and solutions proposed.
- 2.1.4 We would welcome the opportunity to engage directly with DECC, Ofgem and other stakeholders on the issues on which we feel most strongly, namely security of supply, the role of gas fired generation in the future and the demand for and provision of flexibility to help meet the UK's decarbonisation objectives, of which we are fully supportive.

### **2.2 EMR context and our response**

- 2.2.1 Overall, we agree with the challenges DECC has set out, particularly around security of supply and the provision of flexibility given the 18-20 GW of retirement expected by 2020 but note that supply side technologies that can provide flexibility should also be a key consideration in EMR (alongside demand-side, storage and interconnection which are considered in some depth).
- 2.2.2 In this context, we also agree that the EMR proposals must “reward back up capacity” with the emphasis being on flexibility which for some plant will mean low load factor operation. In the absence of robust market price signals which are sufficiently able to reward low load factor peaking plant then capacity tenders or similar mechanisms will be required.
- 2.2.3 In the context of the Government's decarbonisation objectives, we also welcome the proposals for Carbon Price Support (CPS) and Feed in Tariffs (FITs) although we note (as DECC does) that there are numerous implementation hurdles.
- 2.2.4 Finally, we also encourage DECC to consider further the long term to 2050 and the form and structure of the energy system over that timescale.

## 3 OVERVIEW OF WÄRTSILÄ AND OUR SOLUTIONS

### 3.1 Overview

3.1.1 Wärtsilä is a global leader in complete lifecycle power solutions for the marine and energy markets. By emphasising technological innovation and total efficiency, we maximise the environmental and economic performance of the power plants and vessels of our customers.

3.1.2 In 2010, Wärtsilä's net sales totalled EUR 4.6 billion. We have more than 17,500 employees, operations in 160 locations in 70 countries around the world, and we are listed on the NASDAQ OMX Helsinki, Finland. We have 3 main business areas:

- **POWER PLANTS** - Wärtsilä is a leading supplier of flexible power plants for the power generation markets.
- **SERVICES** - Wärtsilä supports its customers throughout the lifecycle of their installations by optimising efficiency and performance. We are committed to providing high quality, expert support as well as availability of services wherever our customers are - in the most environmentally sound way.
- **SHIP POWER** - Wärtsilä enhances the business of its customers by providing integrated systems, solutions, and products that are efficient, economically sound, and environmentally sustainable for the marine industry.

### 3.2 Wärtsilä Power Plants

3.2.1 Wärtsilä is a leading supplier of power plants. Our technology enables a global transition to a more sustainable and modern energy infrastructure. We aim to provide superior value to our customers by offering Smart Power Generation which comprises a number of key characteristics, including:

- **Agility of dispatch** reflecting superior starting performance and quick shut down, fast ramp rates, high availability and starting reliability
- **High efficiency**
- **Wide economic load range** ie high sustained efficiency across load levels
- **Low capital cost**
- **Optimal plant location and size** including ability to locate inside distribution networks and major load centres with a low plant footprint
- **Communication with a smart grid** including automatic response, start and stop
- **Low environmental impact** including low CO<sub>2</sub> and other emissions even when ramping and on part load
- **Fuel flexibility** reflecting multi-fuel capabilities

## 4 REQUIREMENTS FOR FLEXIBILITY IN A DECARBONISING MARKET

### 4.1 Current flexibility requirements in the GB electricity market

- 4.1.1 The requirement for flexibility is driven by a number of factors, including hourly capacity margins (and thus utilisation of reserve), net demand<sup>1</sup> swing, net demand forecast error, and potential unplanned loss of generation in-feed or transmission infrastructure. We have analysed the potential net demand swing on the GB system for 2010. This shows a net demand swing of around 7 GW over a 2 hour period and 11 GW over 4 hours. This reflects the current plant mix and demand shape and broadly reflects an electricity system which is well understood and successfully operated to meet defined operational standards.

### 4.2 Drivers for change in flexibility requirements and their impact

#### Drivers for change

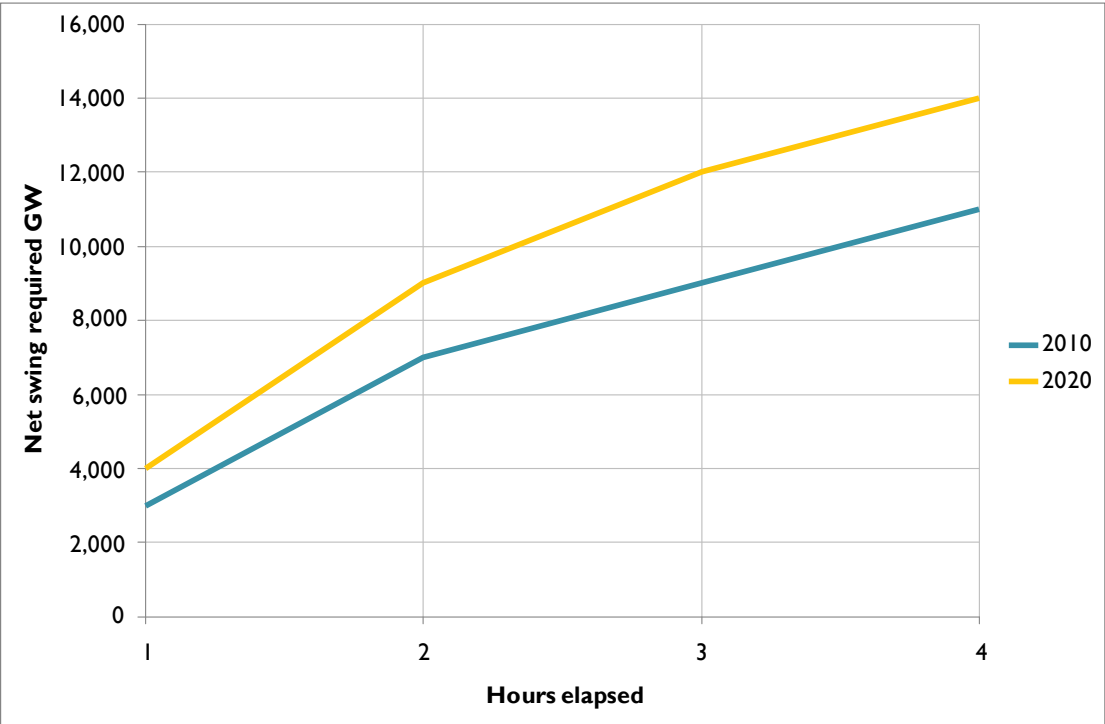
- 4.2.1 It is well understood that the potential net demand swing (and hence the need for flexibility) will increase over time as decarbonisation under EMR is successful, with the specific drivers being:
- ☐ Increasing penetration of intermittent renewables
  - ☐ Changing demand profiles with electrification of heat and transport
  - ☐ Larger unit sizes with new generation nuclear plant
  - ☐ Increasing levels of inflexible plant, like nuclear and CCS
  - ☐ Ageing infrastructure and reduced reliability

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<sup>1</sup> Net Demand = Demand – Inflexible generation (nuclear, CHP, small scale renewables) – intermittent generation (wind, marine) + pump energy – imports – part loaded reserve plant.



4.2.2 Based on consideration of these drivers, the figure below compares a representation of the 2020 net demand swing requirement with that from 2010<sup>2</sup>, with the difference representing the incremental net demand swing that would need to be provided from flexibility sources by 2020, given the impact of the drivers listed above. The graph shows how the net demand changes with elapsed time, starting with the position after 1 hour.



4.2.3 Our analysis shows that the net demand swing could increase by 2GW over a 2 hour period and over 3 GW over a 3 hour period by 2020. Over the same time period, much flexible capacity on the system will be retiring, albeit older and less efficient plant, causing a significant challenge. Given these twin factors, a substantial investment in a portfolio of flexibility sources will be required. To put these figures into independent context, we provide an overview below of National Grid's forecast of its future requirements for reserve under its "Gone Green" scenario, contracted reserve being a key source of flexibility in ensuring supply-demand are balanced.

The demand for operating reserve

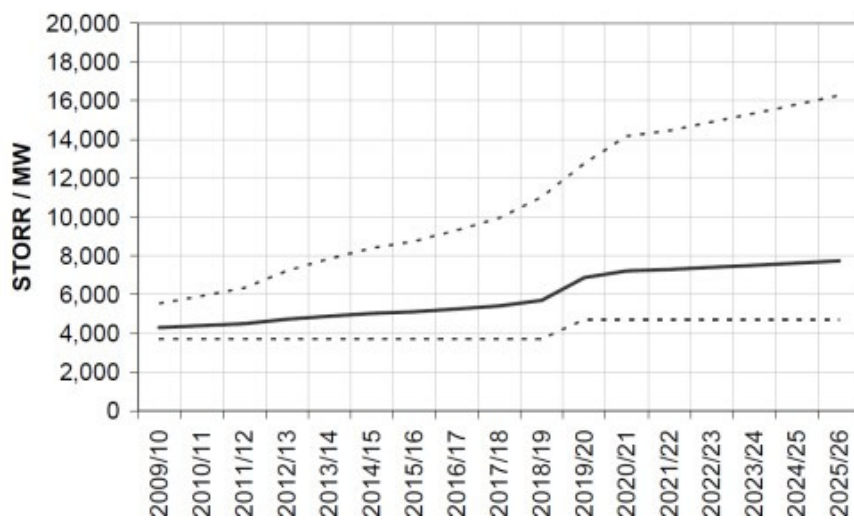
4.2.4 National Grid has sought to quantify the impact of increasing penetration of wind plant and larger units on its requirement for Short Term Operating Reserve (STOR), one of its reserve mechanisms. The key

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<sup>2</sup> This representation shows the 95th percentile from a frequency distribution of net demand swings simulated across the year. Significantly more extreme specific profiles will occur.

driver behind STOR is to provide power generation or demand reduction when demand is greater than forecast or in response to unplanned outages<sup>3</sup>.

- 4.2.5 If the decarbonisation of the GB electricity supply occurs as currently envisaged, the STOR requirement (STORR) will increase. The chart below plots National Grid's projection under its "Gone Green" scenario of the average annual STORR (middle line) together with the minimum and maximum STORR (lower and upper lines).



Source: National Grid

- 4.2.6 The difficulty in forecasting wind means STORR increases year on year as the amount of wind on the system increases. The range of wind output will also increase, meaning the range of STORR will do the same. The maximum reserve requirement occurs when forecast wind output is highest. Additionally, in 2019 the capacity of largest generation units is forecast to increase (due to larger nuclear unit sizes), causing a step up in the need for reserve.

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<sup>3</sup> The need for STOR varies according to the demand profile (across the time of year, week and day), and to reflect this NG splits the years into six seasons, differentiating between working and non working days. STOR is procured by NG for these seasons through a tender process run three times a year. The participating parties must meet minimum technical requirements, and tenders include an availability price (in £/MW/h) and an utilisation price (in £/MWh). The former is paid to providers for making their unit available, the latter is paid for energy delivered. STOR is procured on Committed terms and Flexible terms.

4.2.7 Further analysis has also been undertaken by Poyry<sup>4</sup> which is inconclusive but overall recommended prompt action to encourage flexibility in long life items (eg new nuclear and CCS) and diversity in supply of flexibility. The report also highlights that a key issue is incentivising new low carbon generation (nuclear, CCS) given the difficulty of servicing its large capital requirements with likely low load factors. Consequently the scenarios still envisage 1-5 GW of gas fired peaking capacity in 2030, and 12-18 GW in 2050, running at up to 3% load factor, requiring price signals that reward low load factor operation or appropriate rewards for making flexibility available.

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<sup>4</sup> Options for Low-Carbon Power Sector Flexibility to 2050. A Report to the Committee on Climate Change, October 2010, Poyry.

## 5 TECHNOLOGY OPTIONS FOR FLEXIBILITY

### 5.1 Sources of flexibility in the UK

5.1.1 We consider that there are three main types of flexibility providers – those that can help to flatten the demand profile (thus expanding the baseload section of the market), those that can vary their output/demand in response to predictable changes in load and renewables output, and those that can provide short term responsiveness to manage very short term and unpredictable variations.

5.1.2 In the table below we illustrate broadly which of these types of flexibility can be provided by alternative sources of flexibility such as supply side (generation) options, demand side options, storage and interconnectors. By definition supply side options cannot flatten the demand profile but can help manage variability and provide responsiveness. Demand side options and storage can fulfil all three roles. Interconnectors can help flatten the demand profile and help manage variability but are less likely to provide short term responsiveness<sup>5</sup>.

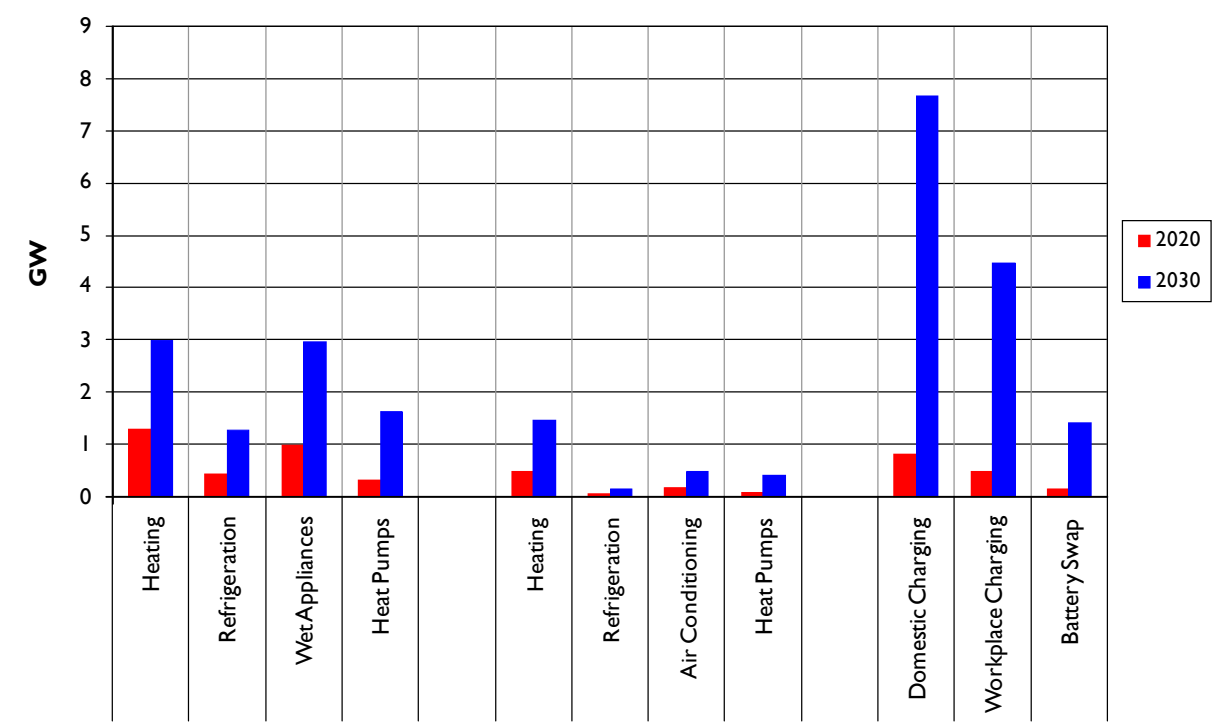
Options	Flattening demand profile	Managing variability	Providing responsiveness
Supply side options		✓	✓
Demand side options	✓	✓	✓
Storage	✓	✓	✓
Interconnectors	✓	✓	

5.1.3 There are a number of different ways in which the flexibility from each of the technology options could be accessed. In the absence of reform, for supply side options, large scale storage and interconnectors, the extent to which the flexibility is accessed will depend on players varying output in response to market price signals versus offering flexibility into the Balancing Mechanism or to the System Operator directly through balancing services contracts. For demand side options and small scale storage, access to flexibility would be based on the development and take-up of static time of use tariffs, dynamic time of use tariffs (those with prices that vary in real-time), automatic control (via smart technologies and in-home devices) and frequency relays.

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<sup>5</sup>This could change in the longer term with increasing harmonisation between system operators.

5.1.4 The figure below illustrates analysis of the potential from the demand side in the period to 2020 which is overall quite low (but an important part of the mix). In summary, demand side response might be able to provide within-day swing of around 1.5 GW by 2020. This represents around 8% to 10% of the overall flexibility requirement we estimated earlier.



Sources: DECC, IHS Global Insight, MTProg, NERA, Element Energy, Redpoint assumptions

- 5.1.5 To achieve this, DECC will need to address what are the barriers (e.g. current settlement arrangements) and enablers (e.g. smart meters) to realising the additional flexibility on the demand side.
- 5.1.6 Further consideration also needs to be given to the impact on distribution networks of changing consumption patterns in response to price. For example, the loading from heat pumps and electric vehicles could put strain on the networks, particularly if a proportion of that load is responding to price signals at the national level i.e. the normal diversification assumption starts to break down. Furthermore, the types of electric vehicle charging need to be considered since fast charging typically involves loads six times that of trickle charging. Battery swaps would provide the most flexibility but involves costs of additional batteries. In and of itself, these challenges in distribution networks of a changing total energy system will require a portfolio of services (eg voltage support, local balancing) to be provided from scalable, efficient and highly flexible generation technologies, acting as enablers for the major changes outlined above.
- 5.1.7 Thus, we note that the demand side, interconnectors and storage are given a lot of emphasis in the EMR consultation document. Overall, whilst we agree that the demand side, interconnectors and storage will have an important role to play as the energy sector is decarbonised, we believe that more consideration

should be given to the characteristics required from sources of flexibility and the role that alternative and new supply side technologies can play.

5.1.8 There are a number of challenges from these potential flexibility providers, for example the specific locations for Demand Side Response (DSR) and points of interconnection, potential dependency on time-of-day or with connected markets, and the sustainability of response.

5.1.9 We believe the emphasis should be on encouraging sources of flexibility which are technically able to provide the required flexibility in an economic manner, with the following key characteristics:

- ☐ A rapid capability to respond to changes in net demand (agility)
- ☐ The capability to sustain operation for a prolonged period after any “ramping” period
- ☐ No significant loss of efficiency or cost increase when only part of an offered volume of service is used (eg part load operation)
- ☐ Multiple fuel capabilities to enhance security of supply
- ☐ Ability to build small and large units of flexibility
- ☐ Cost competitive with competing technologies or providers

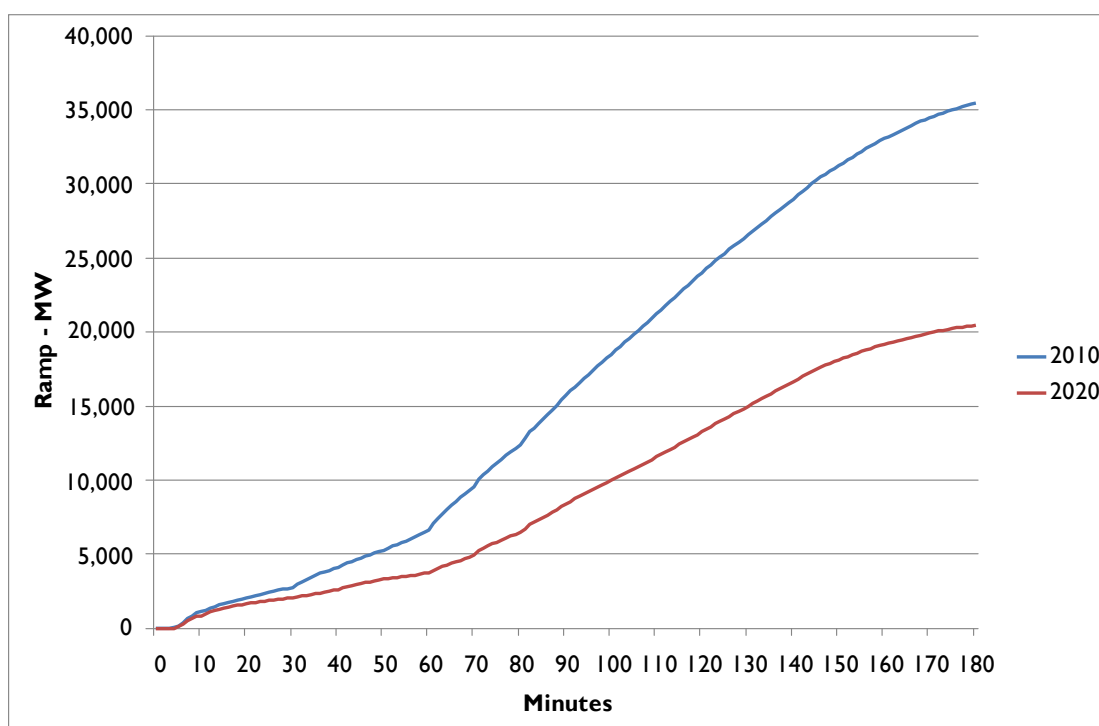
5.1.10 It is clear that our understanding of the system dynamics, and potential contributions from different providers of flexibility, will evolve over time. As such, a road map may be helpful in understanding key decision points, such that a full view of the evolution of flexibility needs can be developed. We illustrate a number of these in the table below.

Decision point	Impact
End of Large Combustion Plant Directive in 2015	Requirement to replace peaking and flexible oil and coal capacity that would be closing
Industrial Emissions Directive	Requirement to replace peaking and flexible coal and gas plant closing between 2019 and 2023 (subject to final agreement in European Parliament)
Significant penetration levels of electric vehicles and heat pumps	Requirement for significant distribution network reinforcement in the absence of flexibility packages
Significant spill occurring due to high levels of inflexible generation	Requirement to constrain off low carbon generation in the absence of flexibility packages
When and whether CCS is technically and economically proven	Contribution from supply side options in flexibility packages
Reforms to settlement	Limitations on time of use tariffs removed if settlement for all customers moved to half-hourly
Critical mass of smart meter deployment	Ability to access demand side response from domestic and small and medium enterprise customers
Deployment of smart grids	Allows access to certain forms of demand side flexibility

5.1.11 We believe that there has been much consideration of the overall sources of flexibility but we consider that further analysis is required of the potential supply side sources of flexibility and the challenges and opportunities in this area. We present some analysis and key messages in this area below.

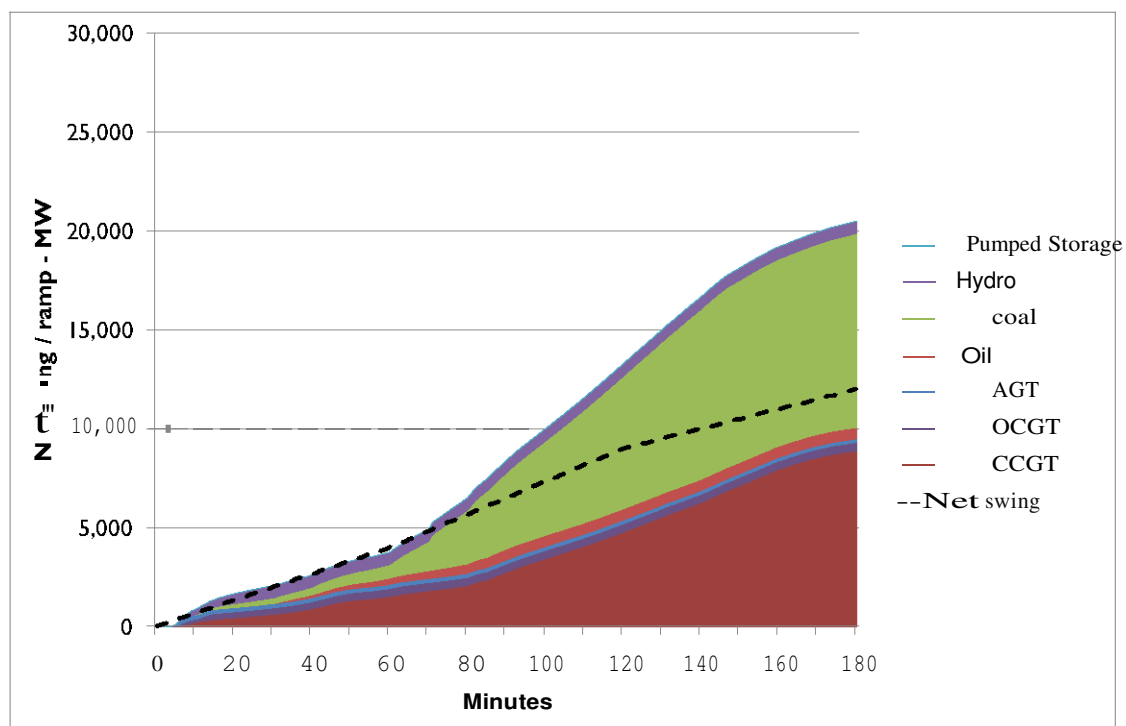
## 5.2 Current and future sources of supply side flexibility in GB

- 5.2.1 Based on the current technologies available, we have undertaken analysis of the current thermal plant in GB using available Balancing Mechanism and related data on unit dynamics.
- 5.2.2 The flexibility characteristics of each of the plant on the system vary by technology, vintage and investment which has been undertaken by the owners over the history of the plant. By examining submitted Balancing Mechanism Dynamic Data for each unit and plant in the GB market, we can assess the capability of current fleet of generation plant to provide the necessary flexibility.
- 5.2.3 The following analysis should be treated as representative only, and show „typical“ pictures rather than the most extreme net demand swings. Clearly the actual operation of the fleet is more complex than the simple representation here, and will depend in particular on the underlying economic running profiles of the plant, and the management of reserve. Nevertheless we believe they illustrate directionally the increasing need for flexibility.
- 5.2.4 The figure below shows the aggregate supply of swing / flexibility from existing plant now and for 2020, following assumed retirements of coal and oil plant under LCPD and some early retirement of older CCGT. Our analysis shows that the system would lose 3 GW of flexibility from the supply side over a 1 hour response period and 15 GW over a 3 hour response period (with the caveat that we have assumed no replacements for our retirements so that the gap can be clearly illustrated).





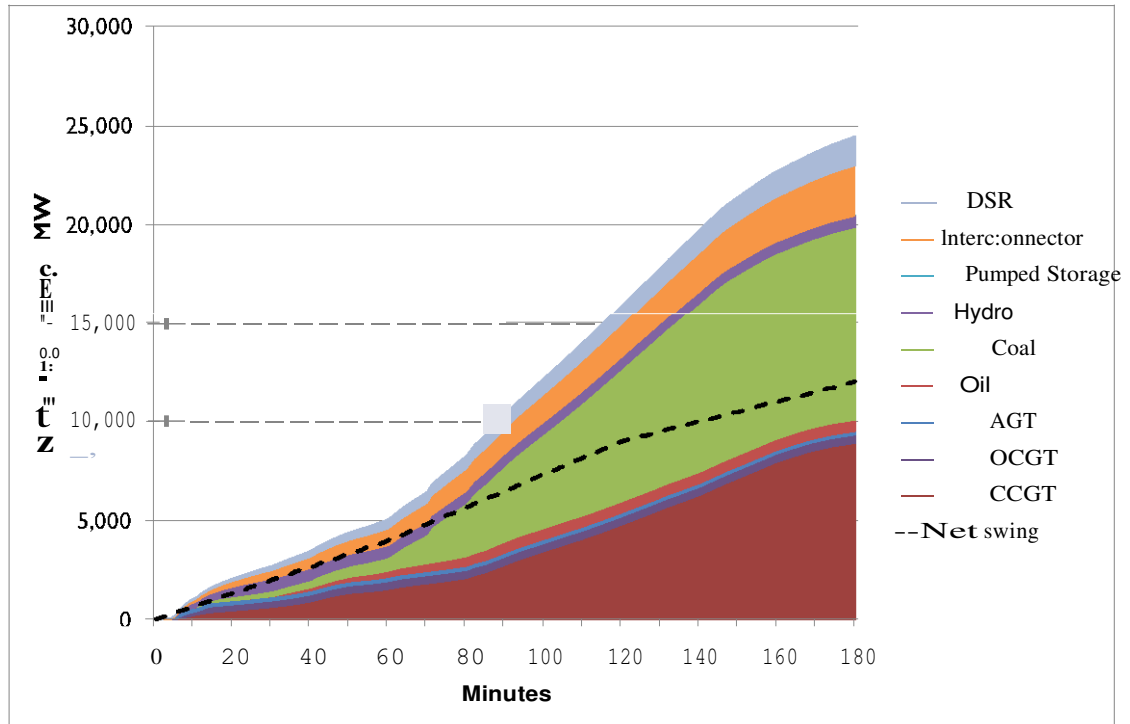
5.2.5 Next, we show how the available flexibility in 2020 compares to the net demand swing<sup>6</sup>, and the contributing plant types, with the same retirement assumptions. By comparing the net demand swing against the available net response from dispatchable generation in 2020 (as shown above) we demonstrate that the system would be tight for first hour and then reliant on coal to meet the balance<sup>7</sup> (Clearly in reality the actual response would be managed to use the available plant in the most efficient manner.)



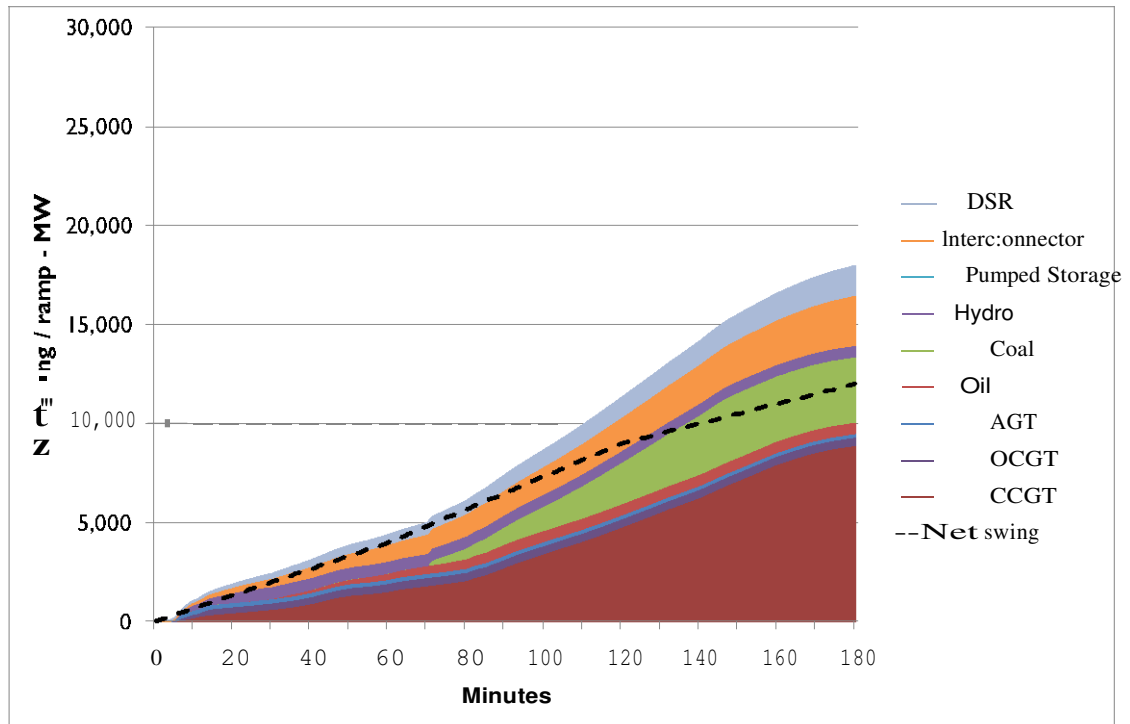
<sup>6</sup> The net demand swing has been linearly interpolated within hours. As the hourly points are derived from a distribution of simulated results, the profile reflects the boundary of a range of underlying profiles, each of which may show significantly more volatility.

<sup>7</sup> This figure uses Notice to Deviate from Zero (NDZ) and excludes Demand Side Response (DSR) and interconnectors and assumes the minimum NDZ submitted for the last three years by unit.

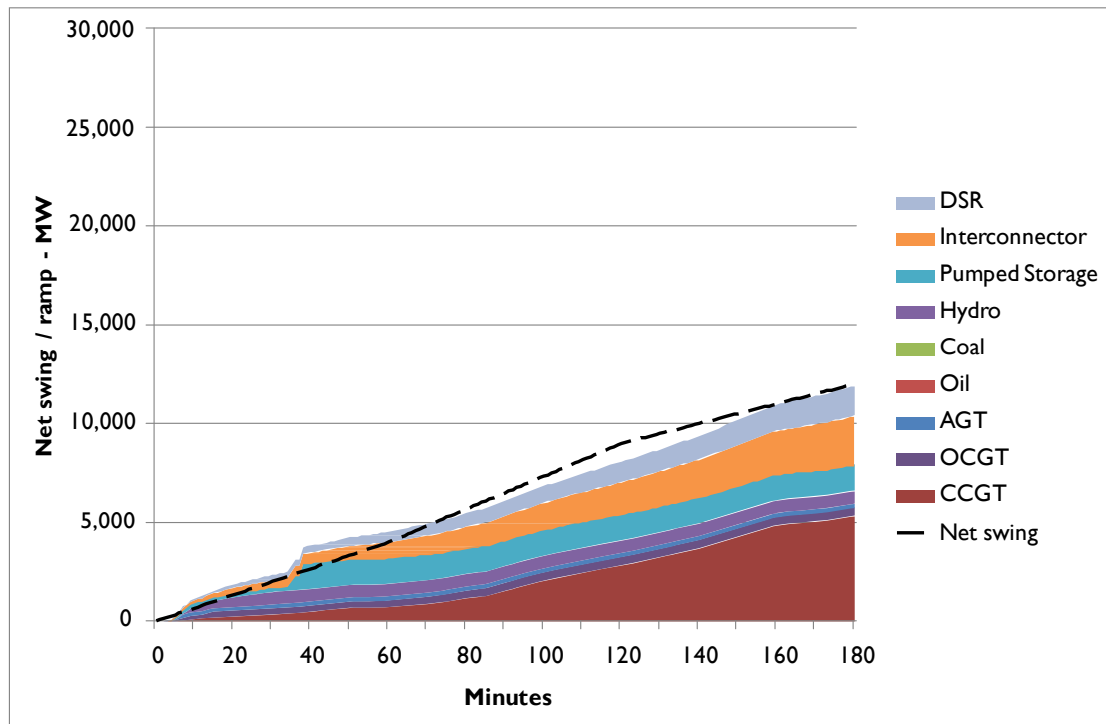
5.2.6 Adding in the possible provision of Demand Side Response (1.5 GW as described earlier) and interconnectors assists supporting the first hour of any net demand swing, as shown below. In practice, of course, the role of interconnectors will be dependent on the situation in neighbouring markets and the arrangements between market participants and system operators.



5.2.7 If coal plant closures are accelerated then the picture tightens considerably. This could represent either plant running out of hours under a Limited Lifetime Obligation under the Industrial Emissions Directive (IED), or a proxy for 2024 when further coal has retired. The system over the first 2 hours of any net demand swing would be likely to create significant operational challenges without further new flexible plant on the system.



5.2.8 To illustrate how a different view on plant dynamic data would affect the picture, using the same Balancing Mechanism data but assuming the NDZ of units is closer to the average of submitted NDZs (rather than the minimum which is the most optimistic picture of technical flexibility in the fleet) then the picture becomes very tight once more (the picture includes interconnectors and Demand Side Response with the LCPD and other retirements shown earlier).



### 5.3 The challenges for flexibility from the current supply side

5.3.1 The true economic cost of providing flexibility from the current fleet of thermal plant, with unit operating regimes increasingly diverging from design assumptions, is not well proven. There are likely to be significant challenges including:

- ☐ Much of the existing fleet will be aging by 2020 just as the need for flexibility becomes more pressing.
- ☐ Even if the current (by then) older plant prove technically able to provide the required dynamic characteristics, this may be at significantly higher cost.
- ☐ Reliability in provision of flexibility given the new operating regimes is untested and most plant have not been designed for flexible operation.
- ☐ Locational issues, and in particular the potential for the provision of flexibility to be reduced as a result of transmission constraints.

5.3.2 The table below shows how the different dynamic characteristics of representative dispatchable plant in GB compare using Balancing Mechanism data. We contrast this to single cycle and combined cycle technology from our (Wärtsilä"s) portfolio of solutions.

Options	Drax Coal	Eggborough Coal	Brigg CCGT	Connah"s Quay CCGT	Staythorpe CCGT	Wärtsilä (Gas engine)	Wärtsilä (Gas Engine CC)
Fuel	Coal	Coal	Gas	Gas	Gas	Gas	Gas
Unit capacity – MW	645	485	250	345	425	Single unit 9.7 MW Total plant up to 350 MW	Single unit 18.3 MW Total plant up to 500 MW
Notice to Deviate from Zero – minute <sup>1</sup>	70	50	50	85	720	30 sec.	1
Total minutes to ramp to full load from cold	115	74	168	149	762	10 min	15 min (90% load) + 65 min to 100%
Total minutes to ramp to full load from hot	45	24	118	64	42	5 min	10 min (90% load) + 65 min to 100%
Stable Export Limit (SEL) as % of full load	34%	41%	50%	67%	50%	1%-30% of facility (depending on number of units)	3%-30% of facility (depending on number of units)

Data sourced from Wartsila and Elexon

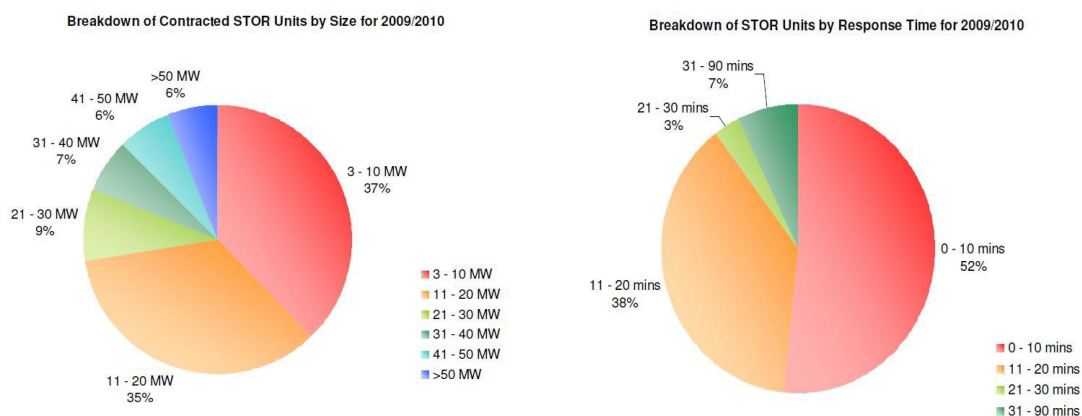
<sup>1</sup> Shortest time declared since 1st Jan 2008 for the existing plant

5.3.3 It is unclear what the economic cost for providers will be to providing true flexibility – thus, as well potential capacity tenders, energy revenues (and thus prompt and imbalance prices) will continue to be an important remunerator.

5.3.4 Evidence from National Grid"s STOR tender rounds provides some indication of the cost of providing flexibility from the current fleet of thermal plant in GB and their characteristics.

5.3.5 The STOR year runs from 1 April to 31 March. In 2009/10, the latest full year for which data is available, NG procured on average 2,623 MW of STOR, for an average availability price of £8.04/MW/h and an average utilisation price of £283.07/MWh. STOR was utilised for 961.5 hours, corresponding to 104.7GWh, leading to total availability payments of £68.3m and total utilisation payments of £23.1m. The following charts illustrate the breakdown of contracted STOR units by size

and by response time for 2009/2010<sup>8</sup>. The data shows that the majority of units winning contracts are small (less than 20 MW) and with a fast response time (less than 20 minutes).



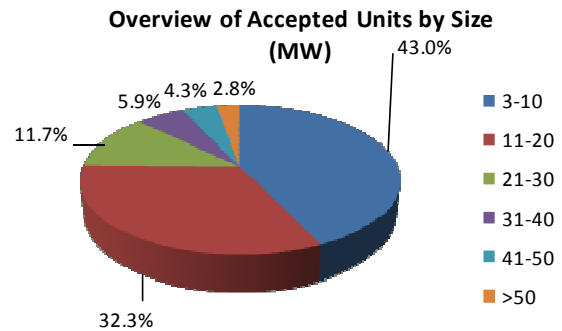
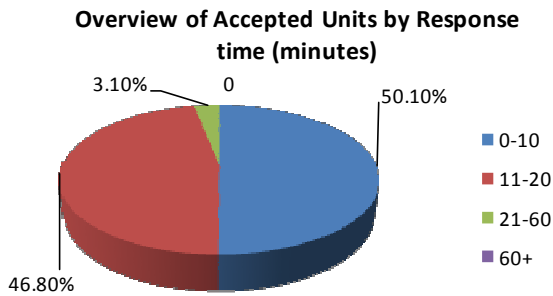
Source: National Grid

5.3.6 The results from Tender Round 10 (TR10), results of which were published in April 2010, illustrate further the types, availability and utilisation prices of flexible plant in GB<sup>9</sup>. The following charts illustrate respectively, the accepted STOR units by response time category, the accepted units by size and the availability and utilisation process achieved by units in this tender round.

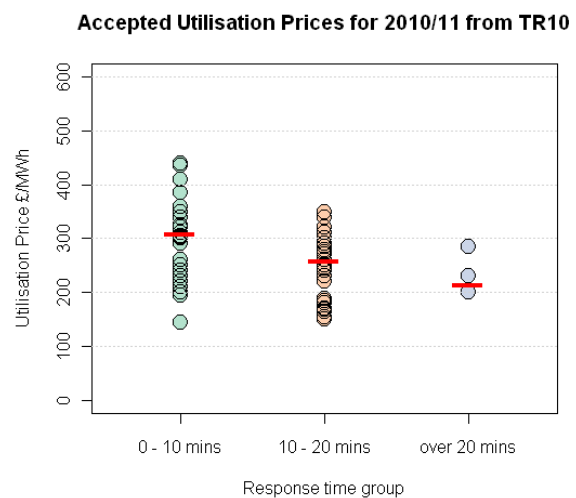
5.3.7 The key messages emerging include that a great number of small units are used to provide STOR currently and therefore one of the challenges will be scaling generation units to provide the greater volumes of reserve and flexibility that will be required in 2020. In addition, as older units retire, gaps in the market may emerge especially in the fast response time categories eg 0-10 minutes where the bulk of the requirements for STOR (in this tender round) were purchased. With respect to prices, we believe that insufficient differentiation appears to exist between very fast response services (5 minutes or less) and slower response times and that greater differentiation will need to be made in order to provide remuneration for fast, efficient technologies that can aid system security at the most critical time during a net demand swing.

<sup>8</sup> Source: STOR Annual Market Report 2009/10, National Grid

<sup>9</sup> Source: STOR Market Information Report: TR 12, National Grid



Source: National Grid



Source: National Grid

## 5.4 Conclusions and implications for EMR

- 5.4.1 Our analysis suggests that the net demand swing (taking into account both load and wind variations) could increase to 2020 by 2GW over a 2 hour period and over 3 GW over a 3 hour period
- 5.4.2 Retirements could decrease available dispatchable thermal plant (without further investment) of 15 GW over a 3 hour response period.
- 5.4.3 Over the period to 2020, Demand Side Response and interconnectors can make a modest but important contribution to the provision of flexibility, but not sufficient to bridge the gap or to provide the portfolio of flexibility services required. The role of interconnectors will be dependent on the state of neighbouring markets and commercial arrangements between participants and system operators.
- 5.4.4 Furthermore, of the remaining dispatchable thermal plant, the true economic cost of providing flexibility from the current fleet of gas fired plant in particular, with unit operating regimes increasingly diverging from design assumptions, is not proven.

## 6 CHALLENGES FOR ELECTRICITY MARKET REFORM

### 6.1 What might happen without further action?

As things stand there is a great deal of uncertainty around the financing and build of flexible plant

6.1.1 Under current market arrangements, there are a number of „channels“ for the use of flexible capacity on a short term basis, including:

- ☐ Used within a portfolio, to enable physical balancing given volumetric uncertainty elsewhere (such as demand changes), and hence reducing exposure to imbalance prices.
- ☐ Traded in the wholesale market, as other participants seek to buy or sell to manage their own position.
- ☐ Offer short term balancing services to the System Operator.
- ☐ Participate in the Balancing Mechanism, offering to ramp up or ramp down as a tool for the System Operator to balance the system, or to manage constraints on a locational basis.
- ☐ Used to take an imbalance position and hence deliberately gain exposure to imbalance prices.

6.1.2 On a longer term basis, flexible capacity could be offered to the system operator for balancing and reserve under long term contracts, or contracted to other parties as a means for them to manage imbalance exposure on a longer term basis, rather than being dependent on short term actions and price volatility.

6.1.3 Investment decisions in flexibility will therefore depend on views on the future shape and level of prices, and the ability of the new flexible capacity to capture these as they arise. In the wholesale market it is likely that prices will be increasingly volatile. In the Balancing Mechanism, whilst there are a large proportion of periods in which offers are accepted at a significant premium above market, there is a concern that the nature of the arrangements, with the System Operator as a „single buyer“, the interaction with balancing services contracts and the influence of the large portfolio players, in themselves create risks. In short, it is not clear whether Balancing Mechanism prices consistently reflect the true value of energy and flexibility at times of system scarcity or system surplus.

6.1.4 This is a very uncertain prospect for investment, and one that is unlikely to provide a framework for investors outside the large utilities. The lack of revenue certainty, combined with the political and regulatory risks, would seem to make any form of debt financing difficult with long term balancing services contracts to support new flexible generation.

6.1.5 There is also a concern that, given the political sensitivity to high energy prices (even if they are only short term spikes), measures might be taken in the future to „cap“ prices (in some manner) should these occur. This concern clearly undermines any investment case even leaving aside the inherent



uncertainty. Furthermore, to the extent that investors price this uncertainty into their cost of capital, this will tend to result in even higher prices which further increases the risk of intervention.

- 6.1.6 Thus far there has been little in the way of longer term price signals for flexibility itself. The STOR auctions have helped in this regard. However, more generally, the value of flexibility is often „hidden“, for example, bundled into long term PPAs for renewables.
- 6.1.7 On top of this, there is a consensus that the cost of imbalance for market participants – reflected in the way in which cash-out prices for imbalance positions are set – does not reflect the true cost of balancing operations that the System Operator must execute. This dampens signals for market participants to proactively manage their own balance positions, and correspondingly reduces the value they place on flexibility.
- 6.1.8 There is therefore a risk that investment in the increasing levels of flexibility required will not be forthcoming under a business as usual type environment.

## **6.2 The impact of EMR**

### EMR will accelerate low carbon technologies and by extension the requirement for flexibility

- 6.2.1 We welcome the Government's recognition that reaching the UK's challenging decarbonisation targets requires a framework that supports investment in low carbon technologies. EMR is likely to accelerate the development of nuclear, and potentially CCS if it is technically proven, alongside the strong growth in wind technology already driven by the Renewables Obligation.
- 6.2.2 This will lead to a substantially more demanding electricity system to manage and balance. Unless further changes are made to the market arrangements, the shape of the price duration curve is likely to steepen, with periods of low, and indeed negative, prices at times of high wind and low demand, and potentially very high prices for a small number of hours each year in which lower load factor plant aim to earn a return.
- 6.2.3 In other words, EMR, in driving faster decarbonisation, is also driving the need for greater flexibility. The most important first consideration is to ensure that the EMR proposals are not making the investment environment more difficult in this regard. We welcome the intention to implement an EPS on an annual (rather than rate-based) limit, and stress that it is critical that an EPS in no way affects the role or value of those plant able to offer the flexibility required.

### The consultation does not directly address challenges for new gas investment

- 6.2.4 In the short term, there is likely to be little or no investment in large scale gas fired plant, over and above committed investments, under the assumption that low carbon policies are effective. If, however,

barriers to low carbon generation remain in place and constrain deployment, new gas build may be required to meet a capacity gap and might be required at short notice.

- 6.2.5 In the longer run, the market will still need new flexible thermal plant to support the low carbon generation mix. However, the policy and market environment for such plant is likely to be difficult and potential developers will face challenges in obtaining finance.

However, the consultation recognises the need for a measure to address security of supply

- 6.2.6 The Consultation Document recognises the existing risk around security of supply and the potential for accelerated decarbonisation to exacerbate this.
- 6.2.7 The Consultation Document lays out the broad options around capacity mechanisms, and we agree with the concerns around a market-wide mechanism, and the associated risk of incentivising the „wrong sort“ of capacity, and therefore we agree with a more restricted, targeted approach.
- 6.2.8 The preferred measure of a Targeted Capacity Tender (TCT) is designed to be a contingency measure that can be implemented if required – in other words, if the market has not brought forward a sufficient level of flexible capacity.
- 6.2.9 In theory the TCT, if well designed, should not change incentives for investment in flexible capacity – ie there should not be a corresponding „displacement“ problem, whereby private investment is reduced because of the (expected or actual) impact of the centrally contracted capacity.
- 6.2.10 However, as we discuss below, we consider that the „last resort“ nature of the proposed TCT may be insufficient to address the concerns the Consultation Document highlights around investment in flexible capacity.

There are very real difficulties in the TCT design

- 6.2.11 It will be very difficult to design a solution that will work in the way the Government envisages. For instance, setting a security standard in a measurable and objective way is in itself very difficult, and forecasting against it even more so. The forecasting body must clearly make assumptions on the contribution of intermittent renewables, new build and retirements, and demand-side evolution – when these could differ substantially in outturn with a material impact on security of supply.
- 6.2.12 Even with perfect foresight, there will be challenges. It is unclear how the TCT would handle a forecasted short term (1-2 year) „dip“ in capacity below the security standard. It would be difficult to envisage a successful tender for new capacity on this timeframe at any sensible price level. Clearly the TCT could handle this through longer term contracts – but at risk of the displacement it is designed to

avoid. As a result, we are concerned that the TCT as it stands may have a displacement effect through a lack of credibility in its design.

6.2.13 A key part of the TCT design will involve determining how the tender tranches will be specified, in regard to the provision of capacity with different technical characteristics. In a sense, this takes the difficult problem described above, and makes it significantly harder, laying on assumptions about the more detailed behaviour of supply and demand in short term timeframes.

6.2.14 There are further questions around how the additional benefits of different flexible options might be considered – such as fuel diversity, and potential low carbon options that could be introduced at a later point in the lifecycle (and may be important in the context of the longer term 2050 goals).

Even allowing for a well designed TCT, there is a significant remaining flexibility „gap “ which needs to be addressed

6.2.15 Perhaps even more importantly, we think that the Consultation Document does not fully address the „gap“ that the market is expected to invest against, between the System Operator's STOR contracts and the „last resort“ TCT capacity. By definition, the TCT is will not intended to provide a more secure way for supporting the broader investments required by a market with increasing intermittency. That is still left to „the market“. Yet as we have noted above, the uncertainty around such projects is likely to deter investments.

### **6.3 Potential additional measures**

Cost-reflective imbalance prices are critical to the success of EMR

6.3.1 A key first step will be to correct the current problems in imbalance pricing to ensure that the signals for flexible investment are efficient. The Consultation Document recognises this but assumes it will be left to Ofgem to take forward this process. However, despite a number of reviews, there has been little progress in this area.

6.3.2 We regard this as a key barrier to investment and we believe that the Government needs to connect more directly the reform of the cash-out regime to the overall EMR process to ensure that this is addressed in a timely way.

6.3.3 We recognise that sharper balancing prices create a larger risk for intermittent renewables, creating a potential barrier to investment. If this turns out to be a significant concern, we think further consideration should be given to the concept, developed by Ofgem, of a central renewables balancing agency, which would provide a service (either optional or compulsory) to intermittent renewable plant whereby it would aggregate positions and hence take advantage of diversity in wind fluctuations and forecast error to minimise imbalance exposure for the portfolio as a whole.

#### Continuing difficulties for flexibility investment

- 6.3.4 Even with sharpened imbalance prices, the problem remains that it is very difficult for flexible capacity to form a robust investment case – let alone procure financing – against such an uncertain revenue stream. This applies to projects – such as peaking plant or DSR – that are primarily targeting the flexibility market, and to incremental investments on new plant to enable them to offer greater flexibility later during their economic lifetimes.
- 6.3.5 Theoretically, there should be a match between players with imbalance exposure, and players with the ability to provide flexibility. However, there are a number of reasons why the market alone may fail to bring this about. The Government makes it clear that there will be a strong requirement on investors outside the main utilities, given their shrinking supply of capital. Recognising this, it will be essential to identify potential investors in flexibility, and address any associated barriers.
- 6.3.6 The structure of the Balancing Mechanism, as a „single buyer“ market for short term flexibility, with the System Operator on one side of all transactions, is a distorting effect. We believe that portfolio players are likely to be able to extract inefficient premia from the Balancing Mechanism, reducing liquidity in the rest of the market, and hence reducing the transparency of signals of value for flexibility in general.
- 6.3.7 The Consultation Document identifies the possibility of a short term reserve market, perhaps on a day-ahead basis, run by the System Operator, as way to generate more cost-reflective cash out prices, as well as generating greater price transparency. We think this could be a helpful approach but would like to see a clearer statement in terms of how it may be taken forward as part of the overall package of reforms.
- 6.3.8 We believe that the need for a high quality credit rating may also be a barrier for new entrants seeking to provide flexibility – either as an agent or directly as a flexibility provider. For example, where a renewables project is seeking a party to reduce or manage the imbalance risk, it may often be the case that the associated debt requirements preclude contracting outside the group of large utilities.
- 6.3.9 The Government has said that the Green Investment Bank (GIB) will have an objective of tackling remaining financing gaps. We would welcome greater clarity as to what the remit of the GIB will be, and to what extent investment in flexibility will be one of the financing gaps it is designed to address.

#### A more central role for flexibility procurement?

- 6.3.10 The crux of the question is whether, in practical terms, flexibility is more effectively provided by the market, or through a more centralised mechanism. We think this key issue requires further consideration and analysis. We suspect that there may be a strong case to extend the remit of the TCT to bring on sufficient flexibility overall, rather than just to act as a „last resort“. If this can provide

greater certainty for suppliers of flexibility, then it may offer a means to security of supply at a lower cost to consumers.

- 6.3.11 We note that there is a risk this happens anyway as an unintended consequence of displacement, or simply as a belated response to a lack of other market investment. We believe that it will be more efficient to recognise this issue up front and design the TCT appropriately to manage it.
- 6.3.12 We think the analogy with STOR is a useful one to consider. It is recognised in this case that reserve is more efficiently procured centrally. An agent (the System Operator) is able to enter into long term (10 year) contracts, thus creating both a direct market for flexible plant, but also some welcome price transparency.
- 6.3.13 Furthermore, if this route is taken, the „last resort" mechanism for utilisation no longer becomes viable given the breadth of the market covered and we think consideration should be given to an extended mechanism, with a corresponding element of „economic dispatch" as the remit of the central body is broadened.
- 6.3.14 The number of those services that are best provided centrally is likely to increase with increasing levels of intermittency. For example, current market arrangements are not designed (nor most generating capacity) to deal with rapid swings in net demand (taking changes in demand and intermittent generation into account). Separate arrangements are likely to be a more appropriate way to deal with this.
- 6.3.15 In a similar way, it is not clear that markets would provide cover for extreme events, such as very cold weather coinciding with no wind. Competitive pressures mean that companies may not be able to afford to cover these extreme risks.

#### Locational issues

- 6.3.16 In making these further considerations, we think two additional dimensions will be important. We think that the location of flexibility will be increasingly important. The problem is not one solely of national-level supply-demand matching, but also of managing transmission constraints in an efficient way. Similarly, ensuring sufficient flexibility at both the transmission and the distribution levels will be essential. This is recognised in the Consultation Document in particular for DSR, but we believe similar considerations apply to generation capacity that can create a more „distributed" flexible response capability.
- 6.3.17 The current transmission charging regime provides a locational signal for generating plant, but we think consideration is required as to how location would be considered in a TCT (or extended capacity mechanism). We also think a clearer vision is required with regard to the respective roles of the transmission system operator and the Distribution Network Operators (DNOs), especially given the

expectations on electrification of heat and transport. This is an important interaction that needs to be considered – and may provide an alternative channel to bring flexibility onto the system with benefits at both the local and national levels. Different types of flexibility will of course vary in the way in which they can provide against location-specific requirements.

#### Negative prices

- 6.3.18 There are a number of other issues we believe warrant addressing. We noted above the potential for negative prices to be set due to the incentive for renewables receiving Renewable Obligation Certificates (ROCs) to continue generating until prices fall sufficiently far below zero to offset the value of the ROC. It has been argued that this is in fact helpful in stimulating demand-side response. However, it is clear that this is a distorted signal, as it does not derive from efficient dispatch, but rather from an unintended consequence of a subsidy regime. It would not be efficient for higher cost demand-side response to be developed on this basis, compared to other forms of flexibility.
- 6.3.19 We believe it will be essential to ensure that the design of CfDs for low carbon technology avoids any incentive to generate other than when it is efficient to do so. However, given that there is likely to be a very high level of renewables under the RO on the system by 2017, we think that the Government will also need to address the concern with negative pricing when it details the grandfathering arrangements for the RO.

## 6.4 Summary of challenges

6.4.1 The Government lays out in the Consultation Document a number of reasons for insufficient investment signals to ensure security of supply. In the table below, we consider each of these, review how they are being addressed in the current proposals, and identify those we think warrant further consideration.

Reason	Proposals	Further considerations
Peak prices may not rise high enough	No specific proposals in EMR beyond referring to potential cash-out developments through industry/Ofgem process (cash out calculation, short term reserve market)	Need for this to be tied more directly to EMR reforms to create certainty that this issue will be resolved
Management of peak price uncertainty	No specific proposals beyond „contingency" of TCT	Reforms required either to generate longer term price transparency or to seek a greater level of central contracting for flexibility
Policy uncertainty	No specific proposals beyond „contingency" of TCT	
Investment cycles in generating capacity	No specific proposals beyond „contingency" of TCT	
Low levels of liquidity	Ofgem review of liquidity and associated proposals for interventions to improve this	Extension of the considerations from liquidity in forwards contracts to ways of generating price transparency in flexibility on long term basis

6.4.2 As the table demonstrates, we believe that while the Government has identified a number of important issues with regard to future flexibility, these are only partially addressed in the proposed reforms. We believe it is important that these are tackled not only to produce the right investment environment for flexible capacity, but also to lower the risk for intermittent plant that outturn balancing costs rise significantly higher in the event that such investment is not forthcoming.

## 7 CONCLUSIONS

### We agree that now is the right time to consider the changes required to the electricity market to achieve a low carbon future

- 7.1.1 We support the broad thrust of the EMR proposals and the preferred package. We agree with the challenges DECC has set out, particularly around security of supply and the provision of flexibility given the 18 to 20 GW of retirement expected by 2020.
- 7.1.2 We note that supply side technologies that can provide flexibility should also be a key consideration in EMR (alongside demand-side, storage and interconnection which are considered in some depth).
- 7.1.3 We would highlight that gas fired generation in general and flexible gas fired generation in particular has a critical and important role in helping to deliver the UK's low carbon energy policy.

### The EMR proposals if successful will lead to a greatly increased need for flexible capacity

- 7.1.4 We agree that there is a potential security of supply risk under current market arrangements, in particular in the light of LCPD/IED impacted plant and nuclear retirements, which is likely to be exacerbated with any acceleration in decarbonisation associated with the EMR proposals.
- 7.1.5 Our analysis suggests that the net demand swing could increase to 2020 by 2GW over a 2 hour period and over 3 GW over a 3 hour period, whilst simultaneously the system will lose flexible generation capacity of 15 GW over a 3 hour response period.
- 7.1.6 In addition, the true economic cost of providing flexibility from the remaining fleet of thermal plant, with unit operating regimes increasingly diverging from design assumptions, is not proven.
- 7.1.7 We believe new gas fired capacity with truly flexible characteristics will be required to meet the potential net demand swings which the electricity system will face with increasing (intermittent) renewables penetration.

### There is significant work to be completed on the EMR preferred package to address key challenges

- 7.1.8 There is clearly a very significant amount of detail that must be added to the proposals to allow stakeholders to take firm views. Whilst we think the Government can and should move quickly to provide clarification where possible to limit uncertainty for investors. However, in some areas we believe further time will be required for due consideration, especially given the very complex nature of the proposals. The timetable should allow for this.
- 7.1.9 As things stand, there is a great deal of uncertainty around the financing and build of flexible plant. Under the current proposals, investment decisions for most flexible plant will depend on views on the



future shape and level of prices and the extent to which they are able to fully reflect the scarcity value of power, and the ability of the new flexible capacity to capture these as they arise. With the risks of intervention should prices spike to high levels consistently and the challenges associated with the current Balancing Mechanism, this is a very uncertain prospect for investment, and one that is unlikely to provide strong incentives for investment in new flexible generation.

- 7.1.10 We agree that additional intervention in the form of a capacity tender or similar mechanism is required to ensure a sufficient level of investment in flexible capacity is forthcoming. We agree with the assessment that a central body should have responsibility, and that a volume-based approach overall is most appropriate. We also concur that a market-wide mechanism, with all capacity receiving payments, does not create the right form of incentive.

We believe the Targeted Capacity Tender proposals need to be broadened to encompass a central role in the procurement from and provision of flexibility to the market

- 7.1.11 Cost-reflective imbalance prices are critical to the success of EMR and the lack of such prices is a major barrier to investment in flexible plant. We believe that the Government needs to connect more directly the reform of the imbalance mechanism to the overall EMR process to ensure that this is addressed in a timely way.
- 7.1.12 We are concerned that the TCT for „last resort“ capacity, as currently proposed, will have a distorting effect despite its intended role, given the design challenges in ensuring that price signals are not affected.
- 7.1.13 We also believe that the TCT alone will not be sufficient to address the flexibility „gap“ that could exist given the very uncertain investment environment, between the System Operator's STOR contracts and the „last resort“ capacity.
- 7.1.14 Hence, we think that rather than attempt to „design out“ the challenges with the TCT, the mechanism and the role of the relevant body should be broadened and the mechanism designed appropriately to recognise a wider centrally co-ordinated role for the procurement of flexibility across the spectrum of energy balancing and network management requirements. This should enable the efficiencies associated with treating requirements on a portfolio basis to be fully recognised, and ensure that technologies that can play a broad range of roles are remunerated appropriately.
- 7.1.15 Due consideration needs to be given locational signals for flexibility providers and the respective roles of the Transmission System Operator and DNOs in ensuring flexibility is effectively and economically located and utilised.
- 7.1.16 We note the potential for negative prices to be set due to the incentive for renewables receiving ROCs and suggest that this will need to be addressed to avoid future distortion of market prices.

7.1.17 We are keen to be involved in the industry discussions needed to resolve the design issues.

## 8 RESPONSE TO CONSULTATION QUESTIONS

### 8.1 Current Market Arrangements

No.	Consultation question	Wärtsilä response
1.	<i>Do you agree with the Government's assessment of the ability of the current market to support the investment in low-carbon generation needed to meet environmental targets?</i>	<p>We agree that current market arrangements are not likely to deliver the level of investment in low carbon generation sufficient to meet the Government's environmental targets, and we support a low carbon future for the UK.</p> <p>However, we would highlight that gas fired generation in general and flexible gas fired generation in particular has a critical and important role in helping to deliver the UK's low carbon energy policy.</p>
2.	<i>Do you agree with the Government's assessment of the future risks to the UK's security of electricity supplies?</i>	<p>We agree that there is a potential security of supply risk under current market arrangements, in particular in the light of LCPD/IED impacted plant and nuclear retirements, which is likely to be exacerbated with any acceleration in decarbonisation associated with the EMR proposals.</p>

### 8.2 Options for Decarbonisation; Feed-in Tariffs

No.	Consultation question	Wärtsilä response
3.	<i>Do you agree with the Government's assessment of the pros and cons of each of the models of feed-in tariff (FIT)?</i>	<p>We have no specific views on this consultation question but are broadly supportive of renewed policy thinking in this area as part of an overall package of measures to ensure a diverse and low carbon generation mix in the UK.</p>
4.	<i>Do you agree with the Government's preferred policy of introducing a contract for difference based feed-in tariff (FIT with CfD)?</i>	<p>We consider that any of the proposed FITs could deliver the level of decarbonisation required, if sufficiently well designed. We think that a FIT with CfD can have benefits, as described in the Consultation Document in terms of attracting a greater pool of capital. We also agree that ideally</p>

		risks around balancing and dispatch would be left with generators assuming adequate rewards for doing so are available for risks taken. However, we also think that to support this, a greater emphasis is required on ensuring that the corresponding level of investment in flexible generation will be brought forward.
5.	<i>What do you see as the advantages and disadvantages of transferring different risks from the generator or the supplier to the Government? In particular, what are the implications of removing the (long-term) electricity price risk from generators under the CfD model?</i>	We do not have a specific view in this area.
6.	<i>What are the efficient operational decisions that the price signal incentivises? How important are these for the market to function properly? How would they be affected by the proposed policy?</i>	We believe that it will be important to ensure that dispatch decisions are efficient (based on short run marginal costs of generation) under any new arrangements (as they may not be under the RO), and similarly decisions around the use of reserve and flexibility, which will become increasingly important. These in turn should be helpful in investment decisions for the needed new flexible capacity that the system will require.
7.	<i>Do you agree with the Government's assessment of the impact of the different models of FITs on the cost of capital for low-carbon generators?</i>	We do not have a specific view in this area.
8.	<i>What impact do you think the different models of FITs will have on the availability of finance for low-carbon electricity generation investments from both new investors and existing the investor base?</i>	We do not have a specific view in this area.
9.	<i>What impact do you think the different models of FITs will have on different types of generators (e.g. vertically integrated utilities, existing independent gas, wind or biomass generators and new entrant generators)? How would the different models impact on contract negotiations/relationships with electricity suppliers?</i>	<p>Whilst we do not have a specific view with regard to different types of generators, we would note that there are significant differences between these different generators which will need careful consideration as the details of the mechanisms are drawn up.</p> <p>We note that the FIT with CfD, in leaving balancing exposure with the generator, will mean that managing this risk is likely to be a key component of negotiations with suppliers, and that</p>

		correspondingly, flexibility price transparency is likely to be an important issue.
10.	<i>How important do you think greater liquidity in the wholesale market is to the effective operation of the FIT with CfD model? What reference price or index should be used?</i>	We think liquidity in the wholesale market is very important for the effective operation of a FIT with CfD model, as well as setting price signals that appropriately reflect the scarcity value of electricity. We have no specific view on the reference price. We would also stress the importance of liquidity in reserve and flexibility markets.
11.	<i>Should the FIT be paid on availability or output?</i>	We believe that the FIT should be designed to ensure economic dispatch decisions, and that it should avoid the risk of negative prices present under the RO, which would distort signals for different types of investment in flexible capacity, and lead to inefficient outcomes.

### 8.3 Current Market Arrangements; Emissions Performance Standards

No.	Consultation question	Wärtsilä response
12.	<i>Do you agree with the Government's assessment of the impact of an emission performance standard on the decarbonisation of the electricity sector and on security of supply risk?</i>	We are broadly supportive of the assessment. Careful consideration needs to be given to the limits which are set and how they are to be applied to ensure flexible generation continues to be able to operate to deliver security of supply. We also note that gas has a critical role to play in our view in a low carbon UK generation sector and care needs to be taken that the development of an EPS does not prevent the development of needed, modern, efficient, flexible low carbon gas fired capacity.
13.	<i>Which option do you consider most appropriate for the level of the EPS? What considerations should the Government take into account in designing derogations for projects forming part of the UK or EU demonstration programme?</i>	We have no specific view here, beyond the general point noted for Question 12.
14.	<i>Do you agree that the EPS should be aimed at new plant, and „grandfathered“ at the point of consent? How should the Government determine the economic life of a power station for the purposes</i>	We agree that the EPS should be aimed at new plant, and that political uncertainty should be minimised.

	<i>of grandfathering?</i>	
15.	<i>Do you agree that the EPS should be extended to cover existing plant in the event they undergo significant life extensions or upgrades? How could the Government implement such an approach in practice?</i>	We agree that the EPS should be extended to prevent „loopholes" by which effective new investment can avoid it. However, we recognise the practical difficulties in defining this appropriately.
16.	<i>Do you agree with the proposed review of the EPS, incorporated into the progress reports required under the Energy Act 2010?</i>	Yes.
17.	<i>How should biomass be treated for the purposes of meeting the EPS? What additional considerations should the Government take into account?</i>	We have no specific view.
18.	<i>Do you agree the principle of exceptions to the EPS in the event of long-term or short-term energy shortfalls?</i>	There is a significant risk that this causes uncertainty in policy in this area and this is to be avoided if investment in modern, efficient generation capacity is to occur. So, whilst in principle we agree with this in principle, it will be important to ensure that this is sufficiently tightly defined to offset the potential for this to dampen investment in new capacity.

## 8.4 Options for Market Efficiency and Security of Supply

No.	Consultation question	Wärtsilä response
19.	<i>Do you agree with our assessment of the pros and cons of introducing a capacity mechanism?</i>	We agree with the assessment on the pros and cons of introducing a capacity market, but also believe that the other changes to market arrangements that are identified must be tackled in an integrated manner with the development of the EMR proposals.
20.	<i>Do you agree with the Government's preferred policy of introducing a capacity mechanism in addition to the improvements to the current market?</i>	We agree that additional intervention in the form of a capacity mechanism is required to ensure a sufficient level of investment in flexible capacity.
21.	<i>What do you think the impacts of introducing a targeted capacity mechanism will be on prices in the wholesale electricity market?</i>	We are concerned that it will be difficult to design a targeted capacity mechanism that does not impact wholesale market pricing, and hence our expectation is that there will be a degree of dampening of signals for peaking capacity as a result.
22.	<i>Do you agree with Government's preference for a the design of a capacity mechanism: a central body holding the responsibility; volume based, not price based; and a targeted mechanism, rather than market-wide.</i>	<p>We agree with the assessment that a central body should have responsibility, and that a volume-based approach is appropriate. We also agree that a market-wide mechanism, with all capacity receiving payments, does not create the right form of incentive. However, we believe that a mechanism broader than the targeted mechanism now proposed will be required, given the issues the Consultation Document raises with regard to market-driven investment.</p> <p>Modern innovative generation technologies could enable a portfolio of services across fast response, high ramp and high efficiency, locational advantage and multiple fuel choices and the design of capacity mechanism should encourage the development of such technologies where economic.</p>
23.	<i>What do you think the impact of introducing a capacity mechanism would be on incentives to invest in demand-side response, storage,</i>	We think that, if sufficiently well designed, the proposed package of options will allow DSR, storage, interconnection and energy efficiency to

	<i>interconnection and energy efficiency? Will the preferred package of options allow these technologies to play more of a role?</i>	<p>play more of a role.</p> <p>We would stress that the most important consideration is to enable efficient decisions to be made by creating incentives that reflect capabilities rather than specific classes of technologies.</p> <p>In addition, we would note that consideration needs to be given to the ability of the gas system (supplies, networks and storage) to support an electricity system which utilises gas fired generation in a flexible manner.</p>
24.	<i>Which of the two models of targeted capacity mechanism would you prefer to see implemented: Last-resort dispatch; or Economic dispatch.</i>	<p>By definition, a „last resort" approach assumes that the market will deliver the flexible capacity required under normal circumstances. However, given the issues identified (the investment environment and whether it will be possible to bring forward new flexible investment), we do not believe that this will be the case.</p> <p>As a result, we believe that a broader remit is required for the contracting of flexibility in the market – and hence that this flexibility will then need to be used more often on an economic dispatch basis.</p> <p>In addition, with a broader remit, there is greater room to address a spectrum of flexibility requirements on an economic basis by building a portfolio of services.</p>
25.	<i>Do you think there should be a locational element to capacity pricing?</i>	<p>We think that locational issues will become increasingly important, and hence that the design of incentives for capacity should reflect this, both in terms of geographic location and in terms of transmission and distribution level requirements.</p>



## 8.5 Analysis of Packages

No.	Consultation question	Wärtsilä response
26.	<i>Do you agree with the Government's preferred package of options (carbon price support, feed-in tariff (CfD or premium), emission performance standard, peak capacity tender)? Why?</i>	We are fully supportive of a coherent package of reforms which enable the UK to meet its energy policy objectives. We consider the preferred package to be a sound, albeit high level starting point, whilst noting our specific concerns around ensuring that the current market issues surrounding investment signals for flexible capacity must be addressed in tandem, and that the capacity mechanism required is likely to be broader than that proposed.
27.	<i>What are your views on the alternative package that Government has described?</i>	We believe that the alternative package could also meet the Government's decarbonisation objectives (with the same caveats as for Question 26).
28.	<i>Will the proposed package of options have wider impacts on the electricity system that have not been identified in this document, for example on electricity networks?</i>	We believe that there is a requirement for more integrated consideration to be given to the development of networks, the respective roles of the transmission system operator and the DNOs, and the arrangements for balancing and reserve procurement, as the proposals are developed.
29.	<i>How do you see the different elements of the preferred package interacting? Are these interactions different for other packages?</i>	<p>A key interaction will be that between the investment signals for flexible capacity, and the balancing risks for intermittent generators. It is important that there is a clear picture of how flexible capacity will develop, and how it will be incentivised and supported, such that the risk for intermittent generators is manageable. This is particularly the case for FITs with CfDs and premium FITs, given the exposure for low carbon generators in this case.</p> <p>We need to be careful that the interaction between multiple policy instruments does not lead to sub-optimal economic investment in the low carbon generation and a portfolio of services to support them.</p>

## 8.6 Implementation Issues

No.	Consultation question	Wärtsilä response
30.	<i>What do you think are the main implementation risks for the Government's preferred package? Are these risks different for the other packages being considered?</i>	There is clearly a very significant amount of detail that must be added to the proposals to allow stakeholders engage fully and to take firm views. Given the very complex nature of the proposals, and the interactions noted in Question 29, consideration needs to be given to the timing for development of the package of reforms. Overall, sufficient time must be allowed for due consultation and consideration.
31.	<p><i>Do you have views on the role that auctions or tenders can play in setting the price for a feed-in tariff, compared to administratively determined support levels?</i></p> <ul style="list-style-type: none"> <li>– <i>Can auctions or tenders deliver competitive market prices that appropriately reflect the risks and uncertainties of new or emerging technologies?</i></li> <li>– <i>Should auctions, tenders or the administrative approach to setting levels be technology neutral or technology specific?</i></li> <li>– <i>How should the different costs of each technology be reflected? Should there be a single contract for difference on the electricity price for all low-carbon and a series of technology different premiums on top?</i></li> <li>– <i>Are there other models government should consider?</i></li> <li>– <i>Should prices be set for individual projects or for technologies</i></li> <li>– <i>Do you think there is sufficient competition amongst potential developers / sites to run effective auctions?</i></li> <li>– <i>Could an auction contribute to preventing the feed-in tariff policy from incentivising an unsustainable level of deployment of any one particular technology? Are there other ways to mitigate against this risk?</i></li> </ul>	We do not have specific views in this area.
32.	<i>What changes do you think would be necessary to the institutional arrangements in the electricity sector to support these market reforms?</i>	It is clear that the proposals represent a much greater level of central intervention than the current arrangements. It will be essential to establish robust governance to support this.

33.	<i>Do you have view on how market distortion and any other unintended consequences of a FIT or a targeted capacity mechanism can be minimised?</i>	<p>We think it is imperative to design FITs to ensure dispatch decisions are made on an efficient basis.</p> <p>Our view is that the targeted capacity mechanism, as proposed, will have a distorting effect despite its intended role. We think that rather than attempt to „design this out“, the role should be broadened and the mechanism designed appropriately to recognise a greater central role in the procurement of flexibility.</p>
34.	<i>Do you agree with the Government's assessment of the risks of delays to planned investments while the preferred package is implemented?</i>	We have no specific view in this area.
35.	<i>Do you agree with the principles underpinning the transition of the Renewables Obligation into the new arrangements? Are there other strategies which you think could be used to avoid delays to planned investments?</i>	We have no specific view in this area.
36.	<p><i>We propose that accreditation under the RO would remain open until 31 March 2017. The Government's ambition to introduce the new feed-in tariff for low carbon in 2013/14 (subject to Parliamentary time). Which of these options do you favour:</i></p> <ul style="list-style-type: none"> <li>– All new renewable electricity capacity accrediting before 1 April 2017 accredits under the RO;</li> <li>– All new renewable electricity capacity accrediting after the introduction of the low-carbon support mechanism but before 1 April 2017 should have a choice between accrediting under the RO or the new mechanism.</li> </ul>	We have no specific view in this area.
37.	<p><i>Some technologies are not currently grandfathered under the RO. If the Government chooses not to grandfather some or all of these technologies, should we:</i></p> <ul style="list-style-type: none"> <li>– Carry out scheduled banding reviews (either separately or as part of the tariff setting for the new scheme)? How frequently should these be carried out?</li> <li>– Carry out an “early review” if evidence is provided of significant change in costs or</li> </ul>	We have no specific view in this area.

	<p><i>other criteria as in legislation?</i></p> <ul style="list-style-type: none"> <li>– <i>Should we move them out of the “vintaged” RO and into the new scheme, removing the potential need for scheduled banding reviews under the RO?</i></li> </ul>	
38.	<p><i>Which option for calculating the Obligation post 2017 do you favour?</i></p> <ul style="list-style-type: none"> <li>– <i>Continue using both target and headroom</i></li> <li>– <i>Use Calculation B (Headroom) only from 2017</i></li> <li>– <i>Fix the price of a ROC for existing and new generation</i></li> </ul>	<p>We have no specific view in this area. We do however believe that the arrangements for the Renewable Obligation after 2017 should address the concern that negative prices could arise as the consequence of allocating ROCs on output.</p>

## 9 APPENDIX – OVERVIEW OF WÄRTSILÄ POWER PLANTS

9.1.1 Wärtsilä Power Plants is a leading supplier of flexible power plants. We aim to provide superior value to our customers by offering decentralised, flexible, efficient and environmentally advanced energy solutions. Our technology enables a global transition to a more sustainable and modern energy infrastructure and our solutions are modular, tried and tested power plants.

9.1.2 Our energy solutions offer a unique combination of:

- ☐ Energy efficiency
- ☐ Fuel flexibility
- ☐ Operational flexibility

9.1.3 We offer our customers competitive and reliable solutions that deliver high efficiency. Our power plants engines can run on liquid fuels, a wide range of gases and renewable fuels. Most of our products have multifuel capabilities and all can be converted from one fuel to another. Furthermore, the operational flexibility of our products enables high system efficiency, flexibility in operations with varying loads, low water consumption, as well as the possibility to carry out construction in phases according to the customer's needs. These key features, combined with the full lifecycle support we offer, create the basis for Wärtsilä's strong position within the Power Plants market.

9.1.4 With gas strengthening its potential to be the fuel of the future, our focus is on developing competitive solutions for the gas market. This focus supports our growth ambitions and enables a stronger presence in the broader markets.

9.1.5 Our business is divided into four customer segments

### Flexible baseload

9.1.6 Wärtsilä supplies flexible baseload power plants mainly to developing markets, islands, and remote locations. Energy consumption growth in these markets is driving a steadily increasing demand for new power generation solutions. Wärtsilä's customers in this segment are mainly Utilities and Independent Power Producers (IPP). Customer needs typically include competitive lifecycle costs, reliability, world-class product quality and fuel and operational flexibility, as well as operations & management services. Wärtsilä is in a strong position to cater to these needs. Flexible baseload power plants are run on both liquid fuels and gas.

### Grid stability and peaking

9.1.7 Wärtsilä's grid stabilising power plants enable the growth of energy solutions based on wind, solar and hydro power. We offer dynamic solutions used for systems support, reserve power, peaking needs, and

in regions with rapidly growing wind power capacity. Customers in this segment are mainly Utilities and IPP's. The strengths of Wärtsilä's products include rapid start and ramp up to full speed, the ability to operate at varying loads, competitive electricity generation and capacity costs, as well as 24/7 service. Grid stability and peaking plants are mainly fuelled by gas.

#### Industrial self-generation

- 9.1.8 Wärtsilä provides power plant solutions to industrial manufacturers of goods in industries such as cement production, mining, and textiles. Customers are mainly private companies and reliability, reduced energy costs, and independence from the grid are among the key factors in their decision making. Power plants in this segment are run on either gas or liquid fuel, depending on fuel availability.

#### Solutions for the oil & gas industry

- 9.1.9 Wärtsilä provides engines for mechanical drive, gas compression stations, and for field power and pumping stations to the oil and gas industry. Typical customer needs include maximum running time, reliability, long term engineering support and 24/7 service. The solutions we offer run on natural gas, associated gas and crude oil.

#### Power Plants and sustainability

- 9.1.10 The world is currently seeking more sustainable solutions for energy infrastructure. This development is driven by climate policies, energy security and economics. Carbon intensive energy sources are being replaced by low carbon fuels, such as natural gas and renewable solutions. Energy savings and efficiency improvements are being encouraged, and even legally enforced, at every level.
- 9.1.11 Wärtsilä's energy solutions offer a unique combination of flexibility, high efficiency, and low emissions. Many different fuels, including bio-fuels, can be used efficiently, which helps in reducing greenhouse gas emissions. The flexibility of Wärtsilä's solutions enables the development of a reliable energy infrastructure, wherein most of the sustainable characteristics are already known.

#### Efficiency development

- 9.1.12 We continuously seek improvements in the present engine portfolio, and are developing new engine concepts for the future. As a power plant contractor, we develop our power plants in parallel with the engines. This enables us to optimise both the performance and the reliability of our power plant offering. We offer high efficiency, single cycle solutions and focus on improving efficiency even further through the use of e.g. combined cycle solutions. Power plant net efficiency can be further improved by plant design and by optimising internal power consumption. Such solutions minimise not only fuel and water consumption, but also the emissions per unit of energy, thereby providing major environmental benefits.

### Flexibility

9.1.13 Flexibility is one of the main features of Wärtsilä's power plant solutions. The high modularity of our products makes it easy for our customers to construct an optimally sized plant, and to later expand its size to meet future needs. Fuel flexibility has many advantages for our customers, notably the lowering of energy production costs by using low cost fuels, minimising CO<sub>2</sub> emissions, and the ability to convert from one fuel to another based on fuel availability.

9.1.14 The unique operational flexibility of our products comprises:

- ☐ Very fast plant starts and stops
- ☐ High ramp rates
- ☐ High part-load efficiency
- ☐ A broad load range

9.1.15 Frequent starting and stopping does not affect the operational costs of the plant. This is unique, no other competing technology offers the same

### Towards an optimally sustainable power system

9.1.16 The power generation system of the future will contain a significant percentage of wind power capacity. Such capacity is non-dispatchable and variable, which creates potential for other power units to balance the system. Wärtsilä is in a good position to meet this need, as the operational flexibility of our products makes them easily adaptable to the needs of the grid.

### Reducing emissions

9.1.17 Wärtsilä places high priority on developing diverse and flexible emission reduction techniques. Since emission requirements and the fuels used differ widely, a comprehensive range of products is required in order to offer competitive solutions.

9.1.18 Mitigating the effects of climate change will call for substantial reductions in greenhouse gases (GHG). We believe that the importance of natural gas will increase in the future. Consequently, the multi-fuel capability of our power plant solutions becomes an increasingly significant competitive advantage, as it enables the utilisation of all liquid and gaseous bio-fuels that may become available on a wider scale. Wärtsilä focuses on developing decentralised energy solutions that emit fewer GHG emissions.