Chapter 10

The use of the sea for wind energy projects

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1 INTRODUCTION

Offshore wind has undergone an interesting development over the last decade or so but one cannot say that it was a rapid development. After the construction of the first large (and truly extensive) offshore project at Horns Rev, off the west coast of Jutland, in 2002,[1] offshore wind project development appeared to be on a good course. Germany and the United Kingdom identified considerable potential for offshore projects in their waters and it appeared to be only a question of (little) time before the North Sea would be subject to considerable turbine activity. Alas, these high hopes were only partly met. The United Kingdom has already installed more than 2 gigawatt (GW) of offshore wind capacity and another 2 GW have received planning consent[2] and the UK remains by far the largest operator of offshore wind projects worldwide. In contrast, Germany, long thought to be the vanguard of offshore wind, as with onshore wind, has not delivered. The first permit for an offshore project in Germany was issued in November 2001 but, to date, not a single project has been fully commissioned.[3] In the meantime, Sweden, the Netherlands and

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1 The 'first' official, but much smaller, offshore wind project is actually a lot older. This was the Vindeby project, consisting of 11 Bonus 450 kW turbines situated between 1.5 and 3 kilometres north of the island of Lolland near Vindeby, Denmark.

2 The British Wind Energy Association estimates that by 2015 a total of 6.6 GW of offshore capacity will be installed, see 'UK Offshore Wind: Moving up a Gear' (2007) 5, reproduced at http://www.bwea.com/pdf/offshore/movingup.pdf (last visited 30 May 2012).

3 There is a test project, Alpha Ventus, consisting of 12 turbines of 5 MW, one half of each supplied by Areva and Repower. This project is operated by Germany's big utilities and grid owners, eon, RWE and Vattenfall. Several large projects are being constructed and some are close to being completed.

Belgium have entered the offshore wind market and have instituted numerous projects. Other countries, especially China and the United States, are set to catch up with this development.

Today, over 4.3 GW are operating in European waters. Over 1 GW was installed in 2012, over 2 GW are expected in 2013 and over 3 GW in 2014.[4] In total, 40 GW are expected by 2020, equivalent to 4 per cent of EU electricity demand.[5] So, clearly, the European market regards offshore wind as an eminently viable and profitable business.

Offshore wind energy will need to be an important part of Europe's energy supply. To take the United Kingdom as an example, the country faces an energy crunch in 2015. Due to environmental regulations, 12 GW of coal-fired power stations, which represents about one-third of the total coal capacity are to be decommissioned, while a further 6 GW of old nuclear power stations will go out of service. Together this represents one-third of peak demand.[6] New nuclear power stations will not be ready before 2018, and this will depend on a speedy decision on permitting. Accordingly, even if this decision is taken, these power stations will not be available to address the looming energy shortfall.

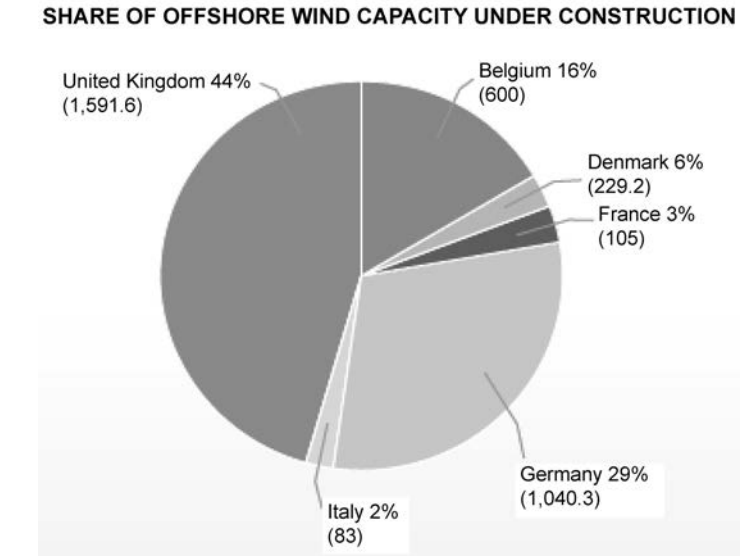
The United States, by now the largest operator of onshore wind projects, is a latecomer to the offshore wind market. The most likely first offshore project in US waters, the Cape Wind project off the coast of Massachusetts, should commence construction soon.[7] Many states in the United States also want to jump on the offshore bandwagon. State authorities or utilities regularly issue requests for proposals, inviting developers to propose plans for the construction of offshore wind projects in return for a favourable power purchase agreement ('PPA') or an expedited planning permit. These requests relate to projects both on the high seas and in the Great Lakes. Costs for projects are ultimately likely to be similar on both sides of the Atlantic. However, with electricity prices in the United States significantly lower than those in Europe, offshore projects in the United States face formidable hurdles before they can be financed and constructed. In addition, the uncertainty about the production tax credit (PTC) makes longterm investments difficult. Yet the Department of Energy ('DOE') estimates that 'the wind resources along the American ocean

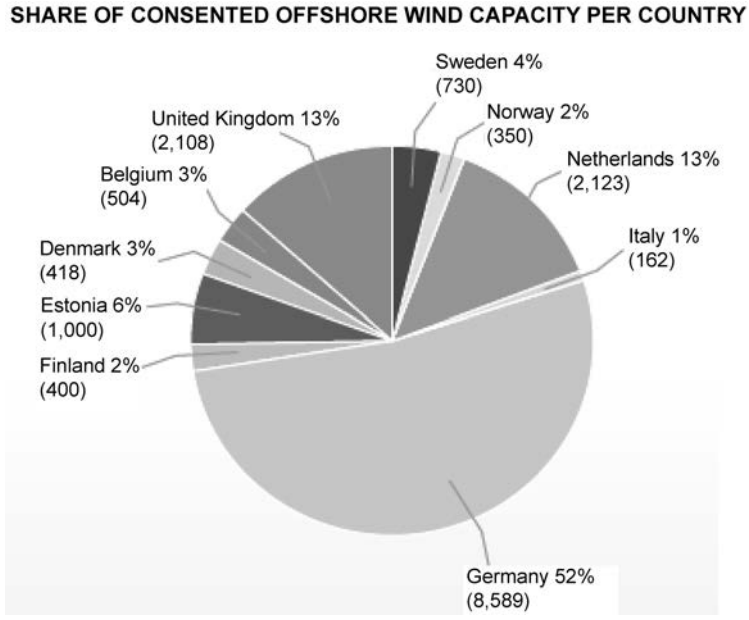
[4] reNews, Global Offshore Report 2012, at 2.

[5] Data from EWEA, Offshore Wind, available at www.ewea.org/policy-issues/offshore.

[6] Professor David Newberry, director of Research at the Electricity Policy Research Group, in an interview with Cambridge University's *CAM*, Michaelmas 2010, at 17.

[7] For more information on the Cape Wind project, see W Kempton *et al*., 'The offshore wind power debate: views from Cape Cod' (2005) 33 *Coastal Management* 119. The Cape Wind power project received Federal approval in April 2011 and construction is scheduled to commence in mid-2013, full commissioning is expected in 2015.





Source: European Wind Energy Association (EWEA), The European offshore wind industry, January 2010.

and Great Lakes are capable of providing 900,000 megawatts (MW) of electricity – an amount nearly equivalent to the nation's current total installed capacity'.[8]

This chapter will examine the international legal framework for the construction of offshore wind projects and evaluate how these rules are applied in the United Kingdom and Germany.[9] It will also provide a concise introduction to other issues of relevance to these projects, notably their construction and financing.

2 OVERVIEW OF OFFSHORE WIND PROJECTS

2.1 Construction

The original choice for the construction of offshore wind projects was, or rather would have been, a turnkey agreement. In other words, the entire construction, including foundations, cables as well as turbines, would have been undertaken and supplied by one company. Banks and investors were keen to avoid a situation where a multitude of companies each provide a piece of the puzzle but, in case of a problem, would each blame different parties. The problem with such a turnkey structure was that no construction company, and certainly none of the turbine manufacturers, was willing to undertake such an agreement. Moreover, even if they had been prepared to offer a turnkey contract, they lacked the financial resources to credibly allow for such a commitment, hence investors and banks would not have accepted them as turnkey provider.

For some time it was thought that this predicament would preclude the practical development of offshore wind projects. This attitude has, however, changed. The more banks and investors came to understand offshore technology and the environment within which it would be built, the more they came to accept multi-contracting as a viable practice. It was pioneered in the Q7 project off the Dutch North Sea coast, the first offshore windfarm to be

[8] Quoted in: U.S. Offshore Wind Collaborative, 'U.S. offshore wind energy: a path forward' 4 (2009). Available at http://www.usowc.org/pdfs/PathForwardfinal.pdf (last visited 30 May 2012).

[9] For a very good summary of the US permitting regime see: M P Giordano, 'Offshore windfall: what approval of the United States' first offshore wind project means for the offshore wind energy industry' (2009) 44 *University of Richmond Law Review* 1149; R W Eberhardt, 'Federalism and the siting of offshore wind energy facilities' (2006) 14 *New York University Environmental Law Journal* 374; and J S Rolleri, 'Offshore wind energy in the United States: regulations, recommendations, and Rhode Island' (2010) 15 *Roger Williams University Law Review* 217.

closed with a true project finance structure. Today it appears that banks actually insist on a multi-contracting structure. There are two reasons for this. First, it is acknowledged that such a structure would assign the right responsibilities and liabilities to the most competent party. Secondly, this structure is considered to be significantly cheaper than would otherwise be the case if one company were to take sole responsibility for the project. The essential piece in such a multi-contracting structure is the interface between the various contracts and parties. Banks seem to accept three to four parties in such structures: the turbine manufacturer, and companies responsible for construction, cabling and possibly for foundations. The interface agreement that needs to be put in place to align and coordinate the various responsibilities and, most importantly, the liabilities *vis-à-vis* the project company, is of paramount importance. Lawyers are accordingly challenged to draft an agreement that will cover every detail and every eventuality. The final content can vary, especially with regards to how liability claims are dealt with, and no generally accepted standard form has yet emerged.

2.2 Costs and off-take

The question of whether or not an offshore project is profitable depends on the cost of its construction and operation and on the cash flow created by the sale of the electricity it generates. In Europe, the cost for offshore wind projects should range from €2.5 million per MW to €3 million per MW,[10] depending on the location (distance from the shore and water depth) and the size of the project.[11] However, there are also other aspects that affect the price and costs of an offshore wind project and are more concerned with the internal structure, market power and last, but not least, political will and pressure to implement a project in the first place. Developers may be able to charge far higher profit rates for some projects, while projects that apply a turnkey structure can be substantially more expensive if the turnkey provider needs to outsource much of the work to sub-contractors and also needs to put a comprehensive (and expensive) insurance structure in place.

[10] The CAPEX costs for the British Ryl Flats alone was £2 million per MW, quoted in BWEA, 'Offshore moving up', Note 2 above, at 8. However, the report also quoted the observations of an anonymous offshore developer that CAPEX should be approximately £1.8 million per MW. However, much higher costs were also quoted. See, for example, €3.3 to €3.8 million per MW: N Weinhold and S See, *Neue Energie*, December 2010 at 30 to 31.

[11] It is expected that these costs will go down to a range of between €0.5 million to €2 million per MW in 2015. The Horns Rev project in 2002 cost about €1.7 million/MW.

With respect to costs in the United States, there is no data currently available from existing offshore projects but it appears that the costs for projects off the Eastern Seaboard are broadly equivalent to those in Europe.[12] The costs inherent in projects in the Great Lakes remain in the realms of conjecture. They are ultimately likely to be lower but, again, there is no current data that would support this view.

The costs for maintenance (O&M) again are fairly well known in Europe, although long-term data is not available, so any figures need to be treated with some caution. Maintenance costs for offshore projects can be substantial. Access to turbines by boat is generally limited to times when wave heights only reach about 1.5 metres – a figure which is usually exceeded in the months between September and April, so that access to offshore turbines during these months is usually impossible. In response, modern offshore turbines now have a so-called heli-hoist: a structure that would allow access by helicopter. But even this method is sometimes not viable due to strong winds and the ensuing danger to personnel servicing the turbine. In addition, the costs of operating one or more helicopters, or maintaining a fleet of such vehicles on standby, pose a significant additional expenditure. In the early times of offshore wind project development, there was a strong opinion that the maintenance costs would render any offshore wind project uneconomical. It appears, however, that with the existing projects, these costs could be managed.

The problem of off-take has been recognised as being of paramount importance and, as a result, European governments have tried to address it proactively. Generally, most observers seem to agree that costs to generate offshore electricity range between €0.07 and €0.10/kWh. However, substantially higher estimates, going up to €0.20, have also been made. This means that offshore wind projects need to have an income from the sale of their electricity which exceeds this cost and, in view of the risk of these projects and the necessity for safety allowances and reserves, exceed it by a substantial margin.

Off-take of electricity is obviously easiest in countries with a feed-in tariff, such as Germany where the utilities have to pay €0.15/kWh for a period of 12 years[13] for projects that are built before 2016. In the United Kingdom, the renewable obligation certificate ('ROC') system makes special allowances for offshore projects.[14] Most offshore projects in Europe are now owned and

[12] The US Offshore Wind Collaborative, Note 7 above, at 28 estimates the costs to be around $4.6 million per MW = c. €3.4 million per MW.

[13] This period can be extended depending on distance off shore and water depths.

[14] As a consequence, in the United Kingdom, a price of around €0.18/kWh is expected, although such a price depends on the development of the ROCs and the availability of long-term off-take agreements.

operated by big utilities, so the off-take is less of a problem than it would be for non-utility owners.

In the United States, there is no feed-in tariff. And while there are renewable portfolio standards that require utilities to have a certain share of their electricity come from renewable sources, there is as yet no provision which forces utilities to buy electricity from offshore wind projects. This means that US offshore projects will need to negotiate power purchase agreements (PPAs) with the utilities. And the utilities will not pay premium or excessive prices without reason – not in the current financial climate and not when they have to justify higher electricity bills to their customers. The Cape Wind project had a PPA with National Grid which had agreed to buy half of the electricity, and at a price of originally US¢20.7/kWh. Following pressure by consumer groups and politicians, this was reduced to US¢18.7/kWh.

From a cost perspective, offshore wind projects appear to offer a great opportunity in countries where a high tariff has been set by law or where a certificate system offers additional incentives. In countries where offshore wind has to compete with traditional energy sources or even other renewable energy, the prospect is much more difficult. However, even there it must not be overlooked that today's electricity prices will stay static – or that offshore wind energy will stay uncompetitive. Prices for fossil fuels are expected to rise, and probably rise significantly, in the future, and with no end in sight. Electricity generated by new nuclear power plants will also be more expensive, especially when the costs for decommissioning are factored in. Costs for offshore wind generation, on the other hand, will remain fairly stable. Prices for turbines may increase slightly, alongside costs for O&M and insurance, but the costs for the underlying feedstock, so to speak, will remain the same, that is, zero.

2.3 Financing

In the early days of offshore wind project development, the financing of these projects was considered the decisive stumbling block, even before the impacts of the recent financial crisis. Banks were hesitant to commit large amounts for senior debt. The technology and environmental risks were largely unknown. Debt service cover ratios[15] of 1.6 and higher were openly discussed, and would have made the financing of such projects impossible. Not surprisingly, the first offshore wind projects were not financed by means of traditional project

[15] Namely the ratio of cash available from the sales of electricity for debt servicing to interest, principal and lease payments. The higher the risk in a project, the higher a debt service cover ratio will be required, that is, a lower portion of the cash revenue will go to debt servicing.

finance. Instead utility companies formed partnerships with turbine manufacturers and financed the projects themselves. This was done, for example, by Copenhagen Energy[16] and Bonus Energy for the Middlegrunden project and by Elsam (now Dong) and Vestas for the Horns Rev project. Unfortunately, the details of the financial parameters did not become widely known. It was not until the Q7 (now Princess Amalia) project in the Netherlands that a true project finance structure was used in 2008. By then, the fear and hesitation of the banks had largely gone. Even objections relating to the contractual structure of the projects disappeared: while banks in the past had favoured a turnkey construction arrangement and refused a multitude of different contracts with different service or equipment providers, such multi-contracting is now the favoured approach.

3 LEGAL REGIME FOR OFFSHORE WIND PROJECTS

3.1 General

The question of which legal regime applies to an offshore project essentially depends on the location of the project. Projects could be located within the territorial waters of a state, that is 12 nautical miles from the baseline (usually the low-water mark) of a coastal state.[17] In territorial waters, the laws of the state, especially planning, environmental and contract laws, are directly applicable.[18] A location within territorial waters is, however, highly exceptional; most projects will be built farther out to sea and in offshore waters, especially if these projects are to be of a substantial size. A few larger projects within German territorial waters in the Baltic Sea are currently under discussion but, if approved, they will be a rare exception to general practices. Construction on the High Seas may occur in the distant future but neither the technology nor the sustained investment is as yet available for such enterprises.[19] This

[16] Copenhagen Energy owned 50 per cent of the project, the other 50 per cent was owned by a cooperative with 8,650 members.

[17] Article 3 of the UN Convention on the Law of the Sea; 1883 UNTS 396 (hereinafter 'LOSC').

[18] Under Article 2(1) of the LOSC the sovereignty of the coastal state extends beyond its land territory and internal waters into the territorial sea, hence these rules will apply directly to this zone of jurisdiction.

[19] The right to construct windfarms beyond the EEZ is uncertain. According to the LOSC, the High Seas are a global commons and as such open to use and exploitation of (most) resources by all countries as long as their activities do not interfere with the freedoms of other nations (Article 87). See N Lund, 'Renewable energy as a catalyst for changes to the high seas regime' (2010) 15 *Ocean and Costal Law Journal* 95 at 97.

chapter will, therefore, focus on the vast majority of projects which will be built in the Exclusive Economic Zone (EEZ) of a state.

3.2 International law

The LOSC governs the commercial exploitation of marine resources outside territorial waters. As will be shown, the Convention provides quite detailed guidance which can be applied to offshore wind projects. Interestingly, it even contains a specific reference to wind projects, giving the coastal state the express right to use the waters for the generation of wind energy. Article 56, addressing rights, jurisdiction and duties of the coastal state in the EEZ, provides that in these waters the coastal state has:

> . . . sovereign rights for the purpose of exploring and exploiting, conserving and managing the natural resources, whether living or non-living, of the waters superjacent to the seabed and of the seabed and its subsoil, and with regard to other activities for the economic exploitation and exploration of the zone, *such as the production of energy from water, currents and winds*. (*emphasis added*)

This reference to wind energy is even more remarkable when one considers that it was included in a treaty that was adopted in 1982, at a time when no offshore wind projects were operating or realistically at the planning stage. Moreover, it was not added as an afterthought but found its way into previous drafts much earlier.

While Article 56 only states that the coastal state has the right to economic exploitation, in other parts the LOSC provides fuller details and allows for the construction of the necessary structures for such exploitation. Article 60(1) provides that 'in the exclusive economic zone, the coastal State shall have the exclusive right to construct and to authorize and regulate the construction, operation and use of: (a) artificial islands; (b) installations and structures for the purposes provided for in article 56 and other economic purposes'. This provision further states that '(t)he coastal State shall have exclusive jurisdiction over such artificial islands, installations and structures, including jurisdiction with regard to customs, fiscal, health, safety and immigration laws and regulations'.[20]

Article 60, however, does not merely grant powers and responsibilities to the coastal state. It also provides very specific guidance as to how these rights are to be exercised and the obligations incumbent on the coastal state when exercising them; these provisions will be discussed further below in the context of national laws regarding offshore installations.

[20] Article 60(2).

Article 60(3) obliges the coastal state to give due notice of the construction of artificial islands, installations or structures, and permanent means for giving warning of their presence must be maintained. Finally, Article 60(3) obliges the coastal state to ensure that 'any installations or structures which are abandoned or disused shall be removed to ensure safety of navigation'. Such removal 'shall also have due regard to fishing, the protection of the marine environment and the rights and duties of other States. Appropriate publicity shall be given to the depth, position and dimensions of any installations or structures not entirely removed'.

Article 60(4) allows the coastal state to 'establish reasonable safety zones around such artificial islands, installations and structures in which it may take appropriate measures to ensure the safety both of navigation and of the artificial islands, installations and structures'. Significantly, Article 60(7) states that the 'artificial islands, installations and structures and the safety zones around them may not be established where interference may be caused to the use of recognized sea lanes essential to international navigation'.

The rights of the coastal state are not limited to the EEZ: the LOSC extends the right of exploitation beyond the EEZ to the continental shelf.[21] The continental shelf of a coastal state comprises the seabed and subsoil of the submarine areas that extend beyond its territorial sea throughout the natural prolongation of its land territory to the outer edge of the continental margin, or to a distance of 200 nautical miles from the baselines from which the breadth of the territorial sea is measured where the outer edge of the continental margin does not extend up to that distance.[22]

4 NATIONAL LAWS

Every offshore project is affected by a multitude of national laws and regulations, ranging from rules on permitting and operation of a project to rules on the laying of cable from the sea to land and over various lands on shore. The application of certain national laws for offshore wind projects in the EEZ can be seen as problematic, notably environmental emission standard laws. Ultimately, these laws were drafted for, and are expressly only applicable to, the territory of a state and the EEZ is not formally considered part of the national territory of a state. It can be argued that such norms are therefore only applicable if they contain an express extraterritoriality clause to that effect. States have increasingly appreciated this issue and started to make the

[21] Article 80 of the LOSC states that the provisions of Article 60 are applicable, *mutatis mutantis*, to the continental shelf.

[22] Article 76(1).

necessary changes;[23] without such clauses it is doubtful that such laws can be legitimately applied to the EEZ.

4.1 The United Kingdom

The two main sets of rules which this chapter will discuss relate to (i) the lease of the seabed for offshore projects, and (ii) the permitting for construction and operation of an offshore wind project. There are, as mentioned, many more provisions, some very closely connected with offshore wind projects, others more remotely connected. Moreover, it should be observed that UK waters, as a result of the ongoing devolution of powers to Wales, Scotland and Northern Ireland, will be subject to regulatory oversight by a variety of actors, which may have further impacts on the development of wind energy in inshore and offshore areas.

4.1.1 Leasing the land

Under international law, especially the LOSC, the seabed within the EEZ does not belong to any state, including the coastal state, within the proper meaning of the concept of ownership as applied in property law.[24] In the United Kingdom, the Crown Estate owns virtually the entire seabed out to the 12-mile territorial limit but, as mentioned before, this regime cannot simply be extended to the continental shelf where the coastal state only has the right of commercial exploitation. However, the Energy Act 2004 effectively entrusted the administration of the continental shelf to the Crown Estate and allowed the Crown Estate to enter into leases for the generation of renewable energy.[25] This does not, and cannot, mean that the land in question belongs to the United Kingdom or the Crown Estate; its exploitation is only administered by that body.

The Crown Estate belongs to the reigning monarch 'in right of the Crown' but this does not mean that the Queen as monarch benefits directly from any revenue or profits of the Crown Estate, as any surplus revenue is paid to the Treasury.[26] And the monies raised by the Crown Estate from rent from offshore wind projects could ultimately be highly lucrative.

[23] For instance, Germany's planning law (*Raumordnungsgesetz*) now contains express provisions for the EEZ in §18a.

[24] Article 56 provides that a coastal state may exercise sovereign rights over living and non-living resources of the seabed and exercise jurisdiction over, *inter alia*, the establishment and use of artificial islands, installations and structures.

[25] On licensing powers see section 89 of the Energy Act 2004.

[26] Under the new Sovereign Grant Act (2011) however, the grant paid to the Queen as sovereign is to be linked to the surplus revenue (profit) of the Crown Estate, so even though

As mentioned before, the Crown Estate grants lease agreements for the continental shelf. This is an interesting fact as the United Kingdom is almost alone in this: other countries let offshore wind projects be constructed without the need or requirement for such agreements. The lease agreements which the Crown Estate offers are very similar to onshore lease agreements. They contain standard provisions and usually have a duration of 50 years.

4.1.2 Permitting

Generally, the permitting regime and applicable rules depend on the size of the project, and the watershed here is 100 MW. Windfarms smaller than 100 MW will be authorised by the Marine Management Organisation ('MMO') under the Marine and Coastal Access Act 2009 ('MCAA')[27] as an Electricity Act consent and marine licence.

Windfarms over 100 MW are considered Nationally Significant Infrastructure Projects (NSIPs) and, as such, require a development consent under the Planning Act 2008. Decisions for such projects will be taken by the Secretary of State. Originally the decision was taken by the Infrastructure Planning Commission (IPC) which was, however, abolished in April 2012 and replaced by the Major Infrastructure Planning Unit (MIPU) within the Planning Inspectorate. The MIPU will now consider evidence and recommend the decision of the Secretary of State. The decisions themselves will be taken on the basis of the National Policy Statement for Renewable Energy (NSP).[28]

The details for the permitting have been laid out in the National Policy Statement.[29] The NPS provides, *inter alia,* that:

- consent will not be granted if sea lanes essential to international navigation are to be interfered with;
- sites should be selected to avoid or minimise disruption or economic loss to shipping, with particular regard to approaches to ports and strategic routes;
- reasonable attempts should be made to minimise adverse effects on fish stocks and fishing activity; and
- regard should be had to the conservation status of habitats.

4.2 Germany

As far as the German regime is concerned, this chapter will concentrate on the legal aspects of permitting. The main difference to the United Kingdom is that

an increase is not paid from the Crown Estate directly, such increase effects the amount payable to the sovereign.

[27] Section 12 of the Marine and Coastal Access Act 2009.

[28] National Policy Statement for Renewable Energy Infrastructure (EN–3) July 2011.

[29] ibid.

in Germany there is no need for, and in fact no possibility of establishing, a lease agreement. Again, and as has been previously mentioned, there are a multitude of laws and regulations which affect offshore wind projects in Germany.

4.2.1 Permitting

Responsibility for permitting offshore wind projects on the Continental Shelf in Germany rests with the *Bundesamt für Seeschifffahrt und Hydrographie* (BSH, Federal Maritime and Hydrographic Agency), in consultation with other agencies. The statutory instrument for the permitting is the *Seeaufgabengesetz* (Federal Maritime Responsibilities Act), implemented by the *Seeanlagenverordnung* (Marine Facilities Ordinance).

Under these rules, a windfarm project has to be approved provided that (a) it does not impair the safety and efficiency of navigation, and (b) it is not detrimental to the marine environment. This means that there is a legal right to receive the permit if there are no reasons for denying it. This is a non-discretionary decision, that is, if neither exempting factor is present the applicants have a legal claim for their application to be approved.

The BSH reviews whether the marine environmental features to be protected (for example, birds, fish, marine mammals, benthos, sea bottom and water) are put at risk by the project. In addition, offshore windfarm projects comprising more than 20 turbines require an environmental impact assessment ('EIA'). The EIA requires that applicants investigate the marine environment in the project area and predict the impact of the projected windfarm.

The BSH has issued regulations specifying the required scope of the investigations to be carried out by the applicants with respect to each of the features to be protected (so-called 'Standards for the EIA').

Other parts of each approval are, *inter alia*:

- limitation of the approval to a 25-year period, and
- the requirement to start building the installations within 2.5 years after receiving the notification of approval.

The BSH will also assess whether the project provides other requirements, notably safety during the construction phase, a state-of-the-art geotechnical study, state-of-the-art methods in the construction of wind turbines prior to start-up, installation of lights, radar, and the automatic identification system ('AIS') on the turbines, use of environmentally compatible materials and non-glare paint, foundation design minimising collision impact, noise reduction during turbine construction and low-noise operation, presentation of a bank guarantee covering the cost of decommissioning.

5 SUMMARY AND OUTLOOK

Using the seas for wind projects offers formidable advantages and opportunities. Winds are stronger and more consistent than in inshore areas, which generates higher energy yields per installed MW of capacity. The strongest and most consistent winds blow above waters deeper than 30 metres.[30] In addition, larger turbines can be built as there will be less resistance from local communities (provided the turbines are sufficiently distant not to be seen) and they are easier to install and transport.[31] These advantages mean that offshore wind turbines can actually continue to grow in size: while onshore installations should reach a limit with the 5 to 6 MW size, both in terms of transport and local acceptance, the trend offshore will be towards ever larger turbines, which, by economies of scale, makes the investment ever more profitable. This is, at least, the theory and the most likely future development. Nevertheless, it must also not be overlooked that offshore wind projects require substantially higher investment.

As far as Europe is concerned, offshore energy capacity is likely to advance ever further. The United Kingdom will continue with the next round of offshore developments and will remain the largest operator of offshore projects for some time, although the greatest increase can be expected to come from Germany. After a virtual stalemate over the last decade, this first commercial offshore project should be operational by the time this book is published and many more should follow in its wake.

The offshore wind market in the United States is poised to advance over the next few years. Despite high construction costs, electricity generated by offshore wind projects will become increasingly competitive as the price for electricity generated by traditional fossil fuels soars. Nuclear power is unlikely to provide new capacity in the short or even medium term and even then the costs for nuclear electricity will be negligible. The United States has, of course, not ratified the LOSC and appears unlikely to do so in the foreseeable future. Hence any project built outside US territorial waters would be constructed without an internationally recognised governing law.[32] The United States is not explicitly bound by the terms of the LOSC and any marine energy regime that it establishes would accordingly not be governed by it. This lack of rules could in theory deter developers and investors but no such hesitation has been seen, probably because there are so many other issues affecting the US offshore market that international law aspects relating to the law of the sea will probably take time to reach prominence.

[30] Giordano, Note 8 above, at 1156.
[31] See Lund, Note 17 above, at 100 onward.
[32] See K Dwyer, 'UNCLOS: Securing the United States' Future in Offshore Wind Energy' (2009) 18 *Minnesota Journal of International Law* 265 at 280.