

Chapter 20

United Kingdom

20.1 INTRODUCTION

In 2002, a total of 87.76 MW of capacity was installed in the United Kingdom, bringing the total installed capacity in the country to 522 MW, an increase of approximately 20% from last year. Although encouraging, this figure falls short of that anticipated for 2002, and it highlights the fact that there is a long way to go to meet the target of 10% from renewables by 2010. However, signs for 2003 are extremely good – approximately 300 MW are expected to be commissioned. In addition, the United Kingdom is overcoming planning permission problems – a total of 535 MW gained planning permission in 2002.

Notable planning decisions in 2002 included the first approval under Section 36 of the *Electricity Act*, which enables the central government to make decisions regarding any projects of more than 50 MW. Approval was granted to a 58.5-MW wind farm near Aberystwyth in Wales, which will produce roughly 1% of total Welsh electricity needs. The United Kingdom's largest Brownfield site was also recently approved; it is a 47.5-MW wind farm by Amec Wind and Corus on an old steelworks site at Redcar in Teesside.

Another noteworthy planning decision came in April with consent for the first large-scale offshore project in the United Kingdom, at Scroby Sands off the east coast of Great Yarmouth in Norfolk. This was followed

in July by consent for another offshore wind farm at North Hoyle, off the coast of Prestatyn, North Wales. National Wind Power (NWP) Offshore hopes to have this 90-MW wind farm operational by autumn 2003. In the last month of 2002, the third offshore wind farm at Rhyl Flats, again in Wales, gained development consent.

There has also been success for small, local schemes with two 1.3-MW machines for the first Windworks scheme at High Sharpley, County Durham. The Windworks scheme is being run by NWP and provides guidance support at no cost to land owners with suitable sites. NWP will construct, operate, and maintain the machines, generating a useful income stream, particularly for the beleaguered farming community.

Planning permission has also been granted for what will be the single largest turbine in the United Kingdom, a 3.2-MW GE Wind Energy machine at England's most easterly point, Ness Point in Lowestoft, Suffolk. It is a prototype installation to be erected on land but only 20 m from the water's edge, with full offshore specification. If the turbine performs as expected, then further U.K. installations will follow, including, if approval is granted, GE's own offshore site at Carnfleet Sands off the coast of Essex.

The United Kingdom British Wind Energy Association (BWEA) predicts that approximately 2,300 MW could be operational in the country in three years.

20.2 NATIONAL POLICY

The U.K. government is committed to putting the environment at the heart of its decision-making. As a result, renewable energy is high on the political agenda. In the United Kingdom, the *Renewables Obligation* (RO) became law on 1 April 2002. This impor-

tant government measure will provide an assured market for renewable energy for at least the next 25 years. Through the RO, it is currently estimated that by 2010 the value of support to the U.K. renewables industry will be 1 billion GBP per year. The government is actively considering setting targets beyond 2010, and this issue will be explored in an *Energy White Paper* to be published early next year. The RO will provide the impetus for a major expansion of renewable energy in general and the offshore wind industry in particular.

A small but growing industrial base has begun to emerge in the United Kingdom, as technology has improved and costs have been reduced. A recent study commissioned by Renewables UK (see the section below on Industry Development and Structure) suggests that the total global market for offshore renewables could be worth as much as 8 billion GBP by 2007, with the European market accounting for 90% of this. It is the intention of the government that the United Kingdom is a major player in this.

Strategy

Following the announcement in 2001 by the Crown Estate of the allocation of leases for offshore wind farm sites, approximately 20 developers obtained agreements for leases. If all of these projects come to fruition, then a total of 1.4 GWh/year of renewable energy could be produced. Three of these projects have already gained development consent from the U.K. government during 2002. The positive response to the first round, which limits development to within the country's territorial waters, has been followed by developers pressing the government to permit further development both within, and beyond, territorial waters.

In response to this pressure, the U.K. Department of Trade and Industry (DTI) issued a consultation paper titled *Future*

Offshore, on 22 November 2002. The paper presents a strategic framework for the offshore wind industry and identifies certain key issues that need to be focused on and clarified before the next round of offshore developments take place.

In summary, the main themes of the strategic framework are as follows.

- Proposed arrangements for future rounds of development leases, including details of the site allocation process and the proposal to focus on strategic areas.
- Specific arrangements for the next round under the existing legal framework.
- Arrangements for a strategic environmental assessment of the three proposed strategic regions prior to the announcement of the next round.
- Proposed changes to the consents process to address specific issues relevant to offshore renewable energy installations.
- Provision and regulation of offshore infrastructure for transmitting electricity.
- Recommendations for a legal framework for future offshore development, to address shortcomings and enable development to take place beyond the limit of territorial waters.

The consultation closes on 18 February 2003.

Progress Towards National Targets

The *Future Offshore* paper also covers a strategic framework for all marine renewable technologies (i.e., wind, wave, and tidal). The paper recognizes the contribution marine renewables can make towards the United Kingdom's target of 10% from all renewables by 2010. The potential benefits for climate change and energy security are the main reasons why the United Kingdom has chosen marine renewables to be its main strand towards meeting its target.

The industry itself has made a projection of approximately 3 GW to 4 GW of new capacity that can realistically be built by 2010, in addition to the 1.4 GW under the first round. Cumulatively, offshore development on this scale would provide approximately 40% to 50% of the 2010 renewables target. Renewable energy is expected to play an important long-term role in providing electricity for households, industry, and the public sector – and ultimately for transport as well. While many renewables offer all of these benefits, the particular advantage of marine renewables is their potential for greater public acceptability. This is mainly because of the likelihood of lower visual impact.

20.3 COMMERCIAL IMPLEMENTATION

Installed Capacity

Between 1 January 2002 and 31 December 2002, the United Kingdom installed 86 on-shore turbines with a total capacity of 87.76 MW. The average capacity of the turbines installed during 2002 was 1.02 MW. This brings the total number of turbines in the country to 999, generating approximately 522 MW of power. Although planning consents were granted for offshore turbines, none were installed in 2002.

Rates and Trends in Deployment

The rate of deployment in 2002 was the highest ever achieved in the United Kingdom, with more than 87.7 MW of capacity installed, just beating the 84.5 MW installed in 1997. Even so, 2002 was not as good a year as the BWEA anticipated. The initial projection showed more than 200 MW identified for commissioning in 2002. However, a number of factors, including many grid-related problems, saw this fall to less than 100 MW.

Against this background, the BWEA reported that a total of 525 MW won planning per-

mission in 2002, which is almost exactly the total amount built during the previous 11 years combined. In addition, the BWEA reports that a total of 23 new projects are confirmed for construction in 2003. More than 300 MW of new wind power capacity is expected to come online, thus increasing capacity by approximately 60% in just one year. Current predictions for 2004 are for an additional 600 MW to be commissioned.

Contribution to National Energy Demand

With a total electricity demand of approximately 400 TWh in 2002, 1,474 GWh was supplied by wind energy, which represents 0.37% of total electricity demand.

20.4 MARKET DEVELOPMENT AND STIMULATION

Main Support Initiatives and Market Stimulation Incentives

The several possible sources of financial support for electricity generated from renewable sources are as follows.

- The *Renewables Obligation*: The RO is a requirement on licensed electricity suppliers to source a specified proportion of their total sales from eligible renewable sources. Most renewable sources are eligible, although there are restrictions on large hydro and co-firing with fossil fuels. Eligible generation supplied by a licensed supplier to customers in Great Britain attracts Renewables Obligation Certificates (ROCs) that may be sold separately from physical electricity. A buy-out option for suppliers caps the cost to consumers, although suppliers may be willing to exceed the buy-out price for ROCs because ROCs attract a share of the buy-out proceeds. The buy-out price is 30.00 GBP/MWh in 2002 and 2003 and will follow the U.K. RPI thereafter.

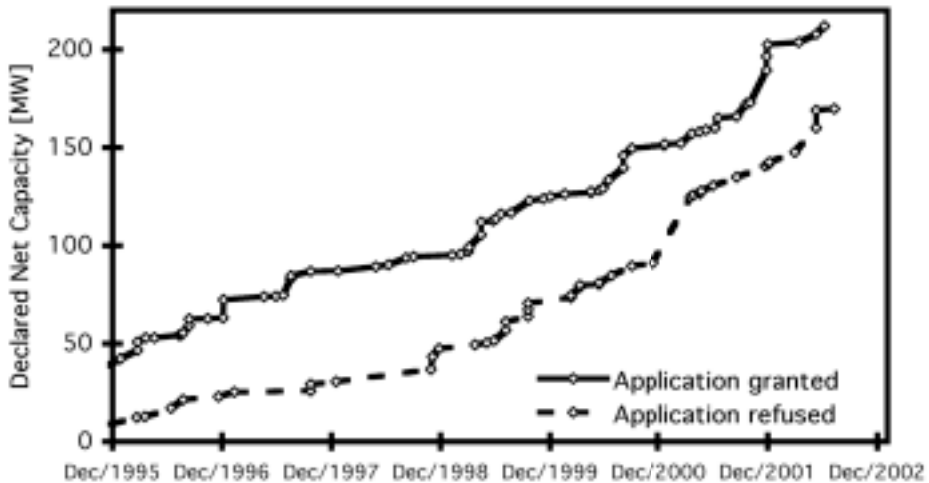


Figure 20.1 Wind farm planning application success and failure rates by declared net capacity

- The Emissions Trading Scheme: In certain circumstances, renewable energy can be used to help meet emissions reduction targets in the Emissions Trading Scheme. In particular, where individual suppliers over-achieve their obligation and do not wish to sell their ROCs to other suppliers, they may be able to convert their over-achievements to credits measured in carbon dioxide equivalents and trade them under the rules of the scheme.

- Exemption from the *Climate Change Levy*: The *Climate Change Levy* is levied on non-domestic end users of energy, including electricity. Electricity from eligible renewables is exempt from the levy and is certified by Levy Exemption Certificates (LECs), which cannot be separately traded from physical electricity. The current levy rate is 4.30 GBP/MWh. Eligibility is similar, although not identical, to that for the RO, and Ofgem operates the accreditation and certification process in parallel to the obligation process.

The government has underpinned the RO with a series of support schemes designed to bring forward technologies at the demonstration stage – these include offshore wind, energy crops, and solar photovoltaics, to

name three. In addition, there is also support for community renewables and an enhanced program of industry-based research and development (R&D). The expected growth in the renewables market offers the U.K. industry a tremendous opportunity to invest in plant and equipment, create jobs, and stimulate innovation.

To assist the U.K. industry, a DTI initiative was launched in March 2002 to set up the Renewables UK. Coupled with the setting up of Renewables UK was the announcement of the new Renewables Advisory Board, which held an interim meeting in May 2002 and its first full meeting in November 2002. The board will play a significant role in the formation and delivery of government policy on renewables. The board is charged with identifying the key areas that the government needs to tackle and provide workable solutions. Specifically, the board will conduct the following activities.

- Develop strategies for improving the development and deployment of renewable technologies in the United Kingdom, and strengthen the U.K. supply chain and the in-

infrastructure required to underpin the growth of a world-class industry.

- Examine and prioritize initiatives aimed at improving the competitiveness of the U.K. industry.
- Identify new export opportunities and the measures required to ensure U.K. companies can fully exploit them.
- Make specific recommendations by summer 2003 for actions to be taken by the industry and the government.

Unit Cost Reduction

As in 2001, no clear cost reduction has been observed in the last year. In the United Kingdom, a wind farm built today would typically cost 675.00 GBP/kW installed, including infrastructure. Costs as low as 550.00 GBP/kW are possible where accessibility is good and grid connection costs are low. Developers continue to be optimistic that onshore costs will fall further, to as low as 500.00 GBP/kW for some sites due to larger, more efficient turbines as well as economies of scale.

There have not been any additional offshore wind farms built since Blyth in 2001, so there are not any experiences to update the extrapolated figure for Blyth of 834.00 GBP/kW. However, there is considerable room for cost reduction as a result of increased experience, improved installation techniques, larger wind turbines, and larger schemes. In fact, several offshore contractors are currently pursuing various schemes that, if successful, will bring the cost down to 650.00 GBP/kW to 700.00 GBP/kW.

20.5 DEPLOYMENT AND CONSTRAINTS

Wind Turbines Deployed

A total of ten new projects, including two repowerings and two extensions to existing sites, began generating electricity to the grid in 2002. Table 20.1 lists these ten projects.

Main Constraints on Market Development

The United Kingdom has historically had problems obtaining planning consent for

Site	Online	MW	Turbines	Location
Out Newton	Jan 31 st	9	7	Humberside
Cemmaes II	Feb 23 rd	15.3	18	Powys
Bu Farm	Mar 6 th	2.7	3	Stronsay
Burgar Hill Repowering	May	2.75	1	Orkney
Mablethorpe	June	1.2	2	Lincolnshire
Blaen Bowl	July	3.9	3	Carmarthenshire
Bowbeat	Sept	31.2	24	Borders
Hafoty Ucha II - extension	Dec 10 th	1.7	2	Clwyd
Lendrum's Bridge II - 2 nd phase	Dec 16 th	7.26	11	Northern Ireland
Tangy	Dec 17 th	12.75	12	Argyll & Bute

Table 20.1 New projects for 2002

wind farms in particular and for renewable energy schemes in general. A joint DTI/DTLR initiative requested all regions to make an assessment of the potential for renewable energy generation in 2010 and propose reasonable targets for their areas. The regional assessments were largely undertaken during 2000 to facilitate a means of encouraging the adoption of regional targets and approaches within Regional Planning Guidance and within Regional Sustainable Development Frameworks. In October 2001, DTI/DTLR commissioned a study to examine whether the targets proposed by the different regions would be sufficient to achieve the national target for renewable electricity generation. Published in February 2002, the study concluded that the 10% RO is more or less reached under the high targets proposed in the regional assessments. Just over half (53%) of the total of the regions' assessments consist of onshore and offshore wind, with 37% for onshore wind and 16% for offshore wind.

In June 2002, it was announced that a total of 1.74 million GBP of funding would be provided to support a range of different activities, including planning and promotion of renewable energy projects and development of targets in the regions throughout Britain. The funding, from a two-year program worth up to 2.5 million GBP, has been allocated to regional government office network.

The limitations of the U.K. transmission system have long been understood. There is a net flow of power from the north to the south. The existing onshore electrical transmission infrastructure effectively tapers off as it progresses north, and the ability to transmit additional loads also reduces as it progresses north. The largest prospective source of additional renewable energy is a wind-based plant located along the western seaboard, running from the north of Scotland and Outer Isles down to the Cornish Peninsula,

with offshore wind power the dominant source.

A DTI-commissioned study was completed in 2002, which investigated the feasibility of developing an offshore, high-voltage, direct-current network to connect these renewable energy resources to the existing transmission system closer to the center of demand. The study identified likely capacity requirements, network topology, and possible points of interconnection with the existing network. It also made a comparison with the alternative option of upgrading existing onshore transmission networks and commented on the cost implications and associated planning issues. Results of the study pointed in the direction of considering land-based options for strengthening the transmission capacity from north to south, although the optimum solution may well end up being a hybrid of sub-sea cable and land-based strengthening.

One constraint not common to the rest of Europe, and of increasing importance over the year, comes from the effect that wind farms may have on aviation, both in terms of radar systems and low flying. In order to ensure development of the wind industry – but recognizing that such a development must take into account national defense and air safety – the DTI set up the Wind Energy, Defence & Civil Aviation Interests Working Group. The group includes representatives from defense and civil aviation as well as the DTI and the U.K. industry. The aim of the working group was to provide information and advice to developers, planners, military, and civil aviation personnel on the potential effects of wind turbines on radar systems.

As one of its first tasks, the working group has put together a document titled *Wind Energy and Aviation Interests - Interim Guidelines*. The guidelines, which were

launched on 2 October 2002 at BWEA 24 at Brighton, set out to do the following.

- Provide a clear, readable, single source of information on all aspects of the impact of wind farms on aviation, both civil and military.
- Identify the range of interactions between wind energy and aviation interests.
- Outline the measures adopted to address the issues that are likely to arise from such interactions.
- Identify the organizations involved in the processes.

The working group has also commissioned various specific studies to further assist in the understanding of the effects of wind farms on radar systems. Rotating turbine blades could affect both military and civil radar in ways that could seriously compromise their operation. A computer model is being developed that will be able to predict the impact of wind farms on specific radar installations. A second study is investigating the feasibility of measures to mitigate the effect of wind turbines on radar. This may permit wind farms to be located in areas that would currently raise an objection from the MOD. The results of these studies are expected in 2003.

20.6 ECONOMICS

Trends in Investment

Financing for wind farms is obtained largely from corporate investors and banks, although there is a small amount of private investment. Since the announcement of the RO, utilities and conventional power generators have become increasingly involved in wind farm development. Because of the high value the obligation places on renewables, corporate investment will yield high returns through an expansion of the core business while reducing exposure to penalty payments. Wind has found particular favor because of

its economics, maturity, and ability to deliver quickly.

There has been no direct public funding available for capital investment in wind farms, but in 2001, the government announced a Capital Grants Scheme for offshore wind. In addition to 64 million GBP of DTI funding, the National Lottery New Opportunities Fund (NOF) will be providing an additional 10 million GBP for capital grants to build offshore wind projects. Launched in October 2001, project consortia had to pre-qualify by 31 January 2002. The pre-qualification process resulted in consortia registering interest in developing nearly 2,000 MW of capacity. The joint scheme will operate over three rounds of competition. The first round closed on 31 August 2002, the second round closed on 31 December 2002, and the third round will close on 30 June 2003. The primary aim of the scheme is to stimulate early development of a significant number of offshore wind farms. This is desirable in order to do the following.

- Deliver early contributions to the RO and emissions trading.
- Underpin development of the industry and equipment supply chains.
- Provide a learning experience that can improve confidence.
- Help reduce future costs and enable future projects to proceed without the need for grant support.

As a result of this scheme, the first two grants were announced in October 2002 for the offshore wind farms planned at North Holye in Wales and at Scroby Sands in Norfolk. Each grant was for 10 million GBP.

Trends in Unit Costs of Energy and Buy-Back Prices

In the existing U.K. market, it is extremely difficult to decipher a typical generation cost from wind. Projects have been developed

for less than 3.0 GBP/kWh under long-term, fixed-price power purchase contracts where wind speeds are high (more than 9.0 m/s at hub height). The value of wind energy in the new climate, with electricity traded under the New Electricity Trading Arrangements (NETA) and the RO, can most easily be seen through auctions of the power generated from wind farms contracted under the Non-Fossil Fuel Obligation (NFFO). The latest NFFO online auction of green electricity from NFFO contracts was completed on 19 August 2002. The auction began on Monday, 12 August, and contracts were finally awarded to a total of 12 successful bidders. In all, 241 contracts, representing approximately 609 MW of green electricity, were successfully auctioned. The contracts are for electricity produced between 1 October 2002 and 31 March 2003. The av-

erage price, at 6.50 GBP/kWh, was more than that of the previous auction, held in January 2002, when the average price was 6.44 GBP/kWh. The price for wind was 6.65 GBP/kWh, somewhat higher than the 6.31 GBP/kWh from the previous auction. These prices are more than twice the price paid for wind in 2001, when the price was 2.84 GBP/kWh. This is because this is the first auction held after the introduction of the RO in April 2002, and prices reflect the market value of the ROCs.

20.7 INDUSTRY

Manufacturing

The United Kingdom continues to supply a wide range of components to the wind



Figure 20.2 NEG-Micon's NM82 wind turbine

turbine industry, including blades, castings, towers, pitch bearings and elastomerics.

NEG-Micon Rotors Ltd. achieved continued growth through 2002 at its blade production facility on the Isle of Wight. Blade production was up by nearly 54% to a total of 860 blades, and the total number of staff was up by nearly 26% to a total of 350, making the company one of the leading employers on the island. Forecasts for 2003 anticipate further increases in blade production and number of employees of 63% and 37%, respectively. Much of this increase in production is due to significant improvements in production techniques such as resin infusion developed by NEG-Micon under the DTI's R,D&D research program.

The United Kingdom now has well-established expertise in consultancy for site exploration, performance and financial evaluation, planning applications, and environmental impact statements. Growing interest in the offshore market has attracted new business for consultants in environmental assessment, meteorology, and oceanography. In addition, the increase in offshore activity has resulted in a number of offshore oil and gas contractors to redirect their offshore experience to the development of offshore foundations and installation techniques for offshore wind turbines.

Industry Development and Structure

As already mentioned, Renewables UK was set up in 2002. Its simple goal is to maximize the country's involvement in renewables projects, both at home and abroad, in terms of jobs and investment in manufacturing services and suppliers. Renewables UK is a route for U.K. business to information on funding, business opportunities, and market analysis. One of its first tasks was to commission a study for offshore renewable energy projects, both in home and overseas markets from 2002 to 2007. The report

World Offshore Renewable Energy Report 2002-2007 was published in October and covers offshore wind, wave, and tidal technologies. The report suggests that the United Kingdom will be the next major growth market for offshore wind, with an expected 42% of generating capacity installed in 2004. Over the complete 2002 to 2007 period, the United Kingdom is likely to install 907 MW, which is 21% of total global new capacity.

U.K. suppliers to the offshore oil and gas industry have decades of experience in operating within a demanding and difficult environment but lack the experience of operating effective, low-cost electricity generation systems. However, the oil and gas industry has a wealth of solutions in design, management, and construction that can have a positive effect on the viability of many of the new and innovative renewable energy concepts being pursued by developers. By combining this expertise with the developers' expertise in operating onshore renewable energy schemes within tightly regulated markets, the United Kingdom now has the potential to develop a new and distinct industry in offshore wind energy.

20.8 GOVERNMENT-SPONSORED R,D&D

Approximately 1.5 million GBP was spent on the wind program area of the DTI's R&D Programme on Sustainable Energy in 2002. The U.K. government increased the budget for R&D support of renewables to 18 million GBP in 2002. The portion of this budget assigned to wind energy has yet to be decided and will depend partially on the level of U.K. industry activity.

Priorities

The government continues to support a cost-shared program with industry – but as the technology achieves maturity, the trend is towards decreasing contributions from the government in onshore technology. Greater

attention is now being directed to the development of the offshore resource, which includes the following.

- The development and evaluation of innovative techniques to reduce the cost of operation and maintenance.
- The development and evaluation of innovative techniques to increase the availability and reliability of wind turbines.
- The evaluation of electrical infrastructure options to improve the assimilation of wind turbines on the distribution network.
- The research, development, and evaluation of innovative materials, processes, and components that would contribute to improved wind turbine performance.
- The development and evaluation of systems and techniques that offer safe, cost-effective, reliable methods of access to offshore wind turbines.
- The development and evaluation of innovative techniques for the installation of offshore wind turbines that will result in the reduction of the cost of offshore wind energy.
- The development and evaluation of innovative wind turbine designs offering improved performance.

Proposals for developments specifically focused on onshore wind technology are also considered, but with a lower priority.

New R,D&D Developments

Recent developments in R,D&D in the United Kingdom concentrate mainly in the offshore area with no less than four projects looking at ways to reduce the cost and decrease installation time for offshore foundations and turbines. A typical design concept is based on a gravity base structure consisting of three cylindrical caissons connected by walls, supporting a telescopic mast and turbine. The whole installation will be assembled onshore and then floated out to

site, where it is ballasted and the tower is extended to hub height. A similar concept also consists of a gravity structure but is comprised of a circular cone/pile extending out of the center of a large base slab. The tower and turbine are attached onto the foundation onshore, and the whole assembly is loaded onto a submersible barge, transported to site, and lowered onto the seabed. A novel aspect of this design is its ability to self-bury itself in sandy conditions using a series of water jets.

The above are typical examples of new and innovative concepts currently being appraised by offshore developers and contractors and supported by the DTI's Sustainable Energy Programme during 2002.

Offshore Siting

In 2002, a total of three offshore wind farms gained consent from the U.K. government: Scroby Sands on 17 April, North Hoyle on 31 July, and Rhyl Flats on 26 December. Scroby Sands will be operated by Powergen Renewables and is sited approximately 2.5 km off the coast of Great Yarmouth in Norfolk. North Hoyle and Rhyl Flats are next to each other off the coast of Prestatyn and Rhyl in Wales. Celtic Offshore Wind Limited originally made the application for consent to build Rhyl Flats. However, the project will now be taken forward by National Wind Power Offshore Limited, which already holds the consents for the neighboring North Hoyle Wind farm.

These are the first of the original 18 sites to be granted leases by the Crown Estate in 2001. An additional six projects are currently being considered by the DTI.

Further developments of offshore wind farms both within and beyond the territorial waters will be subject to the outcome of the current consultation paper, *Future Offshore*. The paper proposes the following specific mea-

asures to enable the orderly development of an offshore industry in the United Kingdom.

- The immediate future of wind farm development should focus on three strategic zones that offer the best development potential. These are the Greater Wash, the Solway Firth down to North Wales, and the Thames Estuary. This will not preclude other proposals, which should be notified as soon as possible.

- Strategic environment assessments (SEAs) of the three key areas will be made so that scale and location of development is environmentally responsible. This will be done before Crown Estate invite bids for the next round of site leases (expected in April 2003) and also before the European directive requires all member states to do so (July 2004).

- New exploration licenses will be given for sites beyond the 12-mile legal limit from

the shore in order to enable work to go forward before a new legal framework is set up that enables development beyond this limit. This would be necessary, for instance, in the Outer Moray Firth where a proposal is being drawn up for outside the territorial limit.

- A new bidding process for wind farms should be introduced that will make the most efficient use of the seabed.

The potential contribution towards the U.K.'s energy requirements is substantial, and this, in turn, will underpin a substantial manufacturing market within the United Kingdom, with opportunities to then contribute to the European market.

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