Chapter 20 United Kingdom

20.1 INTRODUCTION

In the United Kingdom in 2003, a total of 95.42 MW of new capacity was installed, bringing the total installed capacity to 647.6 MW, an increase of about 20%. Although encouraging, this figure falls short of that anticipated for 2003 and highlights the long way to go to meet the target of 10% from renewables by 2010.

In order to assist U.K. industry – and recognizing the reluctance of the financial community to take risks on wind projects with financing periods of 10 to 15 years – the government announced in December 2003 that it was increasing the level of the Renewables Obligation (RO) to 15% by 2015. The increased certainty provided by the higher target will be vital in securing the necessary financing for building large-scale wind projects, particularly those proposed offshore.

During early 2003, the U.K. government published its *Energy White Paper* that set out four goals for the U.K. energy policy. These are discussed in detail in the following section.

The Capital Grants Scheme for offshore wind has now awarded a total of some 117 million United Kingdom Pounds (UKP) spread over 12 offshore wind farms, with consents to build up to 1,163 MW of new capacity.

Finally, in late 2003, the Crown Estate announced the successful bids for 15 new sites in Round 2 of the United Kingdom's leasing for offshore wind farms. The wind farms, which are expected to be producing electricity by the end of the decade, are expected to provide between 5.4 GW and 7.2 GW of generating capacity, enough electricity for more than one in six U.K. households.

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 its political agenda. In the United Kingdom, the RO became law on 1 April 2002. This important government measure will provide an assured market for renewable energy for at least the next 25 years. Through the obligation, together with the Climate Change Levy (CCL), it is currently estimated that by 2010 the value of support to the U.K. renewables industry will be 1 billion UKP per year.

On 24 February 2003, the government released its *Energy White Paper: Our Energy Future – Creating a Low Carbon Economy*. In drafting the white paper, more than 6,500 individuals and groups took part in the consultation, representing the most significant consultation on energy policy ever carried out in the United Kingdom. The white paper set out four goals for the nation's energy policy, as follows:

1. To work towards cutting carbon dioxide emissions by some 60% by 2050 (as recommended by the Royal Commission on Environmental Pollution), with real progress by 2020
2. To maintain the reliability of energy supplies

3. To promote competitive markets in the United Kingdom and beyond, helping to raise the rate of sustainable economic growth and to improve productivity
4. To ensure that every home is adequately and affordably heated

A range of measures were announced including the following:

1. An ambition to double the share of electricity from renewables by 2020 from the existing 2010 target of 10%
2. 60 million UKP in new money for renewables projects, bringing total spending on renewable energy up to 348 million UKP over four years
3. Reforming planning rules to unblock obstacles to renewable energy
4. A new carbon trading system to come into effect from around 2005 that will give energy suppliers and consumers incentives to switch to cleaner energy
5. creating a new Energy Research Centre to help develop the latest cutting- edge energy technologies.

Strategy

To help deliver the stated energy policy, the United Kingdom has put in place a range of measures. They are as follows:

1. Introduced a Renewables Obligation for England and Wales in April 2002 that will provide incentives to generators to supply progressively higher levels of renewable energy over time – the cost is met through higher prices to consumers
2. Exempted renewable electricity from the CCL
3. Created a renewables support program worth 250 million UKP from 2002 to 2005
4. Drew up a strategic framework for a major expansion of offshore wind
5. Created a new organization within government, Renewables UK, to help the nation's renewables industry grow and compete internationally

In addition, from 2005 onwards, the EU emissions trading system will provide a further incentive for renewables. The above measures are being pushed forward in consultation with industry. A new Renewables Advisory Board – comprised of representatives of the relevant industries, the government, and the devolved administrations – has been set up with a remit to provide expert independent advice to the U.K. Department of Trade and Industry (DTI) on renewable issues.

Progress Towards National Targets

The United Kingdom is still on track to meet its Kyoto targets to cut greenhouse gases and its domestic goal of reducing carbon dioxide, according to figures published in March 2003. Greenhouse gas emissions dropped by 3.5% in 2002. The drop is in line with the trend needed to ensure the United Kingdom meets its Kyoto target to reduce greenhouse gases to 12.5% below 1990 levels by 2012.

Carbon dioxide emissions fell by 9.0% from 1990 to 2001, keeping the domestic Climate Change Programme goal – reducing carbon dioxide to 20% below 1990 levels by 2010 – firmly on the agenda. The carbon dioxide drop came at the same time as a 30% growth in gross domestic product (GDP), proving that economic growth does not have to be at the expense of a cleaner environment. The figures also suggest the proportion of the U.K. electricity generation accounted for by all renewables in 2002 was approximately 3%, up from 2.6% in 2001.

20.3 COMMERCIAL IMPLEMENTATION

Installed Capacity

Between 1 January 2003 and 31 December 2003, the United Kingdom installed a total of 58 wind turbines – 28 onshore and 30 offshore – with a total capacity of 95.42 MW. The average capacity of the turbines installed onshore during 2002 was 1.3 MW. The average capacity of turbines installed offshore was 2 MW. This brings the total number of turbines in the United Kingdom to 1,057, generating some 647.6 MW of power.

Rates and Trends in Deployment

The rate of deployment in 2003 was the highest ever achieved in the United Kingdom, with more than 95 MW of capacity installed, just beating the previous highest ever of 87 MW installed in 2002. Even so, 2003 was not as good a year as the British Wind Energy Association (BWEA) anticipated. The initial projection for 2003 showed more than 300 MW identified for commissioning. However, a number of factors listed below caused this to fall to 100 MW.

Against this background, the BWEA reported that a total of more than 1,300 MW won planning permission in 2003, almost exactly double the total amount built during the previous 12 years combined. Of the 1,300 MW, some 943 MW (discrepancies may occur between capacities consented and capacity that will be built, with particular reference to offshore), representing 75% of the total consented is to be installed offshore. This brings the total of built, under construction, and planned projects with consents to 1,163 MW.

The average size of turbine currently installed offshore is 2 MW, which will increase to 3.5 MW, taking into account turbines to be installed in the next few years. This clearly demonstrates the move towards bigger machines.

Contribution to National Energy Demand

Figures for 2003 are not available.

20.4 MARKET DEVELOPMENT AND STIMULATION

Main Support Initiatives and Market Stimulation Incentives

Three sources of financial support for electricity generated from renewable sources have already been mentioned: the RO, the Emissions Trading Scheme, and the CCL. The RO has been described as the cornerstone in delivering the nation's target for renewable energy. Introduced in April 2002, it has prompted an unprecedented level of interest in the renewables, and particularly wind, sectors.

By way of illustration, in the first year of operation of the RO, the U.K. wind industry effectively doubled, with consents for an additional 525 MW of capacity, which is equal to the combined total built during the previous 11 years. This success was repeated in the first quarter of 2003 when a further 567 MW of capacity was granted permission. Planning consents have been steadily won throughout the year such that the U.K. wind industry has just less than 650 MW of capacity installed up to 2003, but an amazing total of well over 2,000 MW of consented schemes awaiting construction.

Following a 2003 consultation, the Renewable Energy Guarantee of Origin (REGO) scheme came into force on 27 October 2003. It now enables renewable energy producers to show that their electricity comes from a green source. It will encourage the development of renewable energy projects by enabling generators to provide their buyers with an assurance of the greenness of their product. The scheme will be particularly helpful to small generators that do not generate enough electricity to qualify for Renewable Obligation Certificates (ROCs).

Originally launched in October 2001, the Capital Grants Scheme for offshore wind had the primary aim to stimulate early development of a significant number of offshore wind farms. This was desirable in order to do the following:

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

In round one of the scheme, as reported last year, the first two grants were announced in October 2002 for the offshore wind farms planned to be developed at North Hoyle in Wales and at Scroby Sands in Norfolk. Each grant was for 10 million UKP.

Following closure of the second round at the end of 2003, an additional 38 million UKP in capital grants was announced by the energy minister on 26 March 2003 for offshore developments around the British Isles. The projects awarded grants as follows:

1. Warwick Offshore Wind for the Barrow Offshore project, Cumbria – 10 million UKP
2. GREP UK Marine for the Kentish Flats project, North Kent – 10 million UKP
3. Offshore Energy Resources and Solway Offshore for the Robin Rigg project, Solway Firth (two projects) – 18 million UKP

These projects are among six sites to have been awarded planning consent from the 19 identified for offshore development by the Crown Estate. Together the projects will create more than 500 wind turbines, generating 1,500 MW of electricity, or 1.5% of the United Kingdom's energy needs. The minister used his speech as an opportunity to outline how the DTI would be allocating a portion of the 60 million UKP in additional funds promised for renewables in the *Energy White Paper* and the 38 million UKP allocated in the chancellor's 2002 Spending Review, with offshore projects receiving approximately 40 million UKP.

The third round closed on 30 June 2003, and on 28 October 2003 the minister announced an additional 59 million UKP of funding for offshore wind farms. Six offshore wind farms will share the capital grant. They are as follows:

1. Burbo, in Liverpool Bay, 6.5 km from the Wirral Coast – 10 million UKP
2. Rhyl Flats, North Wales – 10 million UKP
3. Lynn, 5 km offshore from Skegness, Lincolnshire – 10 million UKP
4. Gunfleet Sands, 7 km off Clacton-on-Sea, Essex – 9 million UKP
5. Cromer, 7 km north of Cromer – 10 million UKP
6. Inner Dowsing, 7 km north of Cromer – 10 million UKP

A further renewable energy initiative for communities and households was launched in January 2003 by the DTI. It is known as the Clear Skies initiative and is a campaign worth up to 10 million UKP. Its aim is to encourage homeowners, schools, and communities across the United Kingdom to take the initiative in developing and installing their own renewable energy schemes and to capture the imagination of individuals and local communities that want to play their part in the renewables revolution.

Unit Cost Reduction

As in 2002, no clear cost reduction has been observed in the last year. In the United Kingdom, a wind farm built today would typically cost about 675.00 UKP/kW installed, including infrastructure. Costs as low as 550.00 UKP/kW are possible where accessibility is good and grid connection costs are very low. Developers continue to be optimistic that onshore costs will fall further, to as low as 500.00 UKP/kW for some sites – due to larger, more efficient turbines and economies of scale.

North Hoyle began generating in November 2003, adding to the first offshore wind farm at Blyth in 2001. The extrapolated figure for Blyth was 834.00 UKP/kW. Official figures are not available for North Hoyle, but it is suggested that the costs are close to 1,000.00 UKP/kW. However, opinion is that there is considerable room for cost reduction coming from greater experience, improved installation techniques, larger wind turbines, and larger schemes. Indeed, several offshore contractors are currently pursuing various schemes that, if successful, will bring the cost down to between 650.00 UKP/kW and 700.00 UKP/kW.

20.5 DEPLOYMENT AND CONSTRAINTS

Wind Turbines Deployed

A total of only six new projects, including one offshore wind farm and one extension to an existing site, started generating electricity to the grid in 2003. These projects are outlined in Table 20.1.

Figure 20.1 provides a graph of wind farm planning application success and failure rates by declared net capacity. It can be seen that there was a marked improvement in the application success rate, illustrating the recent successes of developments gaining permission.

Main Constraints on Market Development

The United Kingdom has historically had difficulty obtaining planning consent for wind farms in particular, and for renewable energy schemes in general. To date, there has been a radical difference between planning approval rates for wind farm development between countries in the United Kingdom and within England. This has led to uncertainty for developers and poses a potential problem for the government's 10% target.

Over the last five years, England has had an average approval rate at the local level of just 50%, compared to more than 90% in Scotland (Figure 20.2). This is testament to the strong policy guidance set out in Planning Policy Guidance Note (PPGN) 6 in Scotland in 2000. Not only has the English approval rate been below average, but there has also been massive inconsistency in decisions made between different parts of England. It is unlikely that there are any other forms of development that produce such an inconsistency of planning response across England. It was recognized that this needs to be addressed, and the white paper requires planning to be "streamlined and simplified" to remove it as one of the key obstacles to renewable energy development.

Since February 1993, *PPGN 22: Renewable Energy* has set out the government's national land-use planning policies for England. Following consultation on the government's *Planning Green Paper* published in December 2001, the government announced, on 18 July 2002, its intention to review and reform the national planning policy guidance. In this context, the United Kingdom's Office of the Deputy Prime Minister (ODPM) – in close consultation with the DTI and the Department for Environment, Food, and Rural affairs (DEFRA) and other relevant government

Online	Wind Farm	Location	Manufacturer & Rating (kW)	No	Project Capacity (MW)	Operator
Nov-03	North Hoyle - Offshore	North Wales Coast	Vestas 2MW	30	60	National Wind Power
Jul-03	Swaffham extension	Norfolk	Enercon E-66	1	1.8	Ecotricity
May-03	Altahullion	Londonderry	Bonus 1300	20	26	B9 Energy
April-03	Forss	Caithness	Bonus 1300	2	2.32	RES
Jan-03	Burra Dale II	Shetland	Vestas 850	2	1.7	Shetland Aerogenerators
Jan-03	Moel Maelogen	Conwy	Bonus 1300	3	3.6	Cwmni Gwynt Teg Cyf / EnergieKontor

Table 20.1 New projects that began generating electricity in 2003

departments – has carried out a review of PPGN 22. This resulted in the publication of a consultation paper on draft *Planning Policy Statement (PPS) 22: Renewable Energy*, in November 2003.

In brief, the key principles in PPS 22 stated the following:

1. Regional planning bodies and local planning authorities should accommodate renewable energy developments, and their plans should contain criteria-based policies designed to "promote and encourage," rather than restrict, the development of renewable energy resources. There will no place for planning policies that rule out or place con-

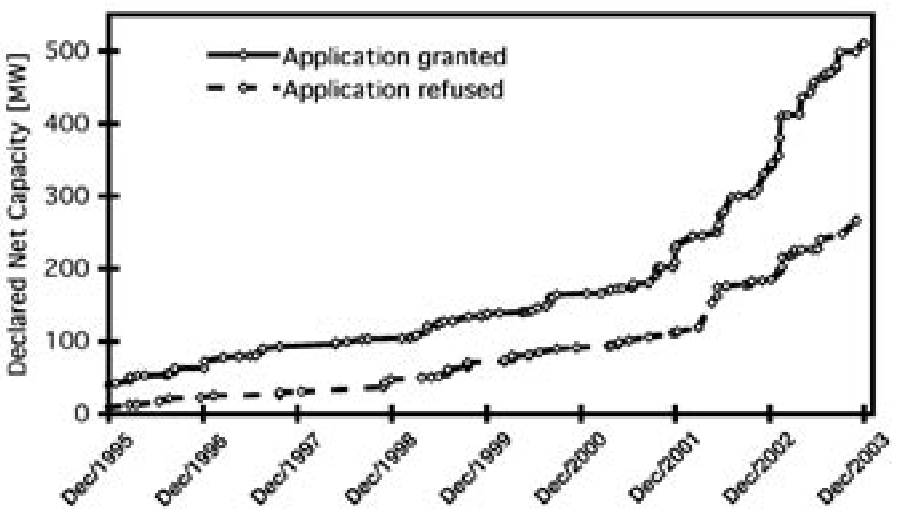

Figure 20.1 Wind farm planning application success and failure rates by declared net capacity

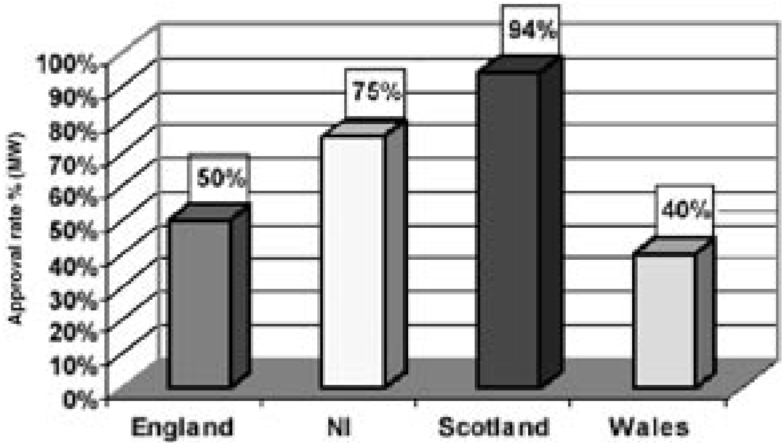

Figure 20.2 Local approval rates by country 1999 to 2003

straints on the development of renewable energy technologies.

2. Regional renewable energy targets should be introduced in regional plans as minimum targets to be monitored and increased if and when they are met.

3. When assessing proposals for renewable energy, the wider environmental and economic benefits are material considerations that should be given significant weight in determining whether proposals should be granted planning permission.

4. Planning authorities should foster community involvement in renewable energy projects and seek to promote knowledge of, and greater acceptance by, the public of prospective renewable energy developments that are appropriately located.

For renewable energy developers and planning authorities, locational considerations have been clarified for sites in the following designated areas: international and national designations, green belts, and buffer zones and local designations, and other locational considerations.

For wind turbines in particular, PPS 22 states, "Regional planning guidance and development plans should not include policies relating to the impact of wind turbines on radar and aircraft nor relating to separation distances from power lines, roads and railways. It is the responsibility of developers to address any potential impacts, taking account of Civil aviation authority and Ministry of Defence guidance in relation to radar and the legislative requirements on separation distances, before planning applications are submitted."

Consultation on draft PPS 22 closes on 30 January 2004. Following final publication of PPS 22, it is the government's intention to publish a companion guide to PPS 22. This document will contain technical advice and guidance on the various individual renewable technologies and examples of good practice within development plans and developments.

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. In April 2003, Scottish Power and Scottish and Southern

Energy, together with Ofgem, announced plans to prepare the transmission grid for dealing with the expansion in renewable power. Both energy companies outlined major investment plans that will upgrade the transmission networks they operate and allow renewable energy generated in the northern regions of the British Isles – including the Highlands, Western Isles, Shetlands, and Orkney – to be transmitted to the rest of the United Kingdom.

One constraint not common to the rest of Europe, and of increasing prominence 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 development must take account of 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 DTI and U.K. industry. The aim of the working group was to provide information and advice to developers, planners, military, and civil aviation personnel on potential effects of wind turbines on radar systems.

As one of its first tasks, the working group put together a document, *Wind Energy and Aviation Interests – Interim Guidelines*. The guidelines were launched on 2 October 2002 at BWEA 24 at Brighton. 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 might affect both military and civil radar in ways that could seriously compromise their operation.

20.6 ECONOMICS

Trends in Investment

Financing for wind farms is obtained largely from corporate investors and banks, though 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 whilst reducing exposure to penalty payments.

Wind has found particular favor because of its economics, its maturity, and its ability to deliver relatively quickly. However, research carried out during the summer of 2003, and presented to a House of Lords Select Committee in October, showed that because of the structure of the current RO, there is a high degree of uncertainty over the value of wind generated electricity after 2010. This is making it extremely difficult for projects planned for later this decade to obtain necessary financing. The wind industry is in a critical phase of development as it approaches the scheduled review of the RO in 2005 and 2006.

Recognizing the importance of the research and the reluctance of the financial community to take risks on projects with financing periods of 10 to 15 years, the government announced, on 1 December 2003, that it was proposing to increase the level of the RO to 15% by 2015.The proposal was warmly greeted by both the industry and financial community. The increased certainty provided by the higher target will be vital in securing the necessary financing for building large-scale wind projects, particularly those proposed offshore.

Trends in Unit Costs of Generation 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 0.03 UKP/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 NFFO contracted wind farms.

The latest NFPA online auction of green electricity from NFFO contracts was completed on 14 August 2003. The auction began on Tuesday 12 August, and contracts were finally awarded to a total of ten successful bidders. In all, 256 contracts representing approximately 701 MW of green electricity generating capacity were successfully auctioned. The contracts are for electricity produced between 1 October 2003 and 31 March 2004. The average price, at 0.0681 UKP/kWh, was more than that of the previous auction, held in February 2003, when the average price was 0.0626 UKP/kWh. The price for wind was 0.0670 UKP/kWh, somewhat higher than the 0.0641 UKP/kWh from the previous auction.

20.7 INDUSTRY

Manufacturing

The United Kingdom continues to supply a wide range of components to the wind turbine industry, including blades, rotors, turbines, castings, towers, pitch bearings, and elastomerics. There are now two overseas companies with turbine manufacturing bases in the United Kingdom, along with U.K. companies expanding their current activities.

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 very simple sounding goal is to maximize the nation’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.

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.

Renewables UK, Scottish Enterprise, Highlands and Islands Enterprise, and the

Scottish Executive have initiated a study to ascertain the health of the supply chain for the entire renewables market. The aim of the study is to determine the capability of the U.K. industry to rise to challenge of developing and maintaining a viable, long-term, globally active renewable energy industry. The United Kingdom has been split into two study areas: Scotland and the Rest of the United Kingdom. Key objectives of the study are as follows:

1. Identifiy the participants in the renewable industry in the United Kingdom and map them along the supply chains of the technologies under review
2. Determine the size of the current market and the potential size and structure of future markets within the context of the *Energy White Paper* goals
3. Assess the gaps in existing supply chains
4. Determine opportunities for the United Kingdom and identify the main constraints

20.8 GOVERNMENT-SPONSORED R,D&D

The main program for R&D is the DTI's New and Renewable Energy Programme. Approximately 1.7 million UKP was spent on the wind program area of the program in 2003 out of a budget for R&D support of renewables of 19 million UKP. The DTI's program supports industry-led and shared-cost R&D work into new and renewable energy technology. The work must be categorized as either industrial research or pre-competitive activity under the European Community State Aid rules. The principal requirement for all proposals is that they should include innovation that (1) offers the prospect for reduced cost and/or improved performance of new and renewable energy, with the goal of improving its competitiveness and the competitiveness of U.K. industry, or (2) helps the DTI to further understand the prospects for new and renewable energy.

Priorities

The DTI has identified certain specific topics that should be addressed as priorities. These priorities have been developed from the Technology Route Maps, developed by the DTI in consultation with industry, academia, and key stakeholders. Proposals for R&D projects that address these priorities are therefore expected to make a significant contribution to the Technology Route Maps. Greater attention is now being directed to the development of the offshore resource. This includes the following:

1. Reducing the cost of operation and maintenance (O&M)
2. Improving the availability and reliability of wind turbines
3. Developing innovative materials, processes, and components
4. Providing access
5. Improving installation techniques
6. Offering innovative designs
7. Mitigating the effect of wind farms on radar and other aviation

Proposals for developments specifically focussed 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 include projects looking at the design and manufacture of radar absorbent wind turbine blades, opportunities for reinforced thermoplastic composites in offshore wind structures, and the Merlin offshore wind turbine system.

Offshore Siting

In 2003, a total of eight offshore wind farms covering nine sites gained consent from the U.K. government: Barrow, Kentish Flats, and Robin Rigg in March; Burbo in July; and

Gunfleet Sands, Cromer, Inner Dowsing, and Lynn in October. Added to the three already granted consents in 2002 (Scroby Sands, North Hoyle, and Rhyl Flats), this brings the total offshore capacity to well over 1 GW. These are the first of the original 19 sites to be granted leases by the Crown Estate in what has become known as Round 1 of the United Kingdom's leasing for offshore wind farms.

Following the success of round 1, the DTI issued the Future Offshore consultation document in November 2002. This set out a preferred strategy for additional rounds of offshore wind farm development to be concentrated on three specific areas. It stated the intention to undertake Strategic Environmental Assessment (SEA) of the three areas to inform future rounds ahead of the introduction of the EU SEA Directive in 2004. It proposed new exploration licenses beyond the territorial sea limit and it also proposed a new bidding process for wind farms to enable best use of the seabed.

In May 2003, DTI issued the SEA for round 2 of leasing. This focused on three specific areas, which are as follows:

1. Thames estuary – the area between the Kent and Essex/Suffolk coasts extending in to the southernmost part of the North Sea
2. Greater Wash – extends from the Wash along the Norfolk and Lincolnshire coasts up towards Flamborough Head and out into the Southern North Sea
3. North West – extends from the north Wales coast to the Solway Firth and out into the Irish Sea

It was the DTI's intention that round 2 projects would provide as much capacity as the conclusions of the SEA would allow.

On 14 July, the DTI requested the Crown Estate to launch the competition for round 2. At the same time, DTI published responses to the Future Offshore and SEA consultation. The conclusions of the SEA resulted in the issue of guidance to the industry on the environmental restrictions that need to be adhered to for site selection within the three strategic areas. Following the issue of the tender, developers were required to submit project site coordinates by noon on 12 September and a full tender by noon on 15 October. Tenders were assessed by a panel of representatives from the Crown Estate and DTI, with consultation with other government departments where appropriate.

Details of the sites, together with the developers chosen to build them, were revealed on 18 December 2003, by The Crown Estate. They can be viewed in figure 3. The wind farms, which are expected to be producing electricity by the end of the decade, will provide between 5.4 GW and 7.2 GW of generating capacity, enough electricity for more than one in six U.K. households.

The new energy bill, which is currently going through parliament, will enable developers to build wind farms more than 12 nautical miles out to sea, beyond territorial waters. Of the 15 wind farms, three are fully outside territorial waters. They include the world's largest proposed offshore wind farm, in the Greater Wash area, 30 km to 40 km off the Lincolnshire Coast, which could have up to 250 or more turbines and provide up to 1.2 GW of generating capacity.

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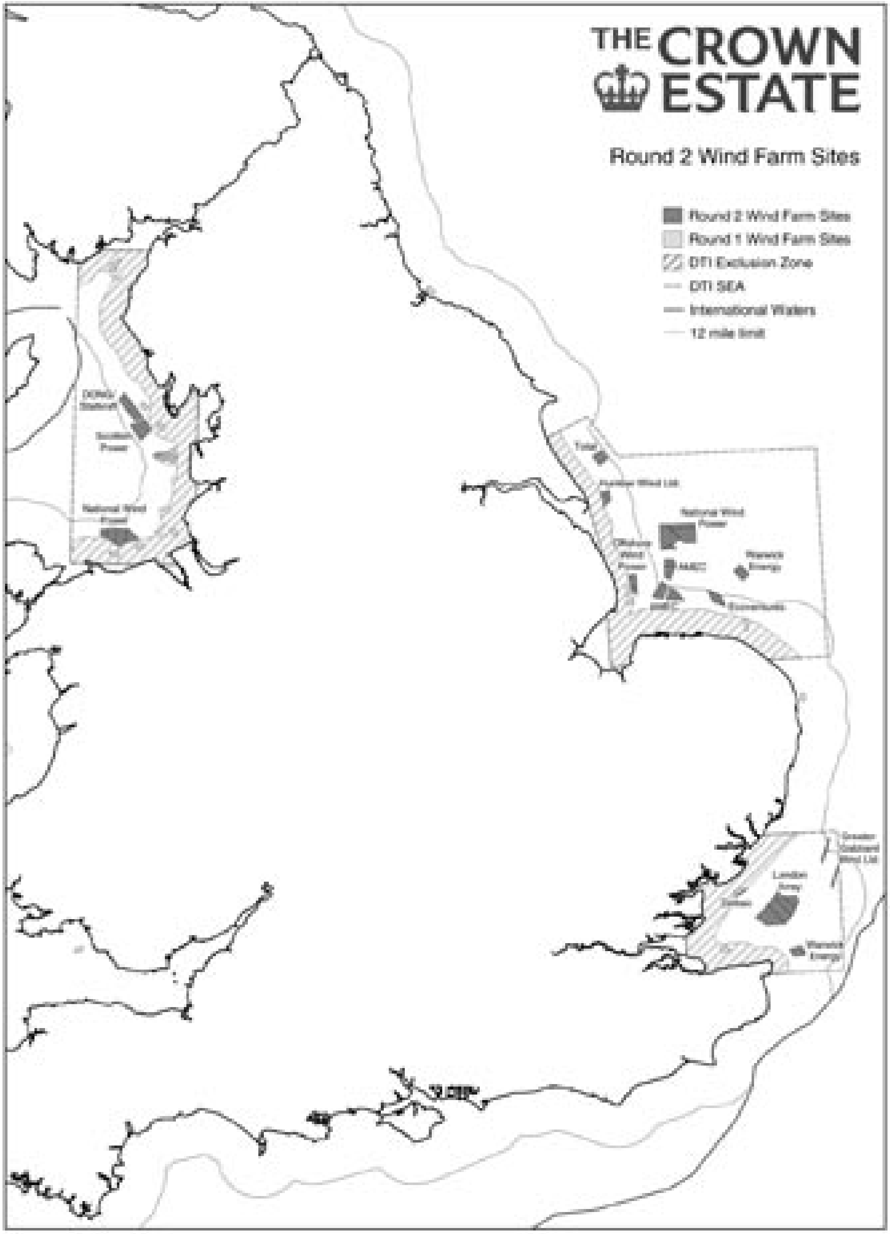

Figure 20.3 Position of the 15 newly announced Round 2 offshore wind farms