FOREWIND

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TEESSIDE A & B

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1 Introduction

1.1 Climate change and the role of renewable energy

1.1.1 Since the industrial revolution the burning of fossil fuels has led to an increase of carbon dioxide (CO_2) in the atmosphere, one of the primary greenhouse gases which influence the global climate. By the end of 2010 it was estimated that the increase in CO_2 concentration in the atmosphere had reached 390ppm, which is approximately 39% above the levels seen during the industrial revolution. It has also been estimated that 85% of primary energy comes from the combustion of fossil fuels and that 56% of all human greenhouse gas emissions come from the consumption of these fuels (Moomaw *et al*. 2001). Therefore it is most likely that the increase in average global temperatures is due to the increase in greenhouse gas emissions caused by human activities.

1.1.2 The Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (released September 2013) has concluded that the combined land and ocean surface temperature increase (approximately 0.85°C between 1880 and 2012) is most likely due to anthropogenic sources of greenhouse gases (IPCC 2013). Despite the fact that future emissions due to human activities are unpredictable and the effect of such changes in emissions on the climate are still relatively unknown, there is still a need to describe the potential scenarios that could ensue. If the current rate of increase in global emissions continues, this may lead to the global temperature rising 6°C on average by the end of the 21st Century. The impacts and risk from uncontrolled climate change are well documented, most notably an increase in extreme weather events, flooding and drought leading to increased global instability, conflict, public health issues and mass migrations (Department for Energy and Climate Change (DECC) 2011a).

1.1.3 To minimise the worst effects of climate change it has been suggested that average global temperature rise has to be kept to 2°C and greenhouse gas emissions will have to start reducing before 2020 (DECC 2011a). There is also a potential economic threat caused by climate change. The Stern Report (Stern 2006) estimated that an annual loss of at least 5% of global gross domestic product (GDP) was predicted due to the risk and overall costs of climate change if the issue is not addressed. When a wider range of risks and impacts is taken into account, global GDP could be 20% lower than it might otherwise be (Stern 2006).

1.1.4 Worldwide, greenhouse gas emissions have become a growing concern to the extent that attention is now being focused on developing renewable energy to replace fossil fuel sources. In 2010 the share of renewables in worldwide electricity generation was approximately 19%, with 16% of electricity coming from hydroelectricity and only 3% from new renewables (geothermal, solar, wind and tidal) (REN21 2011).

1.1.5 The need to tackle rising greenhouse gas emissions and climate change is clear, for humanitarian, economic and environmental reasons. To address this issue, there is a need to make use of energy sources which are a naturally occurring and inexhaustible source of energy, which do not generate CO_2 emissions and therefore do not influence the global climate (DECC 2011b).

1.1.6 Though it may not be possible to prevent climate change, society and the economy can still, to some extent, be protected from its impacts through mitigation measures such as developing alternative sources of low carbon energy. The next section describes the UK Government strategy for tackling climate change and the central role renewable energy will play in delivering energy security as well as economic opportunities.

2 The Need for and the Benefits of Renewable Energy

2.1 The key drivers for renewable energy

2.1.1 The need for renewable energy can be summed up in a statement by DECC, when answering the question "Why do we need renewable energy in the UK?"

"For a whole variety of reasons. It will help us get off the fossil fuel hook and reduce our greenhouse gas emissions. If we meet our target of delivering 15% renewables by 2020 it will reduce our overall fossil fuel demand by around 10%. Our gas imports will reduce by 20-30% against what they would have been in 2020. More renewable energy will also bring outstanding opportunities to create jobs and we will become more energy secure (DECC 2012a)."

2.1.2 Through this the UK Government has recognised that the key drivers for moving towards providing energy from renewable sources include:

- Tackling climate change – the reduction of greenhouse gases and the shift towards renewable energy;
- Provision of a secure energy supply for the future – reducing the net import of energy especially electricity;
- Developing new infrastructure – to support greater development of renewables; and
- Provide economic opportunities – employment and output from the sector.

2.2 Tackling climate change

2.2.1 The UK Government stated its commitment to providing energy from renewable sources in its 'First Progress Report on the Promotion and Use of Energy from Renewable Sources for the United Kingdom' (2011) (under Article 22 of the Renewable Energy Directive (2009/28/EC)). In July 2011 the Government published its UK Renewable Energy Roadmap (DECC 2011c) in which it reiterated the commitment to reaching its target of producing 15% of its total energy from renewable sources by 2020 from the transport, heat and electricity sectors. In relation to offshore wind, the Roadmap predicts that up to 18Gigawatt (GW) could be deployed by 2020 (central range), with very high potential for deployment over 40GW by 2030.

2.2.2 Under the Climate Change Act 2008, the UK is legally bound to reduce its greenhouse gas emissions by at least 80% by 2050. This is expected to be achieved through action either at home or abroad. In relation to this, in December 2011, the Government published its Carbon Plan which sets out how the UK would halve the 1990's level of greenhouse gases by 2020 and how the UK would make the transition to a low carbon economy, while at the same time maintaining energy security. In order to achieve this, there will have to be major changes in how energy is used and generated. Energy efficiency will have to

increase significantly across all sectors. The oil and gas used for cars, to heat buildings and for the power industry will largely need to be replaced by electricity, sustainable bioenergy, or hydrogen. Electricity will need to be decarbonised through renewable and nuclear power, and the use of carbon capture and storage (CCS). The electricity grid will need to be larger and smarter at balancing demand and supply. Pertinent to establishing the need for developments like Dogger Bank Teesside A & B, the Carbon Plan estimates that approximately 40-70GW of new low carbon electricity generation will be needed by 2030 and this will be provided, in part, by offshore wind farms.

2.2.3 The UK Government has supported long-term investment in the UK's renewables industries through the Renewables Obligation (RO) in which a mandatory requirement was placed on UK electricity suppliers to source a specific and annually increasing percentage of energy from renewable sources. The RO is the current main mechanism for supporting large scale generation of renewable electricity and, since its introduction in 2002, it has succeeded in more than tripling the level of renewable electricity in the UK (DECC 2012a). In 2010 the end of the RO was extended from 2027 to 2037 to ensure the continued support for renewables beyond 2020.

2.2.4 In July 2011 the Government launched The Electricity Market Reform (EMR) White Paper (DECC 2011d). The aim of the policy is to develop and deliver a new market framework that will enable the cost effective delivery of secure supplies of low carbon energy (DECC 2012a). The EMR Project will overhaul the electricity market to help promote investment in energy infrastructure, especially low-carbon generation (DECC 2011d). This marked the first stage of the reform process and set out the Government's commitment to transform the UK's electricity system to ensure that our future electricity supply is secure, low-carbon and affordable. The National Policy Statement (NPS) for renewable energy infrastructure (EN-3) recognises the importance of electricity generation from renewable sources in the development of a low carbon economy and in achieving the Government renewable energy targets of 15% by 2020 (DECC 2011e).

2.2.5 The UK has made very good progress against the target of 15% of energy consumption to come from renewable sources by 2020. At the end of 2012, 4.2% of UK energy consumption came from renewable resources. This was up from 3.8% in 2011. Across 2011 and 2012 combined, an average of 4.0% energy consumption came from renewable sources against the first interim target of 4.04%, with the small shortfall falling within the margin of error around the estimate. Renewables' share of electricity consumption in 2012 was 10.8 %, an increase from 8.8% in 2011. Around 40.2 TWh of renewable electricity was generated in 2012, an increase of 23% on the 32.7 TWh in 2011. Capacity increased by 27% from 12.2GW to 15.5GW between the end of 2011 and 2012 with strong growth in the onshore and offshore wind and solar sectors.

2.3 Secure energy supply

2.3.1 Over the next decade an impending energy gap will be caused by the closure of the UK's nuclear and coal-fired power stations. It is estimated that over this period the UK will lose a third of electricity generating capacity and this is exacerbated by the fact that the UK is a net importer of electrical energy (DECC 2012a). In 2011 net imports had risen 134% above the 2010 figure to 6.2TWh which was partly due to a 45% fall in the level of exports. Of this figure imports contributed 1.7% to electricity supply (DECC 2012a). This dependence has long been seen as unsustainable and puts the UK at a financial and demand risk due to the worldwide increase in competition for energy resources.

2.4 New infrastructure

2.4.1 With the move towards low carbon energy sources there will be a need for net additional electricity generating infrastructure to guarantee sufficient supplies due to the changes in the nature of generating capacity. Currently the UK has a generating capacity of 85GW although the annual demand is half this amount. To reduce the risk to energy security and ensure resilience to changes in demand the Government estimates that there will be a minimum need of 59GW net of new electricity capacity by 2025 (DECC 2011a).

2.4.2 Currently coal and gas supply the UK with 75% of its electricity needs. To meet the government target on tackling climate change by 2050, nearly all electricity will need to come from zero carbon energy generation such as renewable sources, nuclear or fossil fuels used in combination with CCS techniques (HM Government 2009).

3 Offshore Renewables

3.1.1 The result of Government support for the development of offshore wind power to supply low carbon electricity is reflected in the increase in the UK's production of electricity from wind farms. In 2011 the UK wind energy sector had the capacity to deliver 2.5GW which is over 50% of total world capacity. Thus the UK is one of the world's leaders in both installed generation capacity and in the development pipeline, which has a predicted capacity in excess of 40GW.

3.1.2 Renewables now generate approximately 11% of the UK's electricity requirements. Of this, wind is by far the largest contributor to the renewables mix. If the level of growth continues, one in ten houses will be powered indirectly by wind energy within two years and wind energy could be providing more electricity than nuclear by 2014 at the earliest (RenewableUK 2012).

3.1.3 Offshore wind energy generation is well placed to play a significant role in response to climate change and energy targets. It has lower lead-in times than nuclear energy and is in a more advanced state, both from a technical and economic perspective, than other forms of low carbon energy technology (such as CCS and other renewable technologies including wave and tidal). The UK Government's draft Delivery Plan set out a range of 8 to16GW by 2020 with a scenario showing up to 39GW of offshore wind by 2030, providing the cost reductions to enable that are delivered. Based on the evidence gathered by the Offshore Wind Cost Reduction Task Force, and assuming its recommendations are followed, it has been agreed that costs for offshore wind can reach £100/MWh by 2020.

3.1.4 The UK offshore wind energy sector is expected to have the potential to create jobs in the manufacturing sector. Potential job creation is related to production capacity of the wind energy sector. Based on information from a variety of sources including RenewableUK (2012), the forecast for future job creation in the offshore wind sector for a range of scenarios suggests that there could be 42,400 people directly employed within the sector by 2021. This is based on a scenario of 31GW capacity by 2021. Currently the wind and marine energy sector provides 12,242 full-time equivalent jobs and this is growing (RenewableUK 2012).

3.1.5 Since 2000, The Crown Estate has run six offshore wind leasing rounds which have increased in scale and technical complexity as the industry has developed. The organisation has been at the forefront of the development and expansion of offshore wind energy in the UK for more than a decade and helped to ensure that the UK is one of the world's leaders in installed generation capacity. Rounds 1, 2 and their extensions are now largely under construction or operational. The much larger Round 3 projects - including those on Dogger Bank - are all in the pre–planning or planning stages.

3.1.6 The offshore wind industry enjoyed a record breaking year in 2013 in terms of new deployment according to RenewableUK's 2013 report "Wind Energy in the UK". The study assessed the state of the wind industry from July 2012 to June 2013, and revealed a step change in the offshore wind sector. Installed capacity stood at 3,321 megawatts (MW) at the end of June 2013, up from 1,858MW 12 months earlier - an increase of 79%. The 1,463MW installed offshore marks the first year in which offshore deployment outstripped onshore wind. The current status of offshore wind farm generating capacity is indicated below in **Table 3.1**.

Table 3.1 Status of UK offshore wind farms – (various sources)

Offshore wind farm status	Number of projects	Electricity generation (MW)
Operational	22	3,653
Under construction	4	1,191
Consented	9	10,245
In planning (application submitted)	12	13,375
In planning (pre-application and registered with the Planning Inspectorate)	6	8,800

Note that 1 site has been refused and a further 4 have been withdrawn. There are further projects where sites have been awarded.

3.2 The Dogger Bank Zone & Dogger Bank Teesside A & B

3.2.1 The Dogger Bank Zone is the largest site available for leasing released by the Crown Estate for Round 3. The site has many attributes which make it an attractive proposition for wind farm development, having a good wind resource with higher annual mean wind speeds than the other Round 3 zones (>10m/s). It also has relatively shallow water depths and good ground conditions which enable a broad range of foundation options (Forewind 2012a).

3.2.2 Dogger Bank Teesside A & B will be the first and second projects of the second stage of the Dogger Bank development. Dogger Bank Teesside A & B will comprise two wind farms, each with a generating capacity of up to 1.2GW, and will connect into the existing National Grid substation at Lackenby, in Teesside. Dogger Bank Teesside A & B will have a total generating capacity of up to 2.4GW (enough to power approximately 1.8 million homes or all businesses in the North East). This is a major step forward towards reaching the government target of generating 18GW from offshore wind generation. Not only will such a development play a key role in reaching the UK renewable energy targets, it will also generate investment in the supply chain and employment across the UK. This will in turn provide a source of sustainable economic growth.

3.2.3 In the north east of England where the onshore elements of Dogger Bank Teesside A & B are located, 17% of people are employed in manufacturing whilst 16% of people are employed in wholesale & retail trade and repairs (see **Chapter 22 Socio-economics**). In the Redcar and Cleveland area 18.8% of jobs are in the manufacturing industry although employment rates are low (63.8% employed) compared to the national average (71.2% employed) (Nomis, Office for National Statistics October 2012 – September 2013).

3.2.4 During the construction of Dogger Bank Teesside A & B it is estimated that between 1,600 – 2,600full-time equivalent (FTE) jobs (through both direct and indirect employment) could be created per project with significant expenditure will be made in manufacturing, services, materials and equipment (see **Chapter 22**).

3.2.5 In conclusion, Dogger Bank Teesside A & B will contribute to national targets for tackling climate change, reducing the reliance on fossil fuels and securing the energy supply. This development will produce up to 8 TWh of electricity which could provide sufficient electricity to cover the annual demand for up to1.8 million British homes. In combination with the other current developments in the Dogger Bank Zone, namely Dogger Bank Creyke Beck A & B, which has the capacity to generate up to 2.4GW of electricity, the cumulative contribution to demand and energy security is considerable. These developments also have an important role in supporting the local economy by providing jobs and new infrastructure, which will enhance the sustainable development of each of the regions in which they operate.

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