Strategy of the German Government on the use of off-shore wind energy

in the context of its national sustainability strategy

Ministries involved:
Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (lead)
Federal Ministry of Economics and Technology
Federal Ministry of Transport, Building and Housing
Federal Ministry of Consumer Protection, Food and Agriculture
Federal Ministry of Defence

contributions by:
German Energy Agency (dena)

As at: January 2002

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1 Background

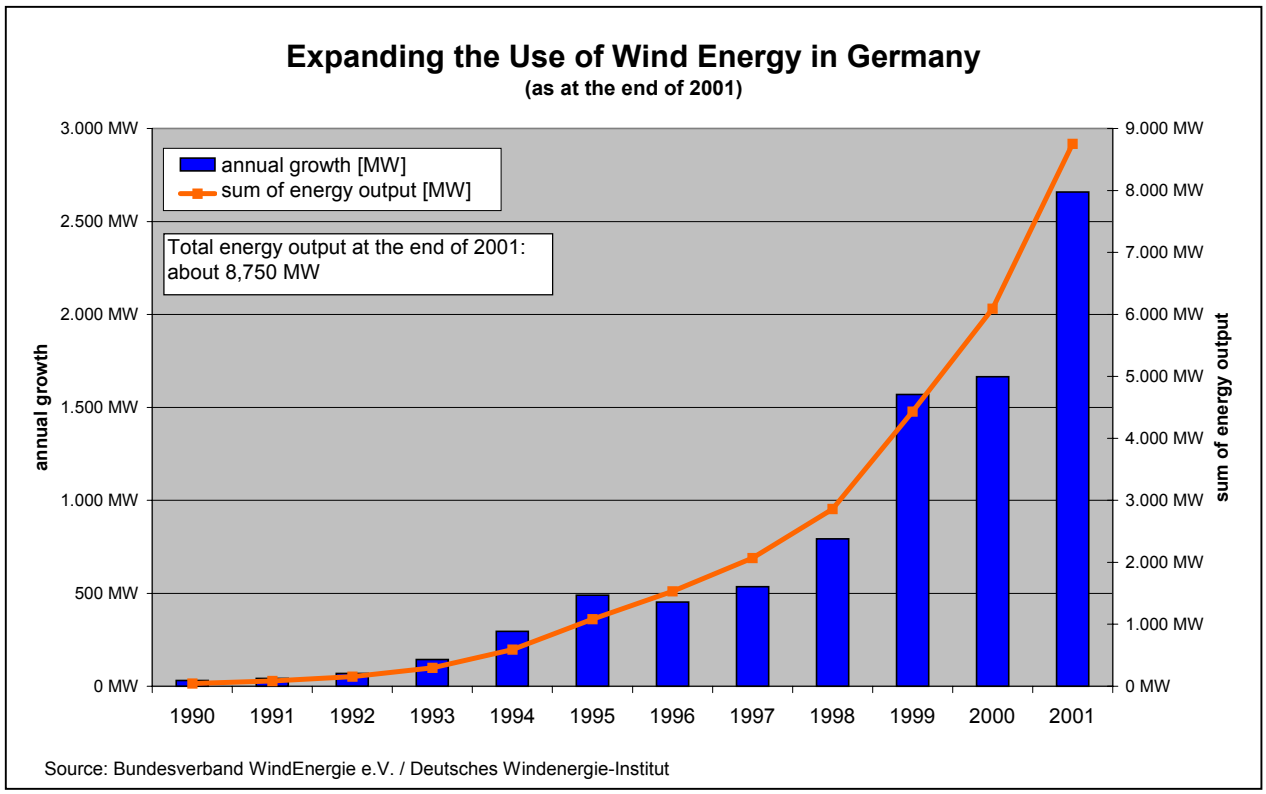
The project on renewable energies and efficient use of energy in fuel cells that forms part of the national sustainability strategy envisions to reduce the dependency on energy imports and to further improve the environmental compatibility of power generation, particularly with a view to climate change. Energy supply should be restructured and put on a sustainable foundation. Guaranteeing a reliable energy supply, profitability for both suppliers and consumers, and the protection of the environment and resources should all be treated with the same priority. To this end, the expansion of the renewable energies sector (supply side) shall be optimally combined with measures to increase energy efficiency (user side). The sub-project on off-shore wind farms therefore aims at creating the necessary preconditions on the supply side that will allow for a rapid construction of offshore wind farms.

The State Secretary Committee for Sustainable Development commissioned the Federal Environment Ministry to develop and implement a targeted strategy with which to solve existing conflicts between the protection and use of resources and to speed up the licensing procedures. Extensive legal and planning security are the priority aims to be achieved as soon as possible. The revised Federal Nature Conservation Act has created the necessary conditions for such legal and planning security.

The German Government has set the target of doubling the share of renewable energies by the year 2010. With 2000 as the base year, this means that by 2010 renewable energies will make up 12.5 % of the total future energy generation.

At the end of 2001, approximately 8,750 MW power came from wind energy plants in Germany. The total energy output of wind energy installations amounted to about 13 TWh (1 TWh = 1 billion kWh) in 2001, covering already more than 2.5 % of the total energy demand. In 2001, the use of wind power will probably reduce CO_2 emissions by about 10 million t which is 1 % of Germany's total CO_2 emissions. These figures clearly

illustrate the importance of wind power in terms of climate protection. Since the Renewable Energy Sources Act entered into force in 2000, the grid operators have paid approximately € 511 million for energy generated by wind power. The figures for 2001 predict an amount of approx. € 920 million. In years to come, a further increase can be expected.



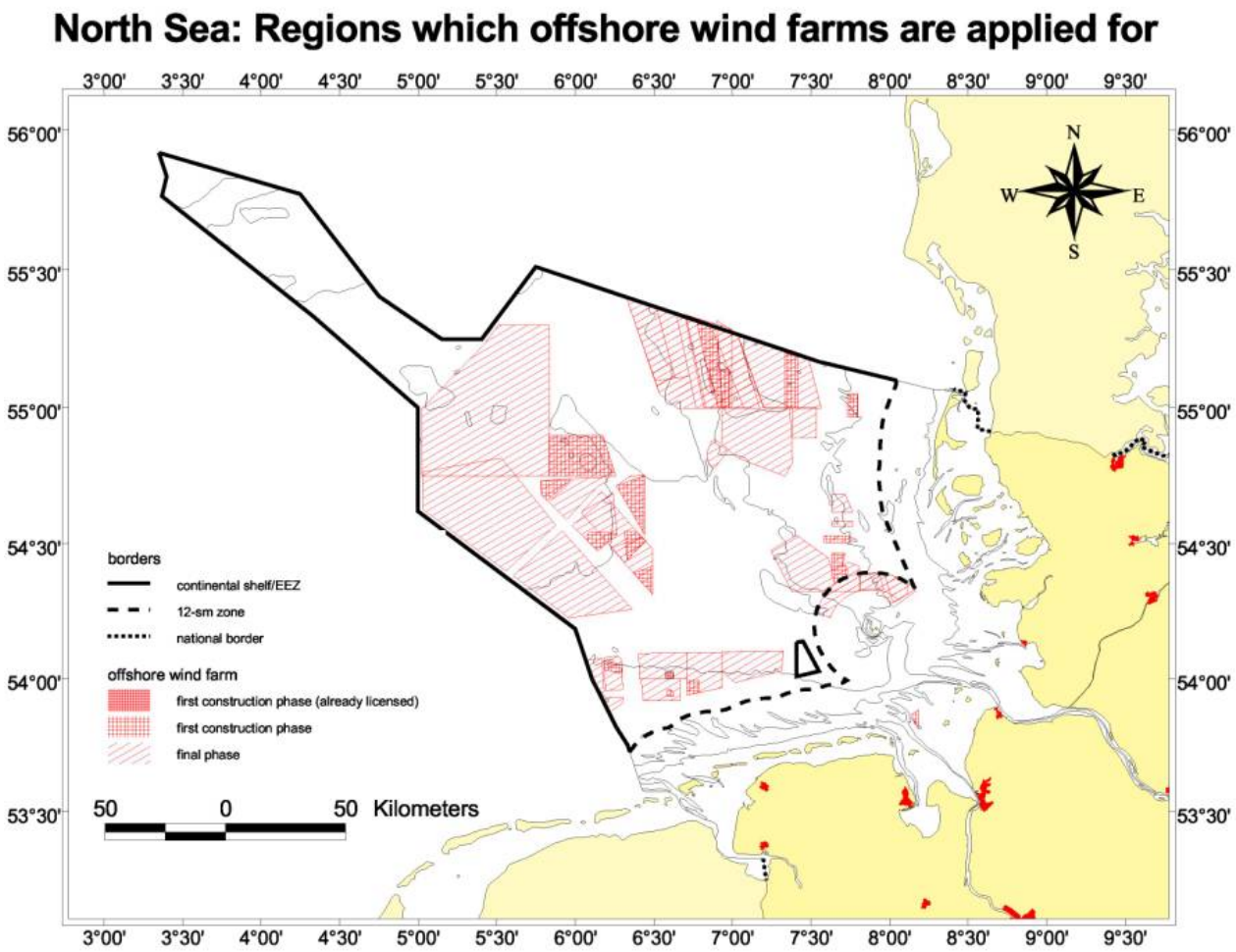
Graph 1: Expanding the use of wind energy in Germany

We can see already today that the number of new wind power installations on shore per year will decrease within a few years. In order to keep up the high level of wind power expansion, it will be necessary to further expand suitable on-shore sites, to replace older and smaller on-shore plants by modern and efficient ones and to start developing appropriate locations off-shore.

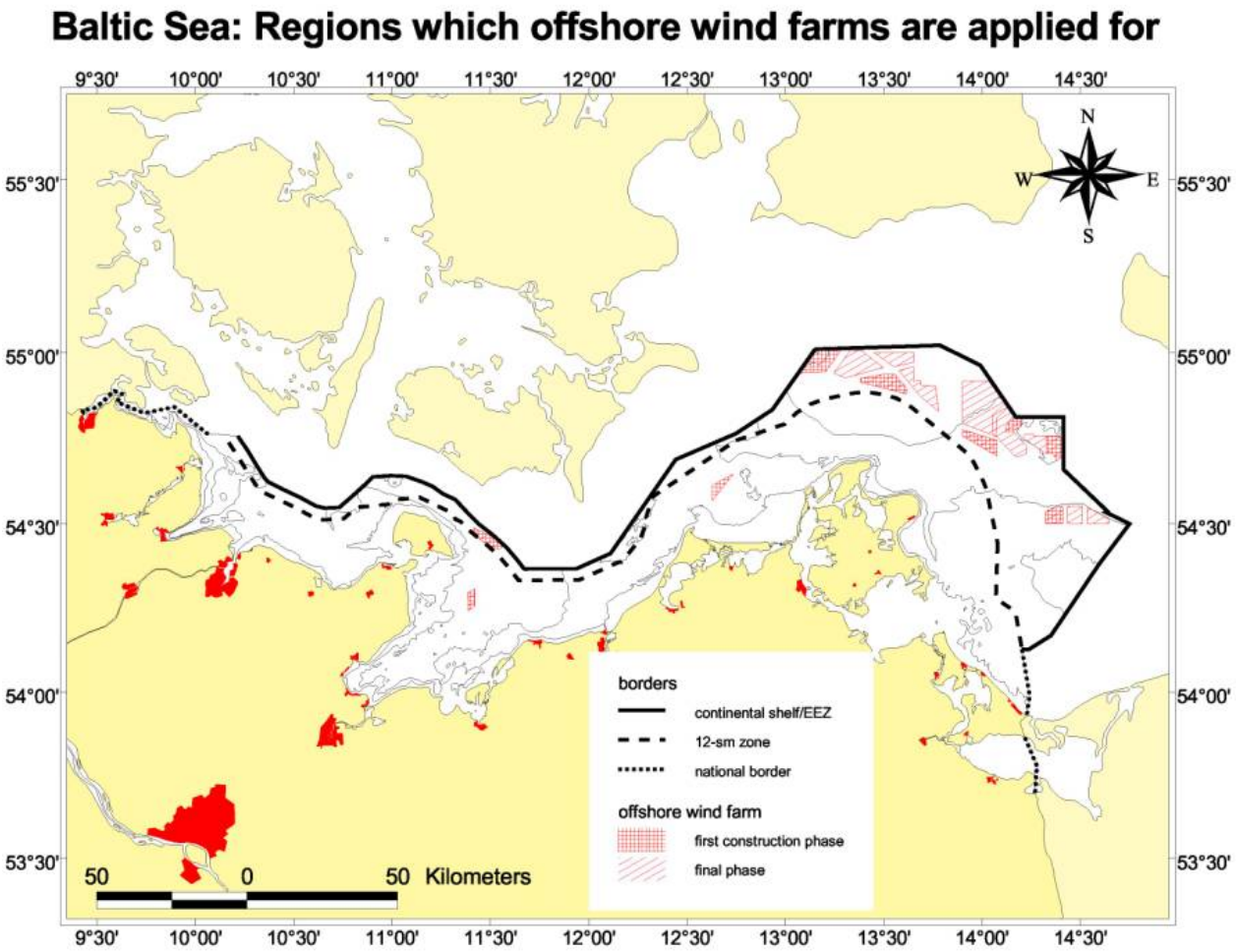
At the moment – as at January 2002 – 29 wind farms have been applied for in the Exclusive Economic Zone (EEZ) (22 North Sea / 7 Baltic Sea) which comprise several hundred separate wind energy plants. Several smaller wind farms and the first construction phases of larger farms are awaiting their licences. In German coastal waters (within 12-sm zone), several wind farms are being planned in Lower Saxony, Schleswig-Holstein and Mecklenburg-Western Pomerania.

Table 1: : Applications for offshore wind farms (EEZ, as at January 2002)

Region	**Number of applications**	**Energy output of the first construction phase (MW)**	**Final energy output as applied for (MW)**
North Sea, EEZ	22	about 5,000	58,500
Baltic Sea, EEZ	7	about 1,500	4,600



Graph 2: Overview of offshore wind farms applied for in the North Sea (as at January 2002)



Graph 3: **Overview of offshore wind farms applied for in the Baltic Sea (as at January 2002)**

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2 Objectives

The sub-project "offshore wind farms" aims at establishing the frame conditions for making use of that considerable potential as soon as possible. The German government assumes that renewable energies will be competitive in the long-run without needing subsidies.

The conditions as they are today would allow the generation of at least 500 MW in the initial phase (namely the first construction phase of the wind farms) in the areas that are projected to be available by 2006, and in the medium-term, by 2010, even 2000 to 3000 MW power is expected from using off-shore wind energy. In the long-term, i.e. up to 2025 or 2030, profitability will be reached with about 20,000 to 25,000 MW of installed power (in the coastal waters and EEZ). For this to come true, investors in off-shore wind farms and the energy sector need to provide for the necessary logistics for the transport of this scale of electricity generated off-shore (sufficient sea cable capacities, links to the land grid, if necessary additional grid capacities on land).

Using wind energy to this extent would amount to 15 % of the energy consumption – compared to 1998 standards.

2.1 Strategic focal points

1. The expansion of this type of energy should be compatible with nature and the environment and also be economically viable. It should be implemented in a step-by-step approach.

2. The fact that there are considerable technical, economic and legal uncertainties for off-shore wind farms should be taken into consideration.

3. The legal situation needs improvement not only from the environmental and nature conservation perspectives, but also in the field of planning and investment security. In this context, a distinction is to be made between sites within the 12-sm zone (German territory) and beyond it (Exclusive Economic Zone – EEZ).

The revised Federal Nature Conservation Act contains important new regulations for marine protection in the EEZ. They deal with the identification of protected areas as well as the provisions for especially suitable areas for the establishment of wind power plants and the licensing procedure in accordance with the Offshore Installations Ordinance (Seeanlagenverordnung). Navigational issues as well as environmental protection and nature conservation issues and commercial (fishery, mineral resources) as well as military uses have to be taken into consideration when choosing the site. They are important for the construction phase, the operation of the plants and for the technical layout of the plant.

4. Technical research and research related to nature conservation and environmental protection should accompany the expansion of the use of off-shore wind energy for a length of time beyond the initial phase.

5. In accordance with § 3a of the Offshore Installations Ordinance, suitable areas for the expansion of the use of wind energy should be identified in an interministerial approach.

6. Following the precautionary principle, the expansion should be gradually implemented, as the use of off-shore wind energy means a large-scale and long-term interference with the marine environment. A second reason for taking a step-by-step approach is the lack of definite projections for the environmental impact of the installations due to a lack of practical experience (e.g. concerning barriers for migrating birds, collisions with birds or loss of habitats for marine mammals). The environmental impacts have to prove positive and balanced before the subsequent steps can be implemented. Table 2 shows the phases as they are planned. The precautionary principle implies that the wind farms should be limited in their size in the initial phase, but at the same time the preconditions for EEC funding must be fulfilled and the operation must be cost-effective and in the future even profitable.

7. Despite the different responsibilities for the licensing of wind energy plants within coastal waters and the EEZ, a constant exchange of experience between the federal level and the Länder is necessary for expanding the use of offshore wind energy.

Table 2: Gradual development of the use of offshore wind energy

Phases	Period	Potential Capacity	Potential Power Yield
1. Preparational Phase	2001 - 2003	-- MW	-- TWh p.a.
2. Initial Phase (first construction phases)	2003/4-2006	at least 500 MW	ca. 1,5 TWh p.a.
3. First Expansion Phase	2007-2010	2.000 - 3.000 MW	ca. 7 - 10 TWh p.a.
4. Additional Expansion Phases	2011-2030	20.000 - 25.000 MW	ca. 70 - 85 TWh p.a.

2.2 Competing forms of use of the resources in the EEZ

When planning to use offshore wind energy, it is important to take other issues such as navigation and aviation, environmental protection and nature conservation into consideration as well as commercial and military uses. Potential conflicts about the kind of utilization have to be solved.

For centuries, the sea has been commercially used for fishing purposes. The German EEZ is no different from the other EU Member States in that it is part of the Community fishing waters and all aspects of fishery are anchored and regulated in the Common Fisheries Policy, and thus the framework is set for this type of utilizing the area.

Furthermore, the mining for and extraction of mineral resources in the EEZ or the shelf area belong to the forms of utilization as recognised by international law. The mineral resources include oil and natural gas in particular, but also gravel and sand, the latter

a.o. for coastal defence purposes. There are existing specific licenses for certain quantities of the mineral resources in question.

3 Legal framework conditions for the swift development of the offshore wind energy potential

The amendments to § 38 of the Federal Nature Conservation Act and §§ 2a, 3, 3a, 5 para 1 of the Offshore Installations Ordinance that have been adopted in the meantime mean that the State Secretary Committee's commission to develop a strategy for a swift establishment of legal and planning security has been largely complied with:

The swift transposition of European legislation is going to be performed by identifying protection areas on the basis of the Habitats and the Bird Directives in accordance with § 38 of the Federal Nature Conservation Act. At the same time, it is necessary to implement the regulation on the identification of suitable areas for the use of wind energy in the EEZ in line with § 3a of the Offshore Installations Ordinance as requested by the German government.

3.1 Federal responsibilities in the EEZ

The above-mentioned provisions made in the context of the revision of the Federal Nature Conservation Act make the federal government responsible for the identification of protection areas and their management but also for the identification of especially suitable areas for wind farms. This is geared towards guaranteeing legal security for the expansion of the use of offshore wind energy.

It is necessary for a swift expansion of the use of wind energy to provide the federal government with responsibilities. If the responsibilities had instead been given to the 16 Länder, the identification of sites would have required considerable coordination and time. This would have meant a delay in the identification of protection areas and the

identification of areas that are especially suited for the use of wind energy. It would have made these processes difficult to such an extent that they would have jeopardized the German government's decision to swiftly expand the use of offshore wind energy.

3.2 Controlling and speeding up the processes and planning and investment security issues

The Federal Maritime and Hydrographic Agency of Germany (BSH) as the licensing authority had so far only been responsible for the evaluation of the suitability of a site on a case-by-case basis without having the possibility to give an early and binding statement on whether the site is suitable or not. This process demanded a lot of time and effort for applications for those sea areas of the EEZ which had not yet been thoroughly explored. The revisions of § 3a of the Offshore Installations Ordinance and § 38 of the Federal Nature Conservation Act established the possibility to control that process and facilitate the structural development and construction of wind farms in the EEZ and help to solve the conflicts in view of the different types of utilization by means of interministerial agreements. In this context, defence aspects which had not been covered explicitly in the previous version of § 3 of the Offshore Installations Ordinance will have to be added.

The provisions in § 3 of the Offshore Installations Ordinance are meant to enable a swift expansion of offshore wind farms in the EEZ by linking the identification studies for suitable sites with the studies for the identification of protection areas that are conducted in accordance with § 38 of the Federal Conservation Act. The current research projects shall provide information on the geographical position of potentially suitable sites together with other research projects that are being planned and already existing data without having to wait for the official designation of the protection areas. These findings should be updated on the basis of information being gained in the ongoing research projects.

Identifying suitable sites for offshore wind farms does not require a prior comprehensive exploration of the whole EEZ. According to §§ 38 of the Federal Nature Conservation Act and 3a of the Offshore Installation Ordinance, the studies first focus on those nearshore areas of the EEZ that are potential sites for wind farms which are projected to be developed by 2010. The second step foresees studies of potentially suitable areas that are further away from the shore and their identification. The ministries involved are responsible for working out the details of the process to identify the suitability of the site.
When areas are identified as especially suitable for the establishment of wind farms, the licensing process will also be simplified for all parties concerned as it will be assumed that all the reservations against the site for reasons of the protection of the marine environment, navigation security or the use of the air space or other forms of utilization have been dealt with before finally defining the area as suitable. Thus investment security is given. This does not have an influence on the requirements for conducting an environmental impact assessment.

3.3 Nature conservation - Protection of the marine environment

Environmental protection and nature conservation issues are covered by

- definitively excluding the establishment of wind farms in areas designated as protection areas pursuant to § 38 of the Federal Nature Conservation Act or as qualified and identified to become Natura 2000 areas in the future, as long as there are alternative low-impact areas that provide for sufficient commercial utilization (§ 6 paragraph 4 of the Habitats Directive in connection with § 3a (1) first sentence thereof of the Offshore Installations Ordinance).

- stipulating that the establishment of wind farms does not give reasons for refusal as specified in § 3 of the Offshore Installations Ordinance.

- guaranteeing that the identification of protected sea areas pursuant to § 38 para 2 and their designation as protected parts of nature and landscape serve to protect species and habitats in these areas under the provisions of § 34 (dealing with plans and projects) or other provisions of the respective regulation on the protection area (§ 38 para 3). In principle, these areas are not suitable for the construction of wind farms;
- by requiring an environmental impact assessment (EIA) pursuant to § 2a of the Offshore Installations Ordinance and
- by guaranteeing that the expansion of the use of offshore wind energy will be implemented in a step-by-step approach (see chapter 2.1 number 6).

3.4 Rules of procedure for opening "reserved" areas and for speeding up the licensing procedure

The amendments to § 5 para 1 of the Offshore Installations Ordinance have been made in order to solve the problems of preferential treatment of applications for licenses (a consequence of the first-come-first-served principle) and competing applications for the same site. The licensing procedure is now characterised mainly by how fast and goal-oriented the applicants themselves pursue it. It is not possible to provisionally reserve areas and block them from access by other applicants by simply submitting the application for a license at a very early stage.

These provisions provide the basis for pending application procedures to be swiftly processed in parallel to the identification of suitable areas.

3.5 Investment incentives to relieve the cost burden

The applicants still have to pay for the procedure themselves, but if the project is situated in an especially suitable area, the costs for the licensing procedure will decrease as data that was collected before for the identification of that area can be used. Usually no further investigations are necessary and this results to be the investment incentive with which the expansion of the use of offshore wind energy is promoted in line with the sustainability strategy of the German government.

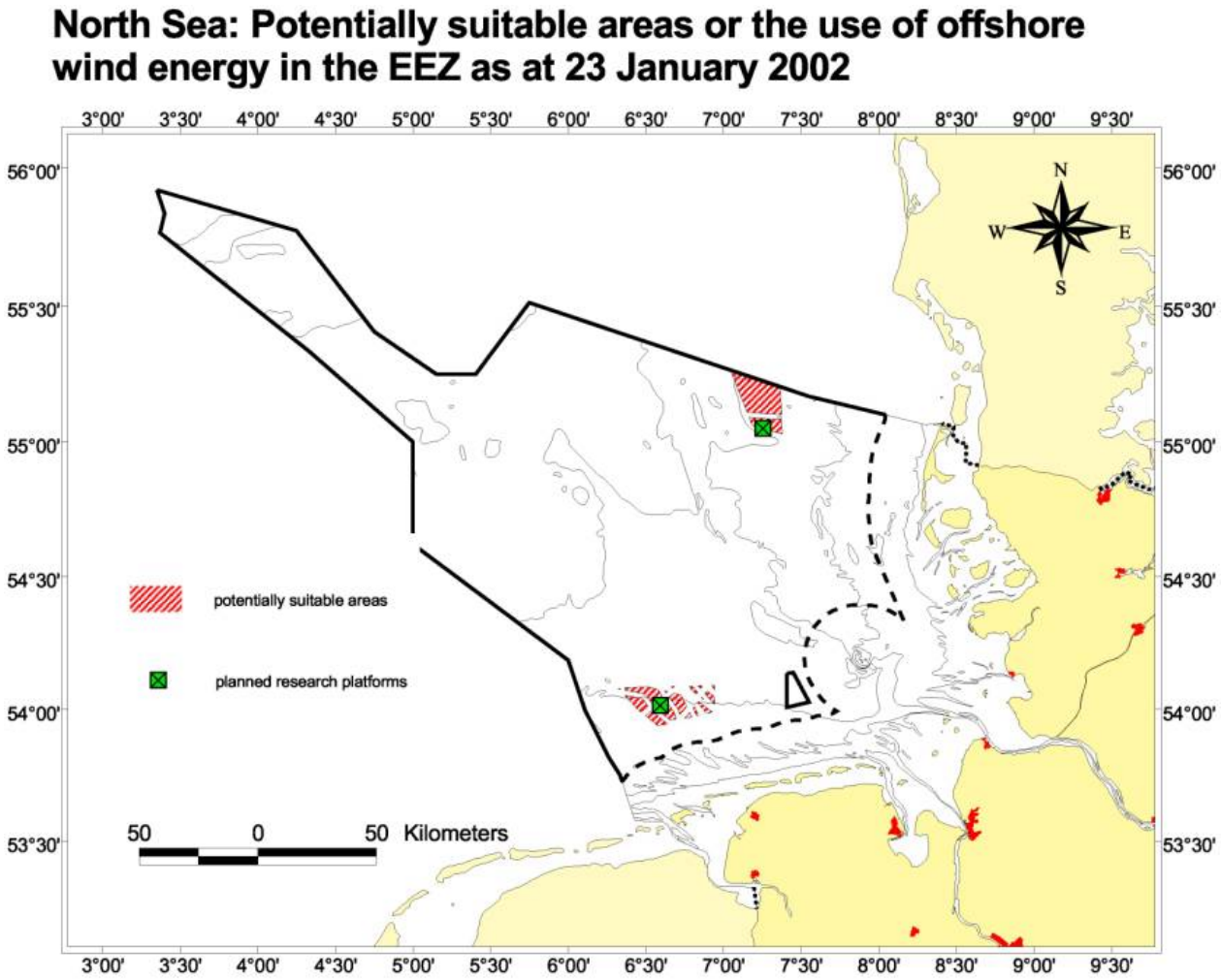
4 Identification of areas in the EEZ to be used for wind energy purposes

The revised article 3a of the Offshore Installations Ordinance stipulates the identification of especially suitable areas for the construction of wind farms. This does not exclude the possibility to grant licenses for specific projects in areas not listed as especially suitable areas.

4.1 Potentially suitable areas

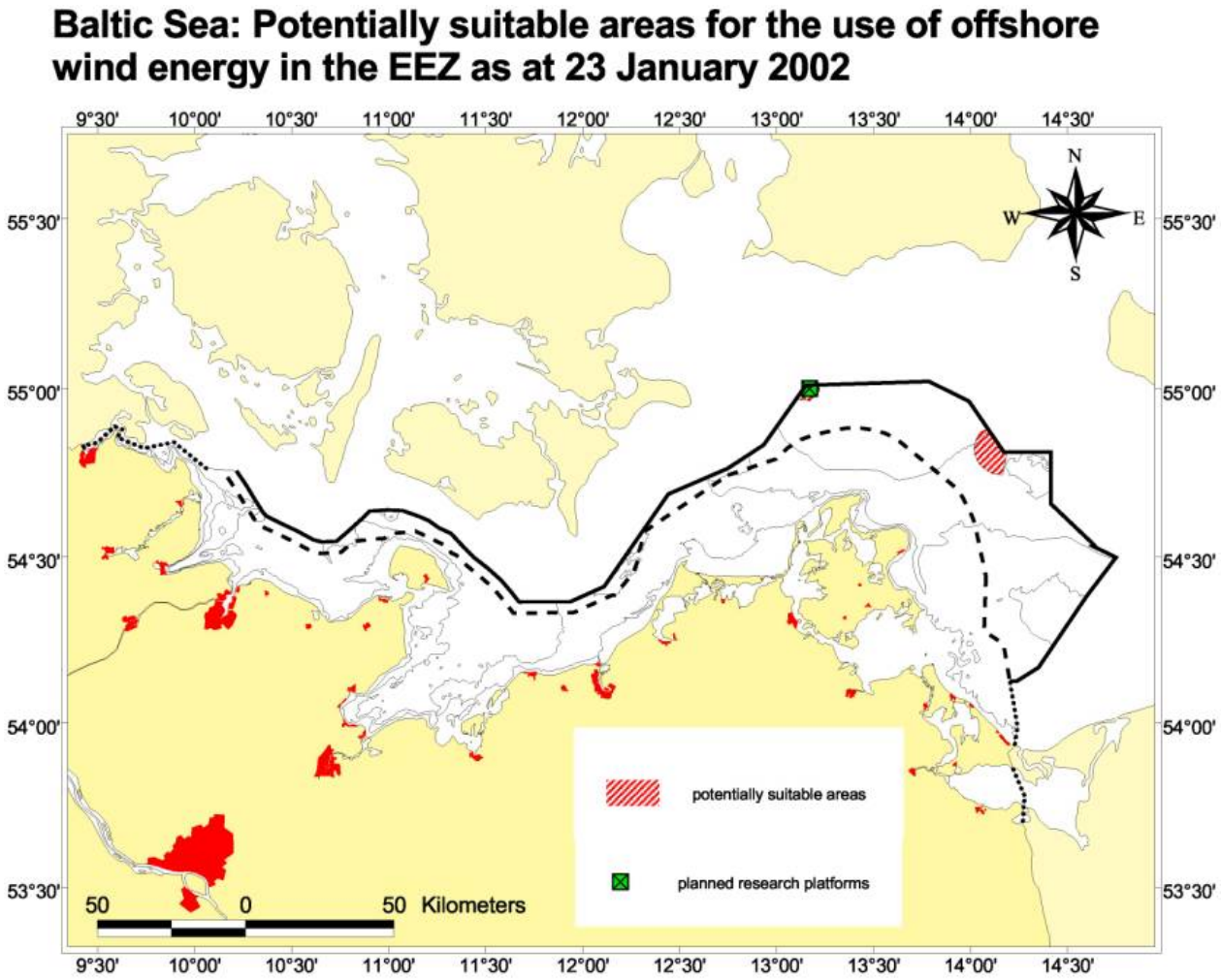
Potentially areas suitable for wind farms comprise areas that are being examined for their qualification as especially suitable areas as defined in § 3a of the Offshore Installations Ordinance on the basis of all the collected data and with the participation of the ministries concerned.

After coordinating the various forms of utilization of the resource and reaching an agreement on interministerial level, first low-conflict areas have been identified on the basis of the existing data. Under the present conditions they are deemed suitable for the initial phase and the first expansion phase of offshore wind farms in the EEZ (see maps below). The information collected in current and planned research projects (see chapter 5) should be fed continuously into the assessment process that determines whether the preconditions as mentioned in § 3 a para 1 third and fourth sentence of the Offshore Installations Ordinance are fulfilled.



Graph 4: North Sea: Potentially suitable areas for the use of offshore wind energy in the EEZ

The regions north of Borkum and west of Sylt cover an overall area of 510 km². On the basis of 5 to 10 MW installed power per km², this would amount to a total capacity of 2,550 MW up to 5,100 MW.



Graph 5:Baltic Sea: Potentially suitable areas for the use of wind energy in the EEZ

The regions north of Rügen (Kriegers Flak) and west of Adlergrund cover an overall area of 135 km². On the basis of 5 to 10 MW of installed power, this would amount to a total capacity of 675 MW to 1,350 MW. The compatibility of this type of use with military use must be established.

In the 12-sm zones of the North Sea and the Baltic Sea, nearshore wind farms are planned by the bordering countries. So far there are plans for about 200 MW of installed power in the Baltic Sea (Mecklenburg Bay and north of the Darss peninsula). The plans for the 12-sm zone of the North Sea have not made much progress.

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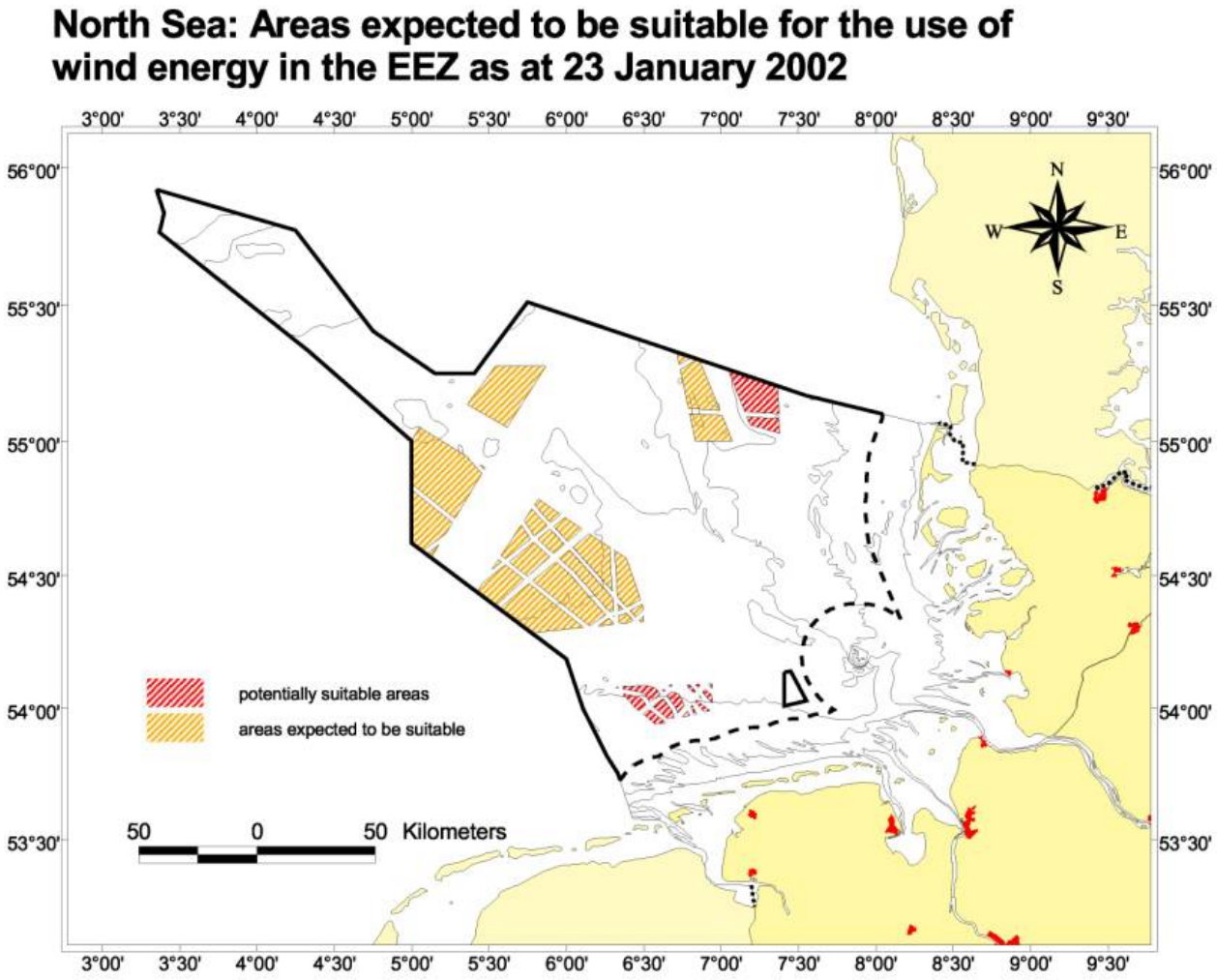
In the regions mentioned above (North Sea and Baltic Sea) a total capacity of 3,425 MW up to 6,650 MW can be reached by 2010 on the basis of the present conditions.

4.2 Areas expected to be suitable

In addition to the potentially suitable areas, the comparison of the different types of use indicated further low-conflict areas which can be categorised as being suitable in the medium or long run for the use of offshore wind energy under the premise that renewable energies should become competitive without subsidies. The implementation depends on when and if this type of use is technically and commercially feasible.

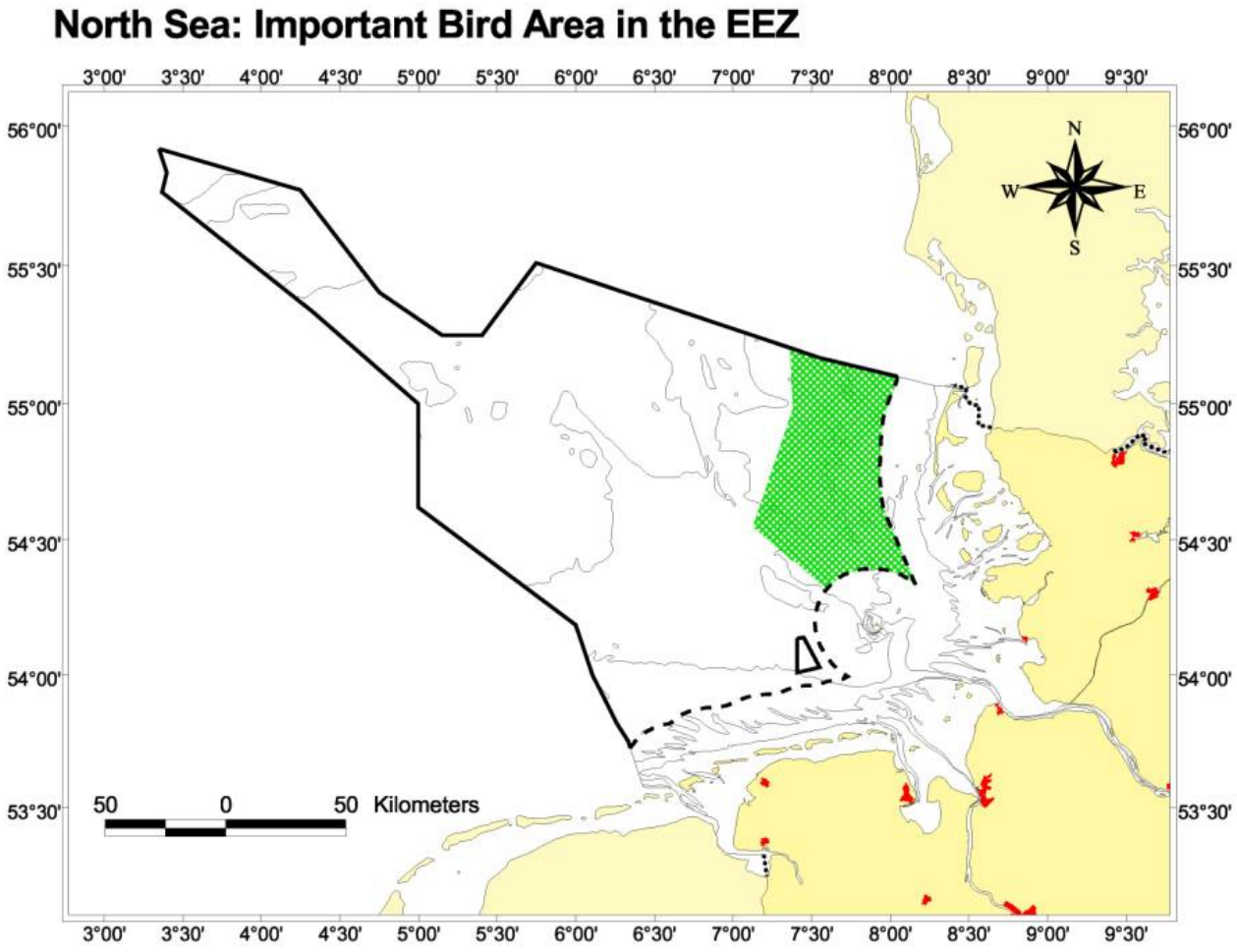
The regions in the EEZ of the North Sea that are expected to be suitable for the use of offshore wind energy by 2025/2030 cover an overall area of 3,574 km² (see graph over leaf). On the basis of 5 to 10 MW installed power per km², the total capacity would be 17,870 MW up to 35,740 MW on the basis of the present conditions.



Graph 6: North Sea: Areas expected to be suitable for the use of wind energy in the EEZ

4.3 Important Bird Areas

In principle, areas that are located within Important Bird Areas (IBA) do not qualify for the construction of wind farms. However, there is the possibility that an expert study of a particular site from a nature conservation perspective could find that this site is suitable and compatible with the requirements of the marine environment despite being situated in an IBA. Areas that have the status of a factual birds protection area cannot be used for the construction of wind farms if they have a significant impact on the objectives of Article 4 of the EU Bird Directive. Further guidelines are expected to emerge in the context of the efforts to identify protection areas according to § 38 of the Federal Nature Conservation Act.



Graph 7: North Sea: Important Bird Area

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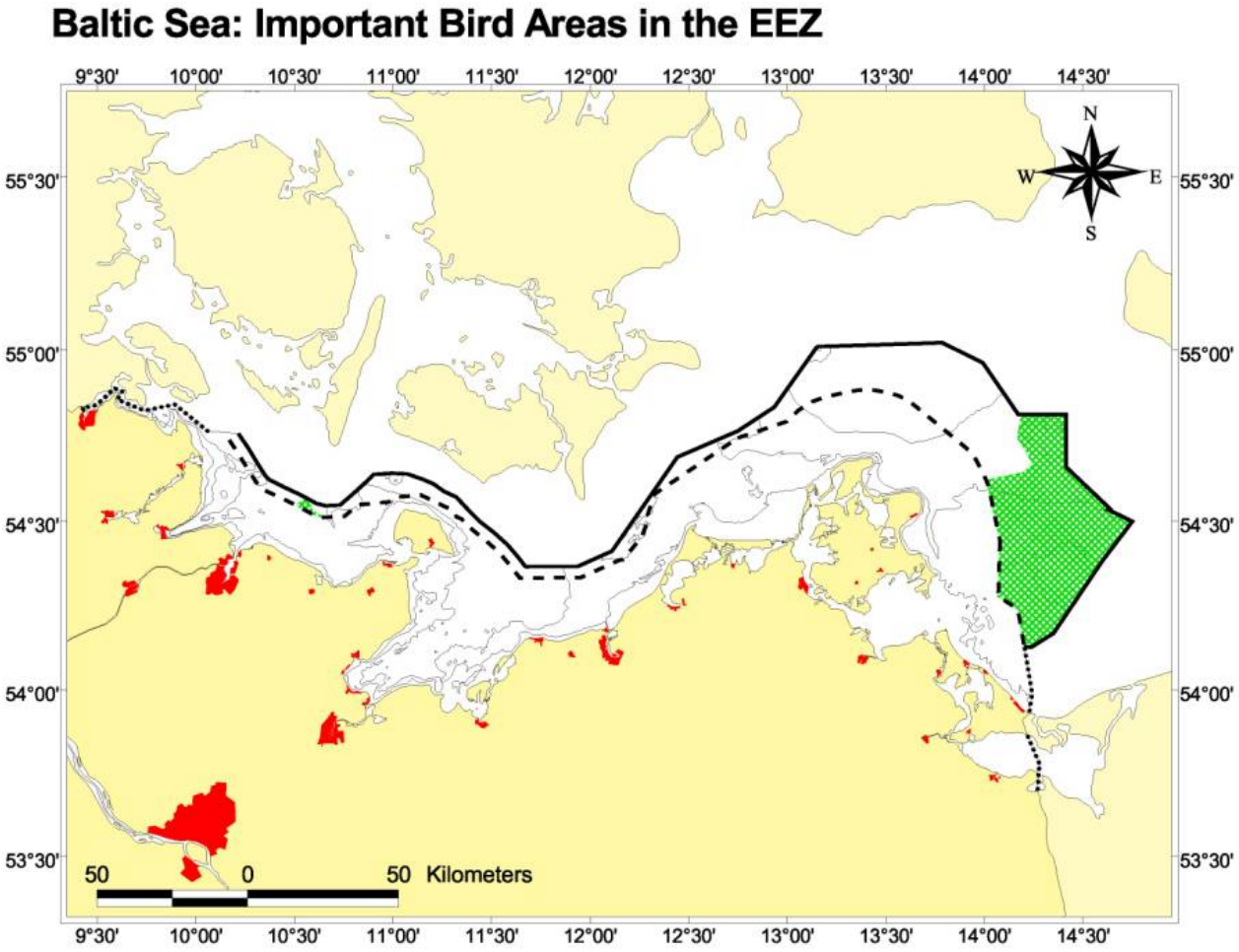

Graph 8: Baltic Sea: Important Bird Areas

5 Initiating research

In addition to a series of current research projects in the research programmes of the ministries, the German government's Investment Programme for the Future has initiated research and development of environmentally sound energy sources in the field of non-nuclear energy use (Federal Economics Ministry and Federal Environment Ministry) with a focus on using offshore wind energy.

5.1 Measuring platforms and testing fields (Federal Ministry of Economics and Technology)

After the interests of the competent authorities have been harmonised, three offshore research platforms will be erected in three potentially suitable areas in close vicinity to larger offshore wind farms that are planned and applied for at the Federal Maritime and Hydrographic Agency of Germany in the course of 2002: in the North Sea they will be located about 40 km of the island of Borkum and about 70 km west of the island of Sylt, in the Baltic Sea there will possibly be one about 40 km north of the island of Rügen (see maps in chapter 4).

The research platforms will be used for the following purposes:

- Measuring the wind force and turbulences and their dependencies on height, wave height, the sea current and the characteristics of seabed subsoil as commissioned by the Federal Economics Ministry;
- Measuring the density of maritime transport in the vicinity of the offshore research platforms as commissioned by the Federal Transport Ministry;
- Accompanying research on issues such as migration of birds, harbour porpoise population, benthic communities and on how to prevent the environmental impacts of a collision of ships as commissioned by the Federal Environment Ministry.

The German government's Investment Programme for the Future envisages a total of € 15.4 Million for 2001 to 2003 for the Federal Economics Ministry to use for the construction, erection and the operation of the three platforms, their measuring equipment, and the data transmission to the mainland via directional radio. Via its project leader, the Research Centre Jülich, the Economics Ministry commissioned Germanischer Lloyd in Hamburg to conduct the calls for tenders, to award the tender, to monitor the construction, to provide the measuring equipment and to operate the offshore research platforms. The radar equipment that is needed for measuring the density of maritime transport will be made available by the Federal Transport Ministry.

The findings are supposed to provide additional information and help to answer open questions concerning the development of wind turbines suited for offshore use and stable cost-effective foundations. Offshore wind turbines are being built for an installed power of up to 5 MW as compensation for the considerable increase in costs incurred by the need for a special type of foundation and the power transmission by sea cable. The tips of the rotor blades of these turbines will reach up to 160 m above sea level. The foundation reaching down to about 40 m have to fulfil the corresponding requirements.

5.2 Accompanying ecological research (Federal Environment Ministry)

The funds provided by the German government's Investment Programme for the Future for research projects of the Federal Environment Ministry of a total of about € 4.2 Million are granted to enable the authorities that are responsible for approval procedures to acquire scientific information that is necessary for assessing specific offshore wind energy projects and by expanding the use of offshore wind energy in an environmentally compatible way. At the same time they provide the technical information for the identification of protection areas in accordance with § 38 of the Federal Nature Conservation Act and the identification and updating of especially suitable areas in accordance with § 3 a of the Offshore Installations Ordinance.

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On the one hand, there will be studies on the migration of birds and bats and on the problems of acoustic emissions generated by offshore wind turbines. These will be complimented by research into the hearing abilities of small cetaceans and seals. Another aspect of the research projects is the simulation of ship collisions and the problems associated with the routing of the cables of wind farms from a legal perspective and in view of nature conservation. On the other hand, there will be large-scale surveys of the population of resting migratory birds and marine mammals. One project deals with the application of the EIA provisions in the EEZ and is designed to develop legal and technical tools for precautionary measures for environmental protection and planning in licensing procedures of offshore wind energy plants.

6 The future of the strategy

For further developing the strategy, the relevant provisions in view of controlling the use of offshore wind energy will be constantly examined. This means that e.g. the Offshore Installations Ordinance and the Federal Maritime Responsibilities Act will be swiftly amended to include defence aspects which are missing as yet.

The next step would be to address the issues concerning the integration of offshore wind farms into the power grid in collaboration with dena, the German Energy Agency, and positive concentration effects that the licensing might have. These involve in particular the following points:

1. construction and operation of offshore cables including the question of concentrated cable routing
2. connecting the offshore cable to the land cable
3. grid capacities on the mainland and energy transport issues

The spatial and structural development on the mainland have to be dealt with too. Once the suitable areas are identified, there will be a better basis for the planning.

Concentration effect:
The licensing for offshore wind farms does not have a concentration effect in the EEZ. Apart from the licenses for the construction that will be approved of by the Federal Maritime and Hydrographic Agency (BSH), further specific licenses are required for laying cables in the EEZ and the coastal waters. This causes a time delay and increases the administrative efforts. The procedure could be made more efficient and faster if the license for the construction of the offshore wind farms not only covered the construction itself and the cables but also any type of additional license for the construction and operation of the wind farms up to its connection to the mainland. This would also reduce the costs and offer the possibility to assess the total environmental impact of the project in a single process.

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7 Public relations / Events:

The strategy will be introduced to the public in a marketing campaign and discussed with different interested parties. The latest findings of the research project shall be continuously forwarded to the discussion process. Thus the introduction of offshore wind energy as part of the energy supply in Germany can be put on a sound basis and existing barriers overcome. Several events such as round table discussions, seminars or workshops will be conducted to enable a participation of the Länder concerned, the wind energy companies, utility companies, local communities, environmental organisations and other groups of society.

This is the calendar of some of the events that have been planned for this purpose:

- Presentation of the strategy (1st Quarter 2002)
- Hanover Fair (15 – 20 April 2002)
- Official inauguration of the first control platform (2002)
- 1. World Wind Conference (4 – 8 July 2002)
- „Earth Summit" Johannesburg (2 –11 September 2002)