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3.6 Energy

3.6.1 Introduction

The demand for energy is increasing year after year. To meet this demand, various sources of energy are available, with fossil energy resources probably predominating in the coming decades. However, at the same time, the use of renewable energy sources, especially offshore windfarming, is recently discussed Wadden Sea wide.

3.6.2 Gas and oil

All exploration and exploitation activities are subject to strict regulations, probably world wide. They will be carried out in accordance with binding international and national mining and nature protection legislation, and in compliance with the Wadden Sea Plan (Stade Declaration, 1997) and international regulations, for example PSSA, OSPAR, AEWA, MARPOL, and the Ramsar and Bonn Conventions. **Germany and The Netherlands** confirmed their commitment not to explore and extract oil and gas at locations within the boundaries of the World Heritage Site (WHS), in line with law in force (CWSS, 2008, 2009).

The 1999 and 2005 QSR gave a detailed overview on the exploration and exploitation of gas and oil in the Wadden Sea Area. This chapter gives a short overview about the present status and focuses on major new developments since 2003.

An overview of oil and gas production sites and pipelines in the Wadden Sea Area is given in Figure 3.6.1.

The Netherlands

In The Netherlands, gas is currently being produced from five fields that are either fully or partially located underneath the Wadden Sea Area (Figure 3.6.1). These fields are: Zuidwal, Ameland, Blija, Moddergat and Groningen.

'Zuidwal' is an unmanned gas exploitation platform in the western part of the Dutch Conservation Area (PKB) between Harlingen and Vlieland. The natural gas is transported to Harlingen via a pipeline. All discharges from the exploitation site are deposited on land and the produced water is returned to the reservoir. An extensive study, carried out in 1999, and a report published by the Ministry of Transport and Water Management in 2004 showed that the effects of gas extraction from the Zuidwal site were most likely very minimal. The production facility is a 'zero emission

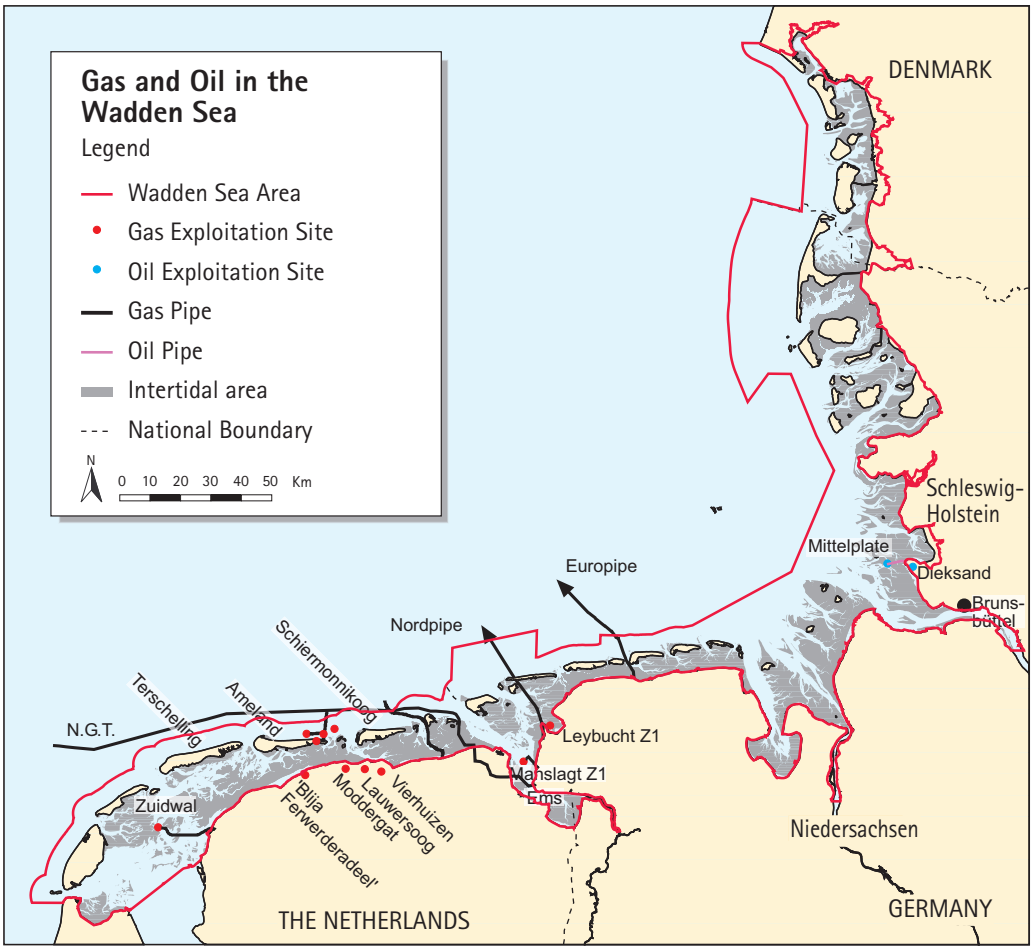

Figure 3.6.1: Gas and exploitation sites and pipelines in the Wadden Sea (source: CWSS 2008. Nomination of the Dutch-German Wadden Sea as World Heritage Site).

unit'. The area excluded from the World Heritage Site encompasses a circle around the platform with a radius of 500 meters.

The other production sites are all located outside the Wadden Sea, but their wells or reservoir may extend under it. Permits for two additional gas exploitation sites adjacent to the Wadden Sea - Vierhuizen and Lauwersoog - were granted. Production is allowed within the limits of the resilience of the Wadden Sea to compensate for sea level rise by natural sedimentation. Both subsidence and the ecological development will be followed by a strict monitoring program.

The production site "Blija Ferwerderadeel' is located on the mainland coast in the eastern part of the province of Fryslân.

The Groningen gas field extends slightly under the Wadden Sea and the Ems estuary. All production sites are on the mainland, and no production wells were drilled under the Wadden Sea.

On the island of Ameland, three sites were constructed with only one producing. The production site is situated on the east cape of the island and is connected to two offshore platforms.

The proven total gas reserve in the Dutch Conservation Area has been estimated by the "Nederlandse Aardolie Maatschappij BV" (NAM) at about 45-60 billion m³. These gas resources underneath the Wadden Sea include the existing production locations, the proven reserves in Nes, Lauwersoog, Ternaard and Vierhuizen.

Not all gas reserves are yet explored or in production. However, it is agreed that new exploration drilling and new production installations within the Dutch part of the Wadden Sea Area will not be permitted in the future. New exploration and exploitation of gas is only permitted from sites on land and from existing platforms in the North Sea coastal zone. Thus, new production from under the Wadden Sea will have to be developed from the mainland, the islands or the North Sea coastal zone.

Germany

In Germany all exploration and exploitation activities are subject to the Federal Mining Act and are carried out in accordance with the relevant mining regulations procedure. In the context of this licensing procedure, standard authorization preconditions are required to be fulfilled. The relevant nature protection regulations of the National Park Acts, the State and Federal Nature Protection Acts, relevant EU directives and international regulations are to be complied with and followed.

An area around "Mittelplate A", within which the oil exploitation occurs, is excluded from the World Heritage Site, together with two smaller boundary adjustments in the Elbe estuary and the Knechtsand area. In these excluded areas, oil exploration drillings will take place pending licensing under the legal regime, in particular assessment and permission according to Article 6 of the EC Habitats Directive and national laws. In case resources are found, it is agreed that exploitation will only take place from outside the World Heritage Site or the existing platform respectively.

Concessions cover most of the German part of the Wadden Sea. To date, zero-discharges are applied at all installations in the German Wadden Sea Area.

Niedersachsen

There are two sites where natural gas is exploited in the Niedersachsen Wadden Sea Area. 'Leybucht Z 1' in the exploitation field 'Juist-Leybucht I"' of the concession area 'Juist' is an unmanned gas exploitation site situated in the Conservation Area:

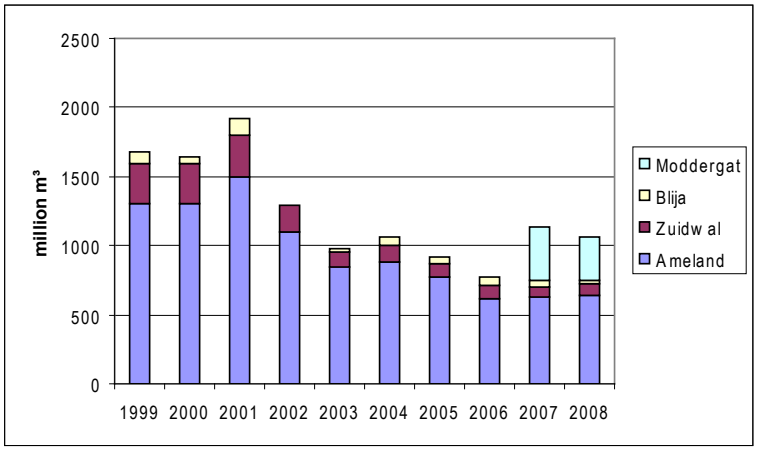

Figure 3.6.2: Gas production in the Dutch Wadden Sea (in million m³) (1999-2007) (data source: 2008 WaddenInzicht).

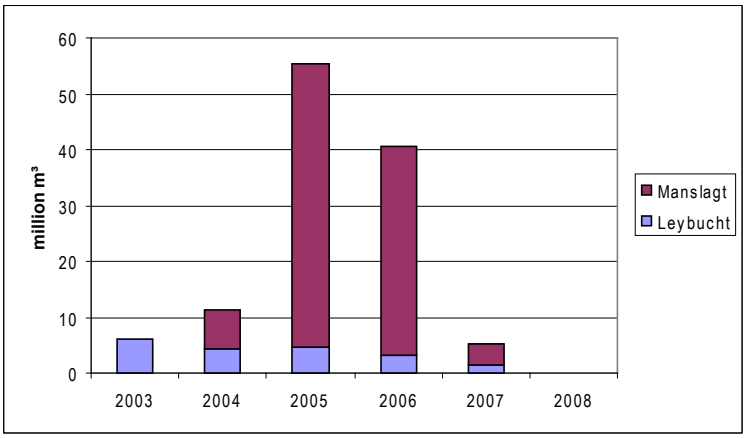

Figure 3.6.3: Gas production in the Niedersachsen Wadden Sea (in million m³) (2003–2008) (source: WEG Jahresberichte 2005–2008).

production started in 1977. The area excluded from the World Heritage Site encompasses the gas production installation. 'Manslagt Z 1', in the exploitation field 'Groothusen II' of the concession area 'Groothusen', is situated in the Ems estuary outside the Conservation Area. The production started in 1993 and stopped in October 2000 because of an occlusion of the drill-hole. In 2004 production started again.

Gas is transported from the Norwegian continental shelf of the North Sea via the Nordpipe pipeline to the Phillips Petroleum treatment plant 'Rysumer Nacken' west of Emden and the 'Europipe I+II' which has been in operation since October 1995 (see Figure 3.6.1).

Hamburg

According to the Act on the Hamburg Wadden Sea National Park, the exploitation of energy resources in the Hamburg Wadden Sea Area is not allowed.

Schleswig-Holstein

In Schleswig-Holstein, the exploitation of natural oil reserves is only permitted in the region of the Mittelplate and the Hakensand south of Trischen, situated in the southern part of the

Trilateral Policy and Management

Discharges from oil and gas exploration and exploitation activities

The exploration and exploitation of the energy resources in the North Sea, as well as in the Wadden Sea Area, has to comply, at least, with the international agreements in the appropriate fora. This results *i.a.*, in a prohibition to discharge oil-based muds and cuttings. Dumping or discharge of water based muds and/or cuttings is only allowed in line with relevant PARCOM agreements. (WSP § 2.1.8)

The leaching of toxic substances from protective coatings of pipelines and other installations will be avoided by the use of appropriate materials. (WSP § 2.1.9)

In the Conservation Area, offshore activities that have an adverse impact on the Wadden Sea environment will be limited and zero-discharges will be applied. In the Wadden Sea Area outside the Conservation Area, discharges of water-based muds and cuttings will be reduced as far as possible by applying Best Available Techniques and by prohibiting the discharge of production water from production platforms.
(WSP § 2.1.10)

Infrastructural works

New infrastructural works which have a permanent or long-lasting impact should not be established in salt marshes. (WSP § 3.1.14)

New licenses for the construction of pipelines in the salt marshes for the transport of gas and oil shall not be issued unless such measures are necessary for imperative reasons of overriding public interest. In that case, the method of construction and the planning of the location line shall be such that the environmental impact on the Wadden Sea ecosystem is kept to a minimum and permanent, or long lasting, negative impacts are avoided. (WSP § 3.1.16; Reference to 4.1.13)

Mineral extraction and infrastructure

In the Conservation Area, new exploitation installations for oil and gas will not be permitted. Exploration activities are permitted within the Conservation Area if it is reasonably plausible that deposits can be exploited from outside the Conservation Area. Net loss of nature value must be prevented. Therefore, exploration activities will be regulated in space and time.

Associated studies, mitigation and compensation measures should be carried out where appropriate. (WSP § 4.1.10)

The construction and planning of pipelines shall be such that the environmental impact on the Wadden Sea ecosystem is kept to a minimum and permanent, or long lasting, negative impacts are avoided, and if this is not possible, compensated. In the Conservation Area, new licenses for the construction of pipelines in the tidal area for the transport of gas and oil shall not be issued unless such measures are necessary for imperative reasons of overriding public interest and if no alternative can be found. (WSP § 4.1.13; Reference to 3.1.16)

In order to prevent a further loss of dune areas, the existing infrastructure will, in principle, not be extended and new constructions will, in principle, not be allowed. (WSP § 5.1.4)
(Wadden Sea Plan 1997)

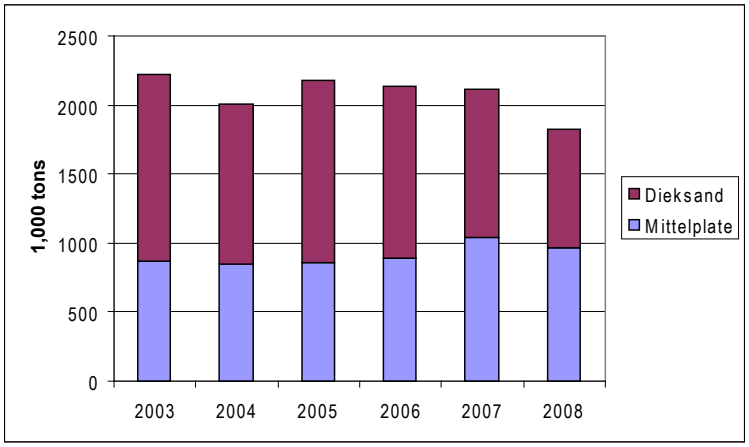

Figure 3.6.4: Oil production Mittelplate (in tons) (source: WEG Jahresberichte 2005–2008).

Schleswig-Holstein Conservation Area (National Park), according to the Act on the National Park Schleswig-Holstein Wadden Sea. This requires specific approval by the responsible ministry. The consortium 'Mittelplate' initiated the construction of the exploitation site 'Mittelplate A' in 1985 and oil production was started two years later. An area around 'Mittelplate A', within which the oil exploitation occurs, is excluded from the World Heritage Site.

According to current estimates by the consortium running Mittelplate (RWE Dea and Wintershall), there are still more than 100 million tons of crude in several layers of oil-bearing sandstone at depths between 2,000 and 3,000 meters. Around 60 million t are considered to be recoverable.

In 1998, drilling operations started to exploit part of the oil from the eastern section of the 'Mittelplate' field from the mainland. Onshore production started at the Dieksand land station in Friedrichskoog in 2000, in order to speed up the exploitation and to limit the impact of the existing drilling site in the area.

Formerly, the crude oil was transported daily from the platform Mittelplate to Brunsbüttel by three special double hull tankers and from here pumped to the refinery near Hemmingstedt. Thus, oil production was restricted by transport capacity and tidal regime. In 2003, the State Mining Authority approved plans for a pipeline link between the Mittelplate production site and the Dieksand land station in Friedrichskoog (Mittelplate Konsortium, 2004). The pipeline construction in the Wadden Sea went into operation in 2005. As a result, disturbance of moulting shelduck has been minimized and potential risks of oil spills have been virtually excluded. Until now, no negative effects at the locality and its surroundings have been found.

Denmark

The Danish part of the Wadden Sea is part of the concession area of the North Sea but licenses are not issued and, according to the Statutory Order on the Nature Reserve Wadden Sea, exploitation of gas and oil in the Danish part of the Conservation Area is prohibited.

3.6.3 Wind energy

The construction of wind turbines is prohibited in the whole Wadden Sea Conservation Area according to the Danish Statutory Order, the German National Park Acts and the Dutch Conservation Area (PKB Area).

On the islands and the adjacent mainland outside the Wadden Sea Conservation Area, the construction of wind turbines and wind farms is only allowed if important ecological and landscape values are not negatively affected.

Policies are in force regarding the construction of wind turbines outside the Wadden Sea Area - along the coast and offshore - considering ecological and landscape criteria.

The following chapters focus on development in the Wadden Sea Area and the adjacent offshore area.

The Netherlands

According to the Dutch Wadden Sea Policy Plan ('pkb Waddenzee'), construction of wind turbines is not allowed in the PKB core area. The licensing of wind turbines on the mainland outside the core area is a responsibility of the provincial authorities. The Natura 2000 protection regime for the Wadden Sea is applicable to this licensing policy.

The territorial sea north or west of the Wadden Sea has been closed for wind turbines according the National spatial policy plan ('Nota Ruimte').

Currently, there are two offshore projects, which are located at the west coast (off Egmond aan Zee) (Figure 3.6.5).

In the Exclusive Economic Zone (EEZ) north of the Dutch Wadden islands, three offshore wind energy projects have been submitted for a license. These projects are situated just north of the territorial border (Riffgrond area) and will probably be approved end of 2009 (see table 3.6.1). These projects are not yet feasible financially.

Currently in the framework of the National Water Policy Plan, an area for wind energy production is to be delimitated in the EEZ North of the Wadden Islands. The three planned projects of Table 3.6.1 are situated within this area. A final decision on this area will be taken in the course of 2010.

Trilateral Policy and Management

1.1.4 The construction of wind turbines in the Conservation Area is prohibited. (Identical with 9.1.9).
1.1.5 The construction of wind turbine, in the Wadden Sea Area outside the Conservation Area is only allowed if important ecological and landscape values are not negatively affected. (Identical with 9.1.10).

Germany

In February 2002, a political aim was set to build offshore wind turbines with an installed capacity of around 20,000-25,000 MW by the year 2030. The aim was to increase the share of electricity consumption generated by wind power on- and offshore to at least 25% within the next 30 years (BMU, 2002). The government estimated that about 500 MW of offshore capacity could be achieved in an initial phase until 2006 and about 3,000 MW in the mid term (up to 2010). In the long term (up to 2015 or 2030) 20,000 to 25,000 MW of installed capacity were thought to be realistic (see 2005 QSR). However, current projections for offshore wind energy predict a capacity of about 1500 MW by 2011 and about 3,000 MW by 2015 and about 10,000 MW in the long term.

At the moment, more than 40 offshore windparks are planned for the German North and Baltic Seas. 33 of them have already been approved by the Federal Maritime and Hydrographic Agency (BSH). An overview of offshore wind farm projects in Germany is given separately for territorial waters (up to 12 nautical miles [nm]) and the German EEZ, because the competences for the licensing procedure of offshore wind farms and their cables vary in the EEZ and the 12 nm zone. In the EEZ, the Federal Government is responsible and

Name (company)	Capacity (MW)	Location	Characteristics	Status
Princess Amalia Wind Farm (outside 12 nm)	120	23 km west of Egmond aan Zee	60 turbines	In operation since 2008
Egmond aan Zee (inside 12 nm)	108	10-18 km of Egmond aan Zee	36 turbines	In operation since 2007
BARD Offshore NL1 (Bard Engineering)	300	EEZ north of Riffground area	60 turbines	In procedure for license and subsidy
EP Offshore NL1 (Eolic Power)	275	EEZ north of Riffground area	55 turbines	In procedure for license and subsidy
GWS Offshore NL1 (Global Wind Support)	300	EEZ north of Riffground area	60 turbines	In procedure for license and subsidy

Table 3.6.1: Offshore wind farm projects in The Netherlands in 2009.

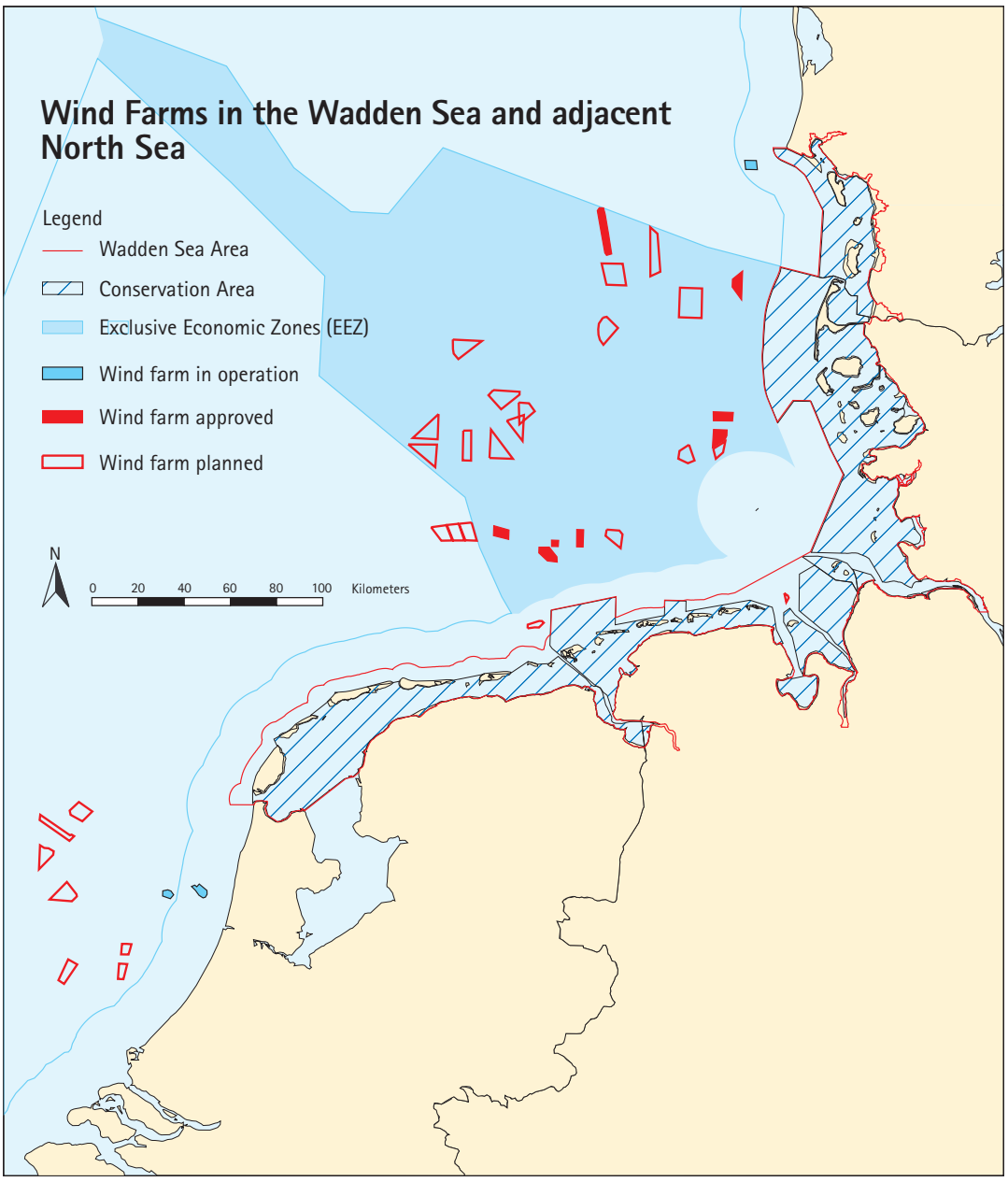

Figure 3.6.5: Offshore Wind Farms in the Wadden Sea and adjacent North Sea (status November 2009). Only approved pilot projects and wind farms in operation are shown.

the licensing procedure falls under the Offshore Installations Ordinance ('Seeanlagenverordnung') whereas in the 12 nm zone the German 'Länder' are responsible and carry out regional planning procedures. The construction of wind turbines along the coastline is also subject to the national building regulations ('BauGB'). Thorough Environmental Impact Assessments are carried out both in the EEZ and in the 12 nm zone. The German Renewable Energy Sources Act (EEG), which is also applicable for EEZ and 12 nm zone, contains a regulation that electricity from offshore wind farms will only be eligible for payment if sited outside of nature and bird conservation areas to discourage intervention in these protected Natura 2000 areas.

The routing of cables from offshore wind farms to the mainland power grid network is under discussion. Presently, four cable connections have been approved by the Federal Maritime and Hydrographic Agency (BSH): 'Windnet' (Borkum West), 'Multikabel' (Nördlicher Grund), 'Sandbank 24', 'OTP' (Amrumbank West, Nordsee Ost).

The German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) aspires to accelerate the offshore wind energy development. For this purpose, it supports

a comprehensive research project at the offshore test site "Alpha Ventus", around 45 km north of the island of Borkum. The project, called RAVE ("Research at Alpha Ventus"), includes wind measurements, technological upgrading of turbines, grid integration and ecological accompanying research. An important prerequisite is the BMU's offshore research platform FINO 1, which started collecting data in 2003. No projects have been undertaken anywhere in the world with the construction and operation of offshore wind parks at a comparable depth and at such a great distance from the mainland. Thus, the results of the project and the lessons learned through the construction of Alpha Ventus will be of prime importance for the technical and environmental assessment of offshore wind technology in Germany. At completion, the Alpha Ventus wind farm will comprise a total of twelve wind turbines; six of them have already been constructed and have been in operation since August 2009. All are expected to be in operation by the end of this year. Already in August 2007 preparatory work for the connection to the German grid has been ongoing on Norderney and around Hilgenriedersiel. To protect the sensitive ecosystem of the Wadden Sea National Park from disturbances, hollow pipes have been laid and lines drilled horizontally through dunes and other points critical for coastal protection. In the spring of 2008, a hollow ducting structure was completed across Norderney. Simultaneously, the new substation at Hager Marsch was erected to which Alpha Ventus was connected. At the end of May 2008, the cable system was laid for the connection from Alpha Ventus to the hollow ducting construction. In summer 2008, both onshore and offshore cables were laid. With the construction of the offshore transformer station in September 2008, the operator DOTI (Deutsche Offshore-Testfeld und Infrastruktur GmbH) created the necessary prerequisites for the transmission of the generated wind power ashore (http://www.alpha-ventus.de/).

In 2008 another research platform, FINO 3, was build 80 kilometers west of the island of Sylt, at the edge of the potentially suitable area for wind farms. As with research platform FINO 1 and FINO 2 in the Baltic Sea, meteorological and hydrological data will be collected and bird migration monitored (http://www.fino3.de).

Niedersachsen

In the Conservation Area, the construction of wind turbines is not allowed but exemptions are possible, for example, on the islands (see 1999 QSR).

Within the regional planning program, a proposal for two offshore wind energy areas within the 12 mile zone was endorsed in December 2003 by the Government concerning the areas 'Nordergründe' and 'Riffgatt' (Table 3.6.2, Figure 3.6.5).

With regard to cable routing, a decision was taken in September 2004 to connect the wind farm 'Nordergründe' to the mainland power grid in Wilhelmshaven.

Schleswig-Holstein

The construction of wind turbines is not allowed in the Wadden Sea Conservation Area. The same is valid for all Halligen, the geest parts of the islands Amrum, Föhr and Sylt, geological formations under protection, as well as the areas seaward of the dikes in the Wadden Sea Area. Wind energy installations are not allowed in, or close to, feeding and roosting areas for birds. Generally, distances of 50-1,000 m from these areas have to be respected.

At the moment, there are wind energy installations on the islands of Föhr (twelve wind turbines), Pellworm (six) and Nordstrand (seven).

Hamburg

According to, the construction of wind turbines is prohibited in the entire Hamburg Wadden Sea Area.

German North Sea EEZ

Outside the 12 nm zone in the German EEZ, the Federal Maritime and Hydrographic Agency (BSH) is in charge of licensing offshore wind farm projects. In September 2008, about 18 projects were in some kind of planning stage for sites in the North Sea (BSH 2008, Figure 3.6.5). In Table 3.6.3, an overview is given of the pilot projects which have been approved by the BSH until September 2009.

Name (company)	Capacity (MW)	Location	Characteristics	Status
Nordergründe (Energiekontor AG)	125	15 km northeast of Wangerooge	25 turbines	Approved November 2007
Riffgat (Enova GmbH)	264	15 km northwest of Borkum	44 turbines	EIA in preparation

Table 3.6.2: Offshore wind farm demonstration projects within 12 sm zone in Niedersachsen.

Table 3.6.3: Overview of approved offshore wind farm pilot projects in the German North Sea EEZ (outside territorial waters > 12 sm) (BSH 2009, status September 2009) .

Name (company)	Capacity (MW)	Location	Characteristics	Status
Alpha Ventus (Prokon Nord)	60	43 km north of Borkum	12 turbines in pilot phase (planned 208)	Approved November 2001
Borkum Riffgrund-West (Energiekontor)	280	50 km northwest of Borkum	80 turbines in pilot phase (planned 458)	Approved February 2004
Borkum Riffgrund (PNE2 Riff I GmbH)	231	34 km north of Borkum	77 turbines in pilot phase (planned 180)	Approved February 2004
Amrumbank West (Amrumbank West GmbH)	400	36 km southwest of Amrum	80 turbines	Approved June 2004
Nordsee Ost (Winkra mbH)	400	30 km northwest of Helgoland	80 turbines in pilot phase (planned 250)	Approved June 2004
Butendieck (Butendieck GmbH)	240	37 km west of Sylt	80 turbinen	Approved December 2002
Sandbank 24 (Sandbank 24 GmbH)	480	90 km west of Sylt	96 turbines in pilot phase (planned 980)	Approved August 2004
North Sea Windpower (Enova GmbH)	240	39 km north of Juist	48 turbines in pilot phase (planned 286)	Approved February 2005
DanTysk (Gesellschaft für Energie und Oekologie mbH)	400	70 km west of Sylt	80 turbines in pilot phase (planned 300)	Approved August 2005
Nördlicher Grund (Nördlicher Grund GmbH)	400	84 km west of Sylt	80 turbines in pilot phase (planned 402)	Approved December 2005
Global Tech I (Nordsee Windpower GmbH & Co.KG)	400	93 km north of Juist	80 turbines in pilot phase (planned 320)	Approved May 2006
Hochsee Windpark Nordsee (EOS Offshore AG)	400	90 km north of Borkum	80 turbines	Approved July 2006
Gode Wind (Plambeck Neue Energien AG)	400	38 km north of Juist	80 turbines	Approved August 2006
BARD Offshore 1 (BARD Engineering GmbH)	400	89 km northwest of Borkum	80 turbines	Approved April 2007
Meerwind Ost & Meerwind Süd (Meerwind Südost GmbH & Co Rand KG und Meerwind Südost GmbH & Co Föhn KG)	200	24 km north of Helgoland	40 turbines (each)	Approved May 2007
Hochsee Windpark He dreiht (EOS Offshore AG)	400	85 km north of Borkum	80 turbines in pilot phase (planned 119)	Approved December 2007
Borkum West II (Prokon Nord Energiesysteme GmbH)	400	45 km north of Borkum	80 turbines	Approved June 2008
Gode Wind II (PNE Gode Wind II GmbH)	240 - 400	33,7 km north of Juist	80 turbines	Approved July 2009
Delta Nordsee II (Offshore-Windpark Delta Nordsee GmbH)	192	38,9 km northwest of Juist	32 turbines	Approved August 2009

Denmark

According to the Danish Government's action plan for energy, 'Energy 21' (published in 1997), 4000 MW of offshore wind power should be installed by 2030. The target for onshore wind energy is 1500 MW. This scheme would enable Denmark to cover more than 50% of the total electricity consumption by wind energy.

At the moment, three offshore wind farms are in operation in the North Sea (Table 3.6.4). The latest one, of about 200 MW, Horns Rev II was inaugurated in September 2009.

In the Danish Conservation Area, the construction of wind turbines is not allowed, although nothing is particularly mentioned in the newly revised Statutory Order for the Conservation Area, which came into force on 1 March 1998. According to § 13-4 of the Statutory Order, the construction of wind turbines is not allowed in the sea territory of the Wadden Sea Area.

Currently, there are two wind energy installations in the Wadden Sea Area (outside the Conservation Area), on the islands of Fanø (sixteen turbines), and Ho Bugt (three). The farm and group

Name (company)	Capacity (MW)	Location	Characteristics	Status
Horns Rev (Elsam essential energy)	160	14 – 20 km off Skallingen	80 turbines	In operation since 2002
Rønland	17	1 km off Limfjord	8 turbines	In operation since 2003
Horns Rev II	200	30 km off Jutland west coast	91 turbines	In operation since 2009

Table 3.6.4: Offshore wind farms in the Danish part of the North Sea.

are both encompassed by a local planning scheme and can be replaced by similar new ones in accordance with these plans.

On the mainland outside the Wadden Sea Area, there are scattered areas on the geest where single and groups of turbines and wind farms are located: east of Esbjerg, near to the salt marshes of Måde; in the Tjæreborg marsh; a wind farm at Hjerpsted Bakkeø up to the Wadden Sea; a few wind turbines in Tønder Marsh; and a reservation area for large wind turbines in the lower geest up to the marshlands north of the river Konge Å.

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