Obstacles for Wind Energy Development due to EU Legislation

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Preface

The current report is part of Component 3: 'Legal and Economic obstacles' for the development of wind energy. The aim of the subtask has been to analyse the legal obstacles from various EU legislation and identifying best practice in navigating through the legal complex. The results of the work will be presented at a project workshop during 2012.

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Executive summary

The has been a growing interest for renewable energy during the last twenty years, and particularly after the more general recognition that energy production and consumption are the biggest contributor to the release of CO_2 into the atmosphere. This recognition was followed by the UN Framework Convention on Climate Change (UNFCCC), which was adopted at the 1992 World Conference on Environment and Development in Rio de Janeiro 1992. The UNFCCC convention entered into force March 1994 the countries are obliged to make greenhouse gas inventories, and to implement measures to mitigate global warming. The Kyoto Protocol of 1997 the countries committed themselves by individual targets and timetables until 2012 for the reduction of greenhouse gasses.

The European Union was the driving forces behind the Kyoto Protocol, and has also played major roles in the efforts to make a global agreement on greenhouse gas emissions after 2012, but referring back to the COP-15 meeting in Copenhagen 2009 with limited success. Nevertheless, the European Union still has focus on renewable energy and climate change mitigation, and several policies and legal frameworks promoting renewable have been adopted by the EU. Wind energy - as a proven technology - has gained an important position in the aims to limit the dominance of fossil fuels and hereby reducing CO_2 emissions to the atmosphere. The European Union has adopted several policies and legal frameworks for the promotion and support of wind energy. Nevertheless, many recent initiatives for new wind farms has experienced as well legal obstacles as opposition from the public.

The objectives of this report are to describe and assess the legal and similar obstacles for wind energy development in the Europe – and specifically the Southern Baltic Sea. First, we describe and analyse the general legal frameworks affecting wind farm development. Second, we focus on the obstacles for establishing wind turbines due to nature protection. Third, we deal with the special regulations having impact on offshore wind farm development. Fourth, we describe and analyse the special problem of noise from wind turbines, and how to deal with it. Fifth, analyse the obstacles due to the visual impact of large wind turbines. Sixth, we analyse the impact of various spatial planning policies in relation to wind farm development. The practical implementation of the EU legislation in relation to wind energy in Denmark is discussed serving as an inspiring platform for carrying out similar analyses in the other countries in the Southern Baltic Region. Finally, we conclude and give recommendation to handle the obstacles.

The general EU legislation with relevance for wind energy are the following: The Directive on Environmental Impact Assessment (EIA), the Directive on Strategic Environmental Assessment (SEA), and the so-called Aarhus Directive on Access to Environmental Information and Public participation. The aim of the EIA Directive is to define the legal framework for the assessment of the

environmental effects of public and private projects, which seems likely the have significant effects on the environment. The Directive distinguishes between projects, where an Environmental Impacts Assessment is mandatory, and projects where the national authorities decide on the need for an EIA after a screening procedure. However, today's large wind energy installations in practice always require Environmental Impact Assessment. Environmental Impacts Assessment is a systematic process to identify, predict and evaluate the environmental effects of proposed actions and projects. The process is rather comprehensive, lengthy and costly, and is one of major tasks in applying for approval of a new wind energy installation. Strategic Environmental Assessment refers to the environmental assessment of policies, plans and programmes, and the concept has developed from the practise of environmental impact assessment. The aim of strategic environmental assessment is to provide decision makers and stakeholders with timely an relevant information on the potential environmental impacts of policies, plans and programmes in order to make necessary changes to make them environmentally more sound. Normally wind energy projects are out of scope for SEA, but for very large projects like the Krieger's Flak in the Southern Baltic may require a Strategic Environmental Assessment.

Although wind energy is generally considered environmentally sound, poorly sited or designed wind farms may have some negative impacts on nature and wildlife. The Birds Directive and the Habitats Directive build together the EU legal frameworks for protecting nature and wild life. Most negative effects on nature and wild life can be eliminated or minimised by avoiding sites with sensitive habitats, and good site location will also help developers avoiding costly investments in inappropriate sites. Accordingly spatial planning – not at least at the regional level covering larger geographical areas – is crucial for successful wind energy planning from a nature conservation point of view.

Locating offshore wind farms has in principle the double advantage of higher and more reliable wind speeds at sea and avoiding conflicts with other land-uses onshore. However, even at sea there are legal obstacles, which must be addressed. The Birds and Habitats Directives also covers the sea areas, but besides the developer have new obstacles mainly due to ship traffic, but also extraction of raw materials like oil and gas. The UNCLOS convention divides the seas and oceans into several zones with different rights and obligations for the coastal states. It is recognised that the States have sovereignty over their territorial sea extending 12 nautical miles from the coastline. The costal State may also exercise sovereign rights over the Exclusive Economic Zone, which extends 200 nautical miles beyond the territorial sea. These rights include exploring, exploiting, conserving and managing the natural resources - whether living or non-living, including energy production form water, wind, and currents. New navigational risks may be introduced by establishing offshore wind farms, and they can be divided into the following four groups: a) Risk of a ship colliding with or contacting a wind turbine or wind farm structure; b) Risk of ship to ship collision resulting from change in navigation to avoid the wind farm area; c) Grounding risks; d) Possible

secondary risks resulting from effects of the wind farm on for example radar operations. The IMO (International Maritime Organisation) has developed a risk assessment process – often referred to as FSA - Formal Safety Assessment. Formal Safety Assessment is a structured and systematic methodology, aimed at enhancing maritime safety, including protection of life, health, the marine environment and property, by using risk analysis and cost benefit assessment. Ship traffic data can be obtained from the Automatic Identification System, which is an automatic system to exchange information between ships, and between ships and land-based stations. A ship equipped with AIS continuously transmits information regarding its name, location, destination, speed and course. Data from AIS are important information for identifying potential conflicts between the coastal state's plans for new offshore wind farms, and the interest for ship traffic – including safety at sea.

The noise component from wind turbines primarily comes from the rotating blades, which speed at the blade tip approaches the speed of sound with 340 km/hr. for a 90-metre blade diameter. Therefore the aerodynamic noise from a large wind turbine can be rather significant. The European Parliament and Council adopted in 2002 the so-called Noise Directive aiming at defining common approaches to avoid, prevent or reduce the harmful effects due to environmental noise. Wind turbines are becoming larger and larger, and accordingly with significant visual effects on the landscape. Although, there is no EU legislation regulation on the various visual impacts from wind energy, it is a severe obstacle for new wind farms. Most often the various visual will be handled as part of an Environmental Impact Assessment.

There is no EU regulation regarding spatial planning but several initiatives – for example the Recommendation on Integrated Coastal Zone Management – are important for the development of wind energy in the coastal zone.

A crucial premise for successful wind energy development is transparency and confidence between the various stakeholders – from developers over authorities to citizens. This is the obvious lesson learnt from several wind energy projects during the last 10 years.

Inform and involve the public as early in the process as possible. Resistance from the general public is the most important obstacle for new wind energy plants, and the citizens have great power through the Environmental Impact Assessment process – and indirectly through the authorities and politicians. Therefore make an information campaign to the local people, and describe the aim of the project in not too technical terms. Remember not to hide anything for the citizens or local authorities. The confidence will be lost, if some critical information are revealed at a later stage. Create contact with NGO's, which can be valuable in the approval process by getting support instead of resistance.

Collect all data relevant for the project – and particular for the Environmental Impact Assessment. It can be a time consuming and costly process, but compared with the huge costs to establish a new large wind farm these costs are of minor importance. Acquire all the data needed for defining areas suitable for the new installation, get all data for identifying legal obstacles, and combine all the information within a geographic information system. Hereby the developer can choose between a limited number of locations, which fulfils as well the physical foundations (e.g. wind potential and geological conditions), as the rules defined by the various legislation and spatial planning. Having potential alternatives strengthens the developer in the negotiations with the authorities, which quite often have positive attitudes to new bigger construction works in their own municipality – because this create jobs, although sometimes only for a limited number of years.

Following these two recommendations, which can be seen as supporting each other, the developer cannot be sure of success, but at least be well prepared for the approval stage, which is one of the most challenging obstacles for establishing new wind energy installations.

1 Introduction

Renewable energy has been on the political agenda in Europe since the first so-called oil crises in the early seventies, and at that time the main focus was on being independent of oil import from the developing countries. Although NGO's like Greenpeace emphasised the importance of reducing pollution, that aspect had minor importance until the early nineties were it was generally recognised that energy production and consumption are the biggest contributor to the release of CO_2 into the atmosphere. This recognition was followed by the UN Framework Convention on Climate Change (UNFCCC), which was adopted at the 1992 World Conference on Environment and Development in Rio de Janeiro 1992. The UNFCCC convention entered into force March 1994 and according to Article 4 the countries are obliged to make greenhouse gas inventories, and to implement measures to mitigate global warming (http://unfccc.int/2860.php). However, the UNFCCC was a legislative framework without explicit reduction commitments.

The Kyoto Protocol of 1997 changed that situation. The developed countries committed themselves by individual targets and timetables until 2012 for the reduction of greenhouse gasses as given in the Annex 1 of the protocol. The main problem with the Kyoto Protocol is that some of the biggest contributors to greenhouse gas emissions – USA and Australia – are not participating. Besides, there is no agreement how to continue after 2012.

The European Union was the driving forces behind the Kyoto Protocol, and has also played major roles in the efforts to make a global agreement on greenhouse gas emissions after 2012, but referring back to the COP-15 meeting in Copenhagen December 2009 with limited success. Nevertheless, the European Union still has focus on renewable energy and climate change mitigation, and several policies and legal frameworks promoting renewable have been adopted by the EU.

A major step forward was European Council decision of March 2007, where the Council committed itself to a binding European wide target on a 20% reduction in greenhouse gas emissions by 2020 compared with 1990 (Council of the European Union, 2007). This decision was followed by the Renewable Energy Directive (European Commission, 2009 b), which sets ambitious targets for all Member States. Thus the European Union will reach a 20% share of energy from renewable sources by 2020 and a 10% share of renewable energy specifically in the transport sector. Wind energy is one of the most promising renewable energy technologies, and is an area in which there have already been many developments and improvements to make electricity generation more effective. Between 1995 and 2005, cumulative wind power capacity in the EU increased by an average of 32% per year.

Besides, the Directive 2001/77/EC of September 2001 on promotion of electricity produced from renewable energy sources (European Commission,

2001) has had significant impact on promoting wind energy – as well as other renewable energies in the European Union. According to this Directive the Member States are obliged to encourage production and consumption of renewable energy. Besides the Member States are required to ensure that the origin of electricity produced from renewable energy sources can be guaranteed in response to a request according to Article 5. Thus the citizens and enterprises can choose 'green' electricity, and be sure that the electricity is 'real green'.

1.3 The Objectives

Wind energy - as a proven technology - has gained an important position in the aims to limit the dominance of fossil fuels and hereby reducing CO_2 emissions to the atmosphere, and as described above there are many good reason for increasing the production of wind energy as well due the mitigating global warming as reducing import of fossil energy form politically unstable regions of the world. In addition the European Union has adopted several policies and legal frameworks for the promotion and support of wind energy. Nevertheless, many recent initiatives for new wind farms has experienced as well legal obstacles as opposition from the public – although there is a general agreement on the positive contributions from wind energy in reaching the goals of a sustainable world.

The objectives of this report are to describe and assess the legal and similar obstacles for wind energy development in the Europe – and specifically the Southern Baltic Sea. First, we describe and analyse the general legal frameworks affecting wind farm development. Second, we focus on the obstacles for establishing wind turbines due to nature protection. Third, we deal with the special regulations having impact on offshore wind farm development. Fourth, we describe and analyse the special problem of noise from wind turbines, and how to deal with it. Fifth, analyse the obstacles due to the visual impact of large wind turbines. Sixth, we analyse the impact of various spatial planning policies in relation to wind farm development. The practical implementation of the EU legislation in relation to wind energy in Denmark is discussed serving as an inspiring platform for carrying out similar analyses in the other countries in the Southern Baltic Region. Finally, we conclude and give recommendation to handle the obstacles.

2 General legal frameworks

The EU Law combines several types of legal sources. Basically, there is a distinction between the EU Treaties (often called primary sources), and the regulations, directives, decisions etc. (often called the secondary sources). The regulations have a direct effect on the national legislation and apply fully in the Member States. This means that they do not need to be transposed into national legislation but confer rights and duties on the EU citizens directly similar to the national legislation. Besides Regulations the Directives is an important instrument in the EU legislation. The aim of the Directives is to harmonise the national legislation in the Member States. A Directive is binding for the Member States regarding achievement of the objectives defined in the Directive, but the Member States has to decide on how to implement the Directive in their national legal systems. However, the Court of Justice has defined the practice that each individual in the EU can rely on the contents of the Directives, and the Member States can be liable for damages for not implementing a Directive (Anker at al., 2008). Especially the Directives have major impact for the development of wind energy.

Environmental assessment is a procedure that ensures that the environmental implications of decisions are taken into account before the decisions are made. Environmental assessment can be undertaken for individual projects, such as a dam, motorway, airport or factory, on the basis of Directive 85/337/EEC – the EIA Directive (Environmental Impact Assessment), or for public plans or programmes on the basis of Directive 2001/42/EC – the SEA Directive (Strategic Environmental Assessment). The overall aim of both Directives is to ensure that plans, programmes and projects likely to have significant effects on the environment are considered for environmental assessment, prior to their approval and implementation. According to the Arhus Convention public consultation is a key feature of both directives (UNECE, 1998).

2.1 Environmental Impact Assessment

Directive on Environmental Impact Assessment (the EIA Directive) has been in force since 1985 and is one of the main legal instruments for protecting nature and environment. The EIA Directive has been amended in 1997, 2003 and 2009. Particularly the amendments from 2003 are important for wind energy projects, because these amendments brought the EIA Directive in accordance with the UNECE Aarhus Convention (UNECE, 1998) regarding public participation and access to information on environmental matters.

The aim of the Directive is to define the legal framework for the assessment of the environmental effects of public and private projects, which seems likely the have significant effects on the environment. The Directive distinguishes between projects, where an Environmental Impacts Assessment is mandatory, and projects where the national authorities decide on the need for an EIA after a screening

procedure. Annex 1 of the EIA Directive lists all the projects where an EIA procedure is mandatory. This list includes big industrial plants (e.g. oil refineries), chemical installations, railways, motorways, waste disposal installations, huge farms, pipelines, and opencast mining. Annex two mentions many projects similar to the Annex-1 projects but typically at a smaller scale. Annex 1 also mentions 'Installations for harnessing of wind power for energy production (wind farms)'. Thus the need of environmental impact assessment has to be decided by the national authorities.

Environmental Impacts Assessment (EIA) is a systematic process to identify, predict and evaluate the environmental effects of proposed actions and projects. The first step relates to the proposed project design: A description of the project, a general description of the fixed physical characteristics, operational characteristics and all kind of emissions. The second step is related to the possible alternatives regarding location, product design, project design and operational characteristics. The third step deals with a description of the baseline environmental criteria encompassing, present land-use, population density and structure, the flora and fauna, the surface and ground water quality, soil quality, landscape, air quality and climate, the built environment, and other relevant features.

Many Member States have implemented the Directive in the wind energy sector by defining rules for the need of an environmental impact assessment, and guidelines for carrying out the EIA – if needed. Figure 1 illustrates the various step in environmental impact assessment in Denmark, but the other member States have developed similar principles and guidelines concerning the assessment of new wind energy plants. The guidelines demonstrate that the EIA process may be a costly and time-consuming process.

2.2 Strategic Environmental Assessment

Strategic Environmental Assessment (SEA) refers to the environmental assessment of policies, plans and programmes, and the concept has developed from the practise of environmental impact assessment. The aim of strategic environmental assessment is to provide decision makers and stakeholders with timely an relevant information on the potential environmental impacts of policies, plans and programmes in order to make necessary changes to make them environmentally more sound.

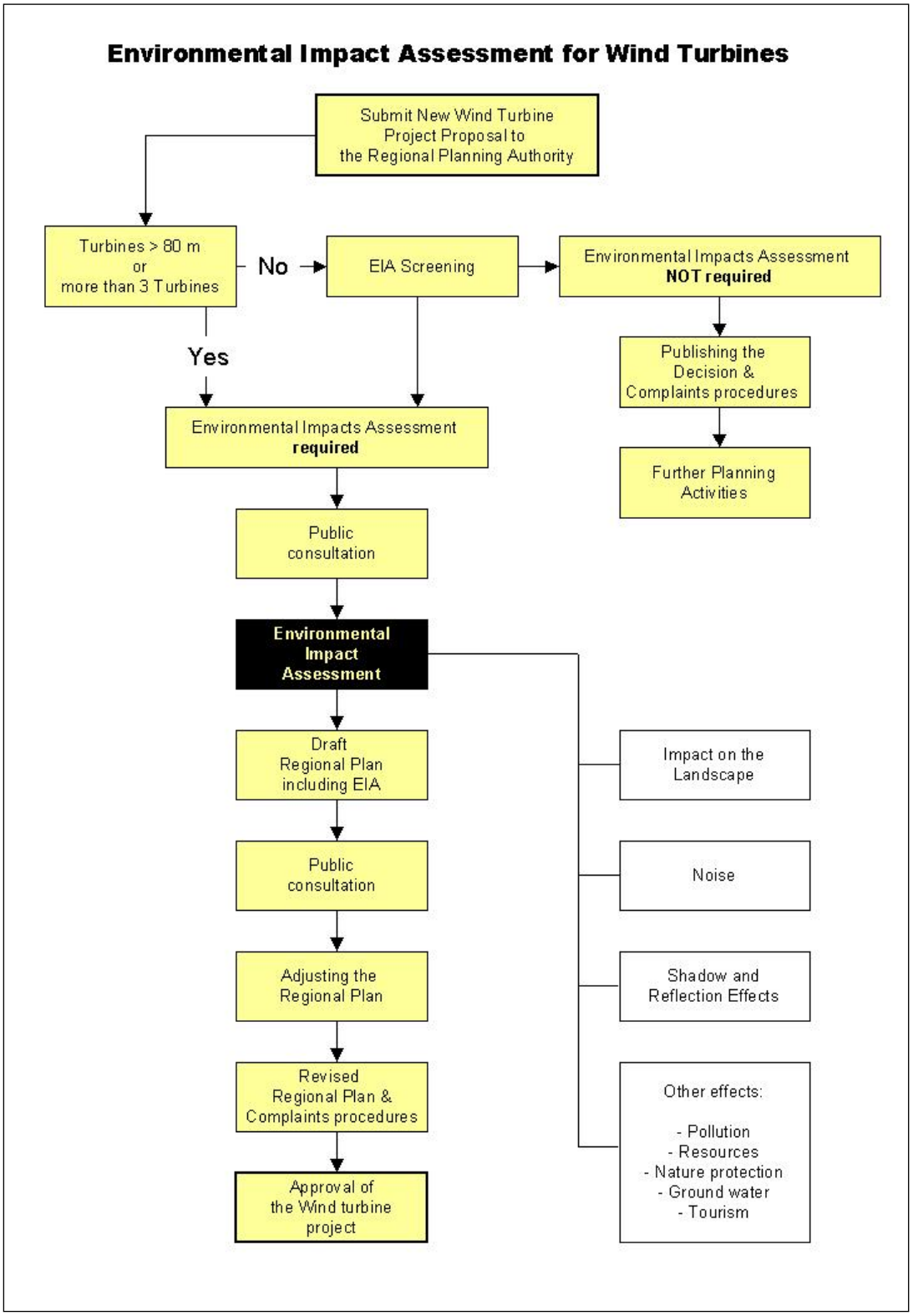

Figure 1. EIA – step by step (The Danish approach).

The EIA and SEA are rather similar in many respects, but there are some differences. The SEA process focuses purely on the assessment of plans or programmes, where as the EIA process focuses on individual development projects. SEA is area wide (e.g. covers geographical areas like regions, whereas EIA is generally site specific (e.g. applies to sites of a specific development project and their neighbourhoods. Strategic environmental assessments are desk based assessment based on existing available information, whereas environmental impact assessments involve a range of assessment methods including site visits, monitoring and modelling.

The Directive on Strategic Environmental Assessment (the SEA Directive) has been in force since 2001, and should have been transposed into EU and national legislation since July 2004 (European Commission, 2001). A strategic environmental assessment is mandatory for policies, plans, and programmes regarding agriculture, fishery, forestry, energy, industry, transport, waste and water management, telecommunications, regional and urban planning, and land-use. Besides a strategic environmental assessment is mandatory if it is requires according to the habitat directive (European Commission, 1992). For plans and programmes not mentioned above, the Member States must carry out a screening procedure to determine whether the plans and programmes are likely to have significant effect on the environment. If there are significant effects, an SEA is needed. The screening procedure is based on criteria set out in Annex II of the SEA Directive.

2.3 Public participation and access to justice

Rights to be informed about new developments, which may affect the citizens or the environment, and rights to be involved in the decision-making process set limitations for the public authorities to act with public participation. Public participation on environmental planning issues has its roots back in the late 1960s and early 1970s, where the authorities produced brochures and posters and arranged meetings to really involve the citizens. Until the 1990s public participation continued in the same manner. The United Nations Conference on Environment and Development (Earth Summit) in Rio de Janeiro in 1992, Principle 10 (United Nations, 1992a) and Agenda 21 (United Nations, 1992b) both called for increased public participation in environmental decision-making and led to the adoption in Europe of the Aarhus Convention (UN ECE, 1998). This development is further facilitated by the appearance of "symbolic politics" and growing popularity and acceptance of non-governmental organisations like Greenpeace and World Wildlife Fund.

The Aarhus Convention extends several EU Directives – particularly the Directive 2003/4/EC on access to environmental information. The Environmental Impact Assessment Directive, and Strategic Environmental Assessment Directive (Anker et al., 2008). Following the Aarhus Convention Article 2, the public in general must have access to environmental information, whereas the directly

affected public must be allowed to participate in the decision process. Also NGO's promoting environmental protection should be included in this group. Regarding public participation, the Arhus Convention distinguishes between: a) participation related to specific plans - Article 6; b) participation related to plans, programmes and policies – Article 7.

Access to justice concerns the right of citizens or NGO's to require a legal review of a public decision by an independent court. The Aarhus Convention Article 9 obliges authorities to ensure that private persons and public authorities having access to administrative or judicial procedures to challenge acts, which are in conflict with laws relation to the environment.

3 Wind turbines and Nature Conservation

Although wind energy is generally considered environmentally sound poorly sited or designed wind farms may have some negative impacts on nature and wildlife. The European Commission (2010) has made a list of potential negative effects of wind farm development:

- Collision risk – mainly birds and bats
- Disturbance – can lead to displacement or even exclusion, and accordingly habitat loss
- Barrier effect – large wind farms with many turbines may force birds and mammals to change direction during foraging and migration activities
- Habitat loss and degradation – whilst the actual land take due to wind farm development may be rather limited the effects may cover a larger area.

Below follows a presentation of the various EU and international legislation aiming protecting nature by avoiding the negative effects of wind farm development.

3.1 EU legislation on nature protection

The Birds Directive (European Commission, 2009 a) and Habitats Directive (European Commission, 1992) build the foundation of the EU biodiversity policy. The Birds and Habitats Directives enable the EU Member States to work together within a common legal framework in protecting species in their own right across the EU and to conserve the core areas for some rare and endangered species through the establishment of the Natura 2000 Network.

The Birds Directive is the oldest nature legislation in EU with the original Directive from 1979. The aim of the Birds Directive is to protect the habits of endangered and migratory species by establishing a network of Special Protection Areas, which is part of the Natura 2000 network.

According to article 5 of the Birds Directive (European Commission, 2009 a) the Member States should prohibit activities that directly threatens birds like:

- Deliberate killing or capture by any methods
- Deliberate destruction of, or damage to, their nests and eggs or removal of their nests
- Taking their eggs in the wild and keeping of eggs
- *Deliberate disturbance of these birds particularly during the period of breeding and rearing as far as this would have a negative effect on the birds*
- Keeping the birds in captivity and their sale.

Particularly, the item in italic can be an obstacle for wind farm development.

The Habitats Directive is the other fundamental legal framework for protecting nature within the European Union. The aim of the Habitat Directive is the protection of biodiversity in the European territory through the conservation of natural habitats and of wild flora and fauna.

Following article 12 and 13 of the Habitats Directive the Members States are obliged to take requisite measures to protect the species listed in Annex IV of the Directive by prohibiting

- Deliberate killing or capture of protected animals by any method
- Deliberate disturbance of protected animals, particularly during breeding, rearing, hibernation and migration
- Deliberation destruction or taking of eggs in the wild from protected animals
- Deterioration or destruction of breeding sites or resting places for protected animals
- Deliberate picking, collecting, cutting, uprooting or destruction of protected plants in the wild
- Keeping, sale and transport of specimens – protected animals or plants - from the wild

Deviations from the general protection rules are allowed in some circumstances. The conditions for deviations are defined in Article 9 of the Birds Directive, and regarding wind farm development it is primarily item a) 'in the interest of public health and safety'. The principles of having deviations from the general rules in the Habitat Directive are stated in Article 16, and for wind energy development it is primarily item 1c on 'other imperative reasons of public interest', which can be applied.

The Birds Directive and the Habitats Directive also require protection of key sites for certain species and habitat types listed in the respective annexes, and these sites form the Natura 2000 Network. Currently, the Natura 2000 areas cover about 17.5% of the EU land area with significant additional marine areas (European Commission, 2011).

According to Article 6.1 of the Habitat Directive, the Member States shall establish the necessary conservation measures involving appropriate management plans, and avoid the deterioration of natural habitats in the Natura 2000 areas if such disturbance could be significant in relation to the objectives of the Habitat Directive Article 6.2. However, regarding Wind Farm development the articles 6.3 and 6.4 are even more critical. Following Article 6.3 any new plan or project likely to have significant effect on a Natura 2000 site shall be subject to what is termed and Appropriate Assessment. Based on the conclusion of the Appropriate Assessment Article 6.4 of the Habitat Directive comes into play. If the assessment is negative, the project may only be allowed for imperative reasons due to public

economic and social interests. However this requires compensatory measures ensuring the overall coherence of the Natura 2000 Network.

The European Environment Agency has developed a Web-based Natura 2000 Viewer, which can be used to support the planner in identifying possible conflicts with Natura 2000 areas. The viewer is available from http://natura2000.eea.europa.eu, and figure 2 below shows an example view from the area between Gedser and Rostock.

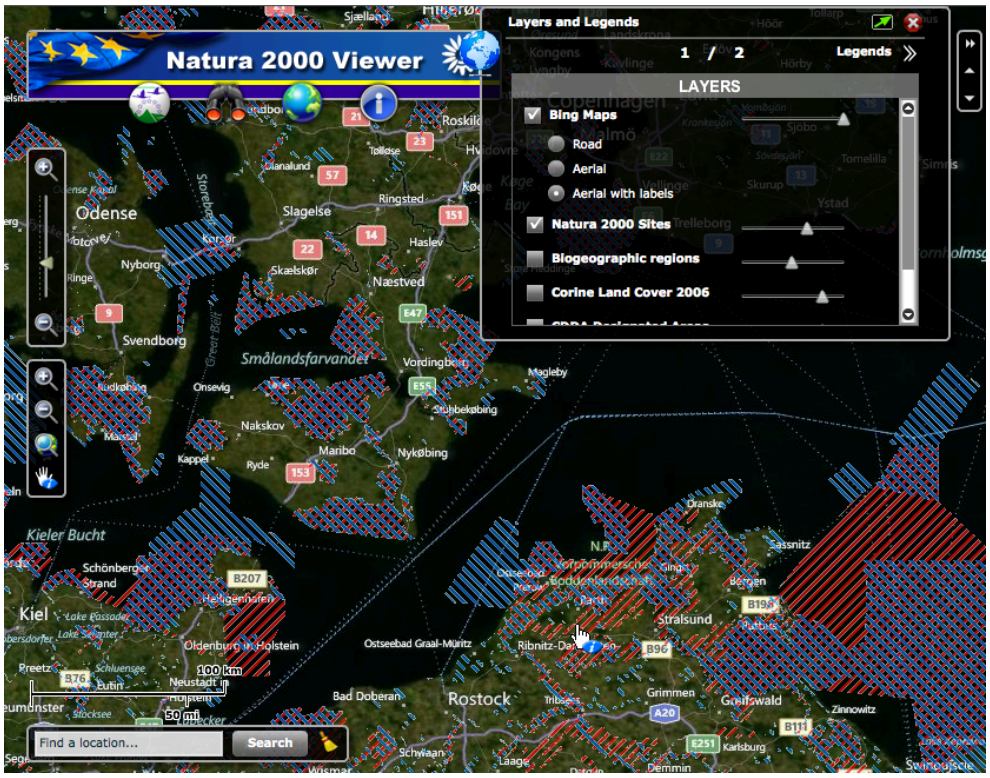

Fig. 2. The Natura 2000 Viewer.

3.2 International legislation on nature protection

Besides the EU legislation for the conservation and protection of the nature and biodiversity several international conventions and agreements regarding nature and biodiversity have effect for the EU and its Member States.

The Convention on Biological Diversity (www.cbd.int) is a global treaty adopted at the World Summit in Rio de Janeiro in 1992. The convention has three major objectives: 1) Conservation of the biological diversity, 2) The sustainable use of the components of biological diversity, and 3) The fir and equitable sharing of the benefits arising out of the utilisation of generic resources.

The Ramsar Convention on Wetlands of International Importance (www.ramsar.org) is an intergovernmental treaty adopted in 1971 and amended in 1982 and 1988. The Ramsar Convention provides a framework for national action and international cooperation aiming at the conservation and wise use of wetlands and their resources.

The HELCOM Convention on the protection of the marine environment of the Baltic Sea Area (www.helcom.fi) was adopted in 1980 and revised in 1992. The convention covers the Baltic Sea plus all inland waters of its catchment area. The principles of the HELCOM Convention can be outlined as follows:

- Responsibility - In order to restore the ecosystem of the Baltic Sea area and preserve its ecological balance the Contracting Parties shall individually or jointly take all appropriate legislative, administrative or other measures to prevent and eliminate pollution.
- The precautionary principle - Preventive measures must be taken whenever there are reasonable grounds to believe that substances or energy directly or indirectly introduced into the marine environment might harm human health, living resources or marine ecosystems, or damage amenities or interfere with other legitimate uses of the sea.
- Best Environmental Practices and Best Available Technologies will be promoted by the Contracting Parties to prevent the pollution of the Baltic Sea.
- Additional measures shall be taken if the consequent reductions of inputs do not lead to acceptable results.
- The "polluter pays" principle should serve as the economic basis for the control of environmentally harmful activities, emphasising the importance of responsibility by forcing polluters to pay for the true costs of their activities.
- Monitoring - Emissions from both point sources and diffuse sources into water and the air should be measured and calculated in a scientifically appropriate manner by the Contracting Parties.
- Avoiding risks - Implementing the Helsinki Convention should neither result in trans-boundary pollution affecting regions outside the Baltic Sea area, nor involve increases or changes in waste disposal or other activities that could increase health risks. Any measures taken must not lead to unacceptable environmental strains on the atmosphere, soils, water bodies or groundwater.

The Bern Convention on the Conservation of European Wildlife and Natural Habitats entered into force in 1982, and 45 Member Sates of the Council of Europe have signed the treaty. Regarding wind farms the Bern Convention adopted a recommendation on the effects on migratory species of mammal and birds in 2002 (Council of Europe, 2003). Location is considered critically important to avoid deleterious impacts of wind farms on birds, and there should be

precautionary avoidance of location wind farms in statutorily designated areas like Natura 2000, Ramsar sites and similar protected areas.

3.3 Strategies to mitigate the negative effects of wind farm development

The European Commission (2010) has developed a Guidance Document how best to ensure that wind energy developments are compliant with the provisions of the Habitats and Birds Directives.

The Guidance Document (European Commission, 2010) emphasises the use of strategic planning, marine spatial planning, and suitability analysis. Wind power does not have to threaten wildlife but appropriate siting is critical and must be a first goal of the planning development process from a conservation perspective.

Most negative effects can be eliminated or minimised by avoiding sites with sensitive habitats, and good site location will also help developers avoiding costly investments in inappropriate sites. Accordingly spatial planning – not at least at the regional level covering larger geographical areas – is crucial for successful wind energy planning from a nature conservation point of view. Spatial planning also provides a means to explore various alternatives and involve the public early in the decision-making process. Besides the focus is not just wind energy - but a more holistic approach dealing with the future land-use in the region.

Until recently spatial planning has focused on the terrestrial side, and nearly ignoring the marine – besides some efforts aiming at integrated coastal zone management as recommended by the EU (ICZM REF) incorporating the near shore part of the marine environment. Today with competing use of the marine area through fishery, aquaculture, marine transport offshore energy production and leisure activities we can introduce the term sea-use in parallel to land-use. According we must introduce marine spatial planning.

Suitability analysis aiming at finding the optimum location for new wind energy farms is a fundamental input to the spatial planning process. The suitability analysis is carried out by combining several map layers describing the various factors relevant for allocating land for wind energy in a Geographical Information System – GIS (Hansen, 2005). According to the European Environment Agency (2009) the European Union has huge wind energy potential, but it varies across the European territory due to variations in meteorological and topographic conditions. The wind resource map is off-course the most important input to the suitability analysis, and generally the highest wind energy potential is in North Western Europe (se fig. 3).

As mentioned above the Natura 2000 areas occupies about 17% of the EU land territory, but even excluding all these areas from being sites for new wind farms, this would have only a limited impact on using the wind energy potential - a

decrease of only about 14% of onshore technical potential is expected European Environment Agency (2009).

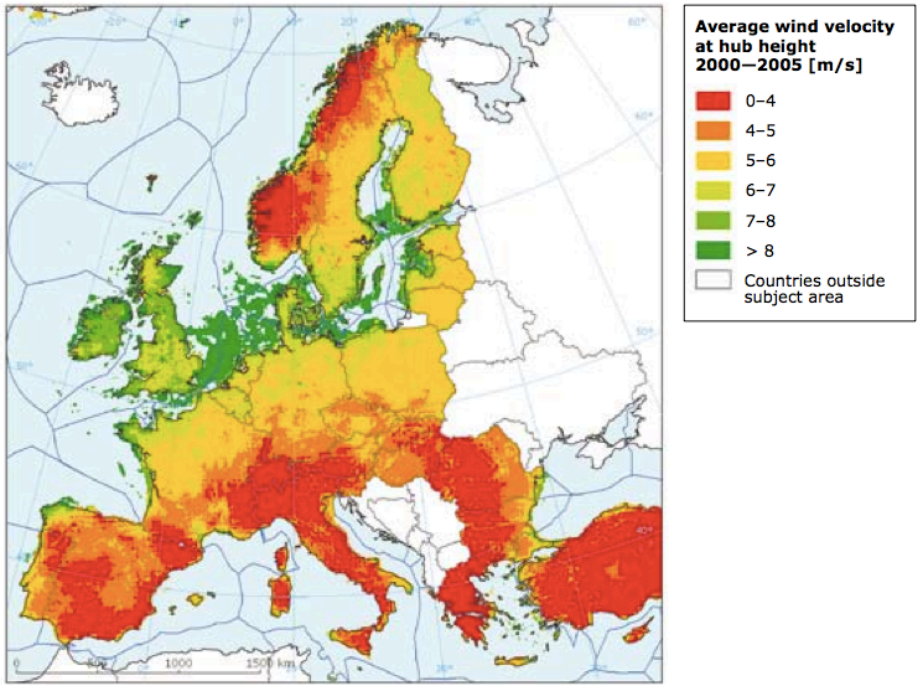

Fig. 3. Wind Field Data after correction for orography and local roughness (European Environment Agency, 2009).

4 Special obstacles against offshore wind farms

Locating offshore wind farms has in principle the double advantage of higher and more reliable wind speeds at sea (fig. 3) and avoiding conflicts with other land-uses onshore. However, even at sea there are legal obstacles, which must be addressed. Besides, we have also competing interest at sea.

UNCLOS (United Nations Convention on the Law of the Sea), which entered into force in 1994 (http://www.un.org/depts/los) and is the "umbrella" Convention beneath which a legal order for seas and oceans can be established for certain general objectives, including safety of navigation and protection of the marine environment. The UNCLOS convention divides the seas and oceans into several zones with different rights and obligations for the coastal states (figure 4). It is recognised that the States have sovereignty over their territorial sea extending 12 nautical miles from the coastline. According to UNCLOS Article 56 the costal State may also exercise sovereign rights over the Exclusive Economic Zone, which extends 200 nautical miles beyond the territorial sea. These rights include exploring, exploiting, conserving and managing the natural resources - whether living or non-living, including energy production form water, wind, and currents.

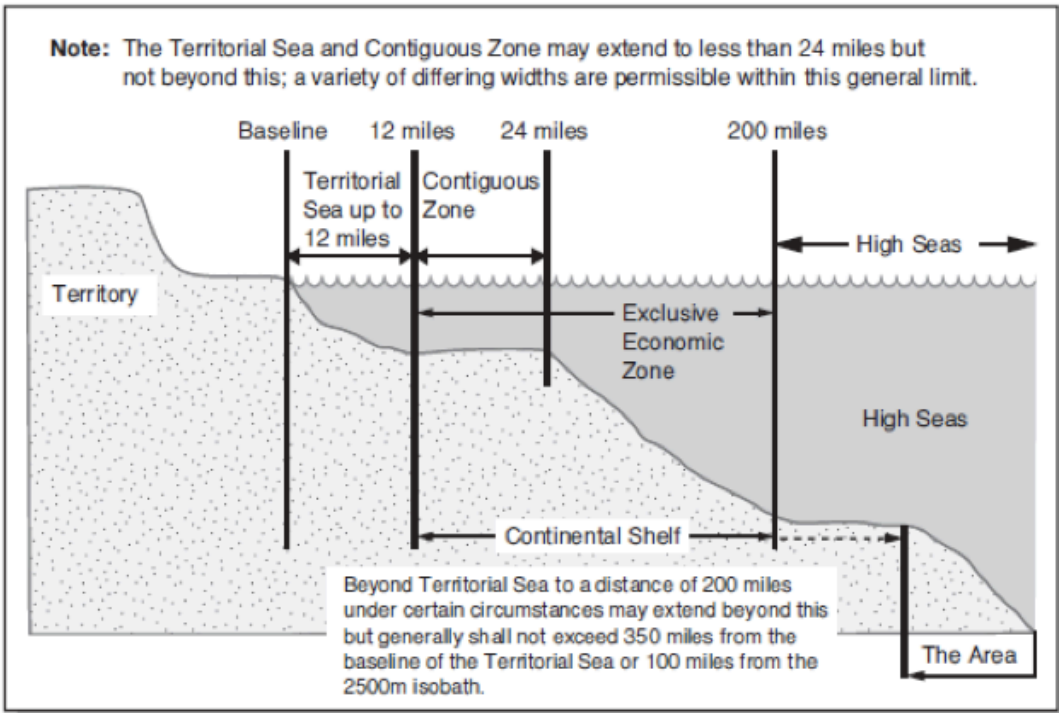

Figure 4. Jurisdiction Rights for Coastal States, (Side, 2008)

However, although the costal state has full jurisdiction within its territorial waters according to Article 56 of UNCLOS other articles may limit the possibilities for establishing for example new wind farms within this zone. Following the articles 37, 38 and 39 of UNCLOS all ships and aircrafts enjoy the

right of transit passage, which should not be impeded by any means. Besides they state the right of laying submarine pipelines and cables. This means that there is a potential conflict between a costal state's interest in establishing for example offshore wind farms and the right of another state given by the convention.

New navigational risks may be introduced by establishing offshore wind farms, and they can be divided into the following four groups (SSPA, 2008):

- Risk of a ship colliding with or contacting a wind turbine or wind farm structure
- Risk of ship to ship collision resulting from change in navigation to avoid the wind farm area
- Grounding risks
- Possible secondary risks resulting from effects of the wind farm on for example radar operations.

The IMO (International Maritime Organisation) has developed a risk assessment process – often referred to as FSA - Formal Safety Assessment (http://www.imo.org/OurWork/safety/SafetyTopics). Figure 5 provides an overview of the five steps FSA process. Formal Safety Assessment is a structured and systematic methodology, aimed at enhancing maritime safety, including protection of life, health, the marine environment and property, by using risk analysis and cost benefit assessment.

Ship traffic data can be obtained from the Automatic Identification System (AIS). AIS is an automatic system to exchange information between ships, and between ships and land-based stations. A ship equipped with AIS continuously transmits information regarding its name, location, destination, speed and course. Data from AIS are important information for identifying potential conflicts between the coastal state's plans for new offshore wind farms, and the interest for ship traffic – including safety at sea.

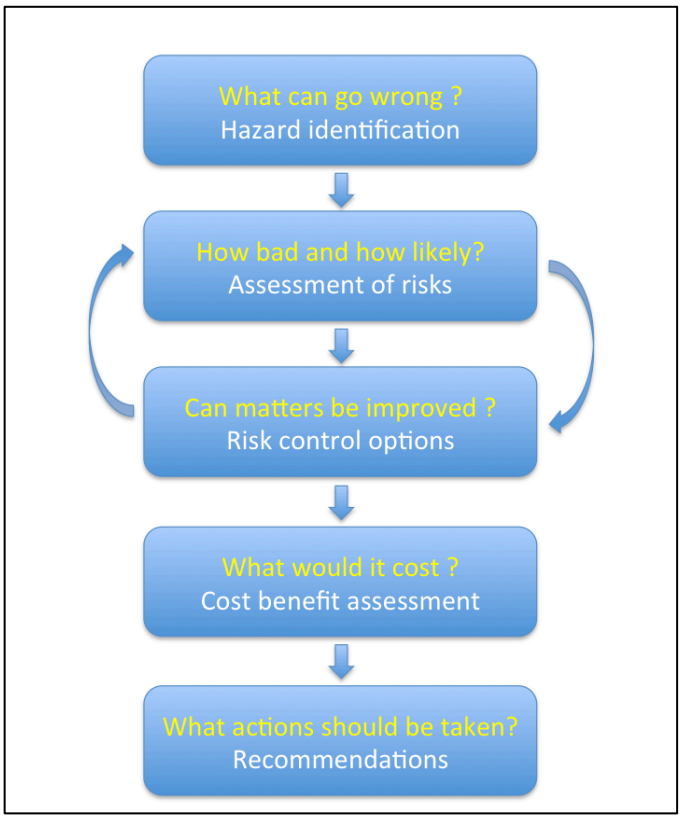

Fig. 5. Formal Safety Assessment procedure.

Fig. 6. AIS Data example for 3 October 2004 (BalticMaster, 2007)

5 Noise

Noise is a major concern over the whole world and intrinsically related to the modern urbanised society. Traffic, industry, and tourism all contribute to this development. Accordingly, the European Parliament and Council adopted in 2002 the so-called Noise Directive aiming at defining common approaches to avoid, prevent or reduce the harmful effects due to environmental noise (European Commission, 2002). The assessment of the acceptability of a sound is complex, but generally it is recognised that different acceptability criteria should apply in different circumstances – e.g. different times of the day (and night), and for different acoustical environments – e.g. urban, rural, nature.

The Noise Directive put forward the following items: a) Monitoring the environmental problem; b) Addressing local noise issues; 3) Informing and consulting the public, 4) Developing a long-term EU strategy regarding noise. The monitoring is based on common harmonised noise indicators – one regarding the day-evening-night noise level termed L_{den} and another indicator L_{night} only considering the noise level during night-time. The World Health Organisation Noise Guidelines recommends a target value of 40 dB for $L_{night,outside}$ from all sources at a specific location.

5.1 Noise emissions from wind turbines

The noise emission from wind turbines comes from mechanical noise and aerodynamic noise. The mechanical noise is mainly caused by the gearbox, and in lesser degree the generator (EPA, 2010). Also the cooling fans and oil pumps can contribute to the mechanical noise. Accordingly, the nacelle must incorporate insulation to prevent airborne transmission of mechanical noise. However, the wind turbine development during the latest decades has put strong effort to reduce mechanical noise, which is a minor concern today.

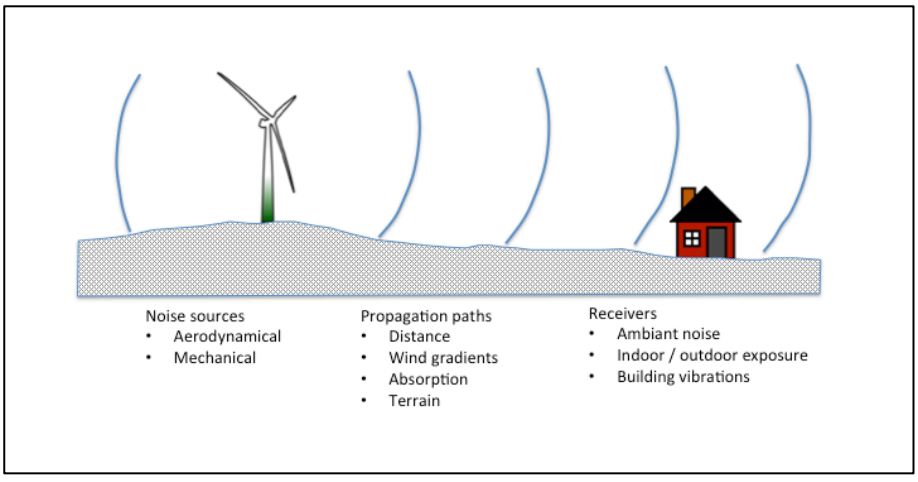

Fig. 7. Sources, receivers and propagation paths (after Rogers et al, 2006).

The aerodynamic noise component originates from the rotating blades, which speed at the blade tip approaches the speed of sound with 340 km/hr. for a 90-metre blade diameter. Therefore the aerodynamic noise from a large wind turbine can be rather significant. The aerodynamic noise is broadband and spread across the audible frequency range.

In relation to the generated output, modern wind turbines emit much less noise than the earlier generations of win turbines in the 1970s. Nevertheless, the noise generated by wind turbines is a major obstacle for wind energy development, and besides the general rules from for example the World Health Organisation and the European Union, all countries has defined their own requirements, which must be satisfied before the approval of ne wind farms.

The introduction of offshore wind turbines has put attention to a new noise problem. Virtually all, marine vertebrates rely to some extent on sound for a wide range of biological functions, including communication, navigation, and detection of predators and prey. Human activities introduce sound into the environment either incidentally e.g., shipping and wind farms or intentionally for a particular purpose e.g., sonars for bottom imaging and mapping. This may be a problem related to the recent Marine Strategy Framework Directive (se chapter 7).

There is no direct EU regulation on noise from wind turbines. Accordingly, this issue is regulated by national law, which can vary widely between the Member States. Thus Neighbour Law will be applied in most Member States. National spatial planning laws combined with environmental impact assessment is another approach to handle the noise issue.

In Denmark especially the environmental law in some degree safeguards neighbour concern by defining specific requirements and tolerance limits for disturbances (Anker et al. 2008). Thus the courts may require the disturbance to be brought under the tolerance limit or awarding the neighbour a compensation, if the tolerance limits have been exceeded. Spatial planning requirements together with the Circular on Wind Turbines generally try to balance the right of the wind turbine owners and the neighbours (Anker et al, 2008). Therefore, it will be difficult to get any compensation, if a new wind turbine operates within the fixed limits for noise and the required distance from neighbours.

6 Visual Impacts and Public Acceptance

The early times of modern wind energy back in the late twenties century was characterised by a general positive acceptance from most citizens. However, this situation changed dramatically as wind turbines became larger and larger, and accordingly with significant visual effects on the landscape (see figures 8). The consequence has been rather reluctant or even hostile feeling about wind energy, and according a limited amount of new land based wind parks due to public resistance.

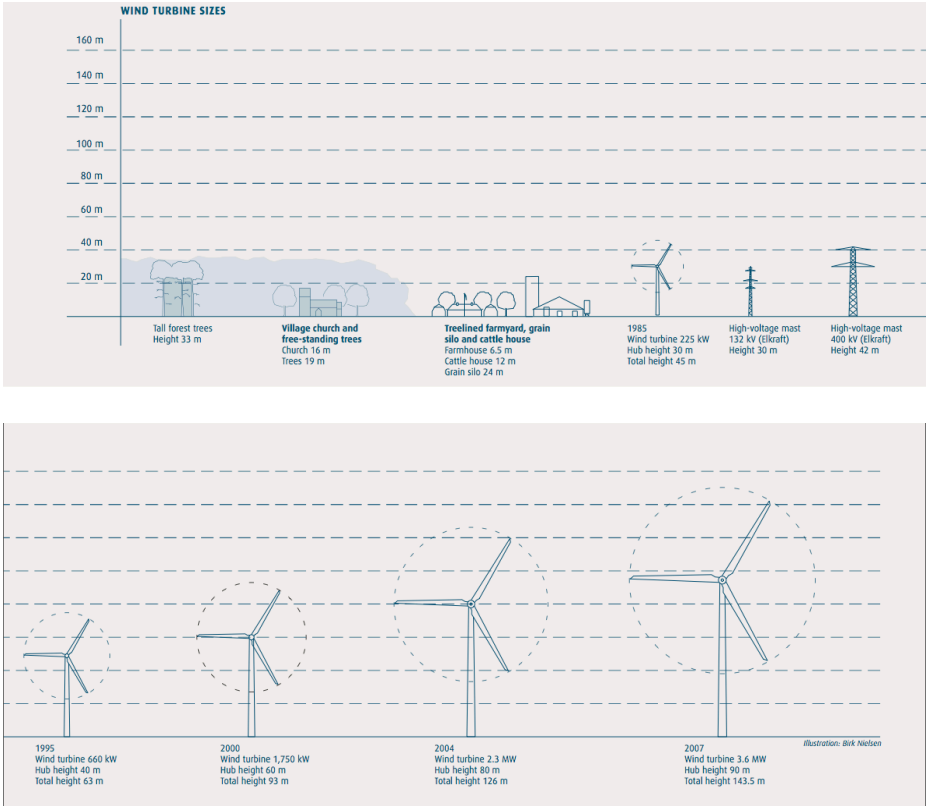

Fig. 8. Wind turbine sizes. (Danish Energy Agency, 2009)

When assessing the potential visual impacts of an offshore wind farm, the extent of potential visibility of the development should be shown. The extent of visibility of a wind farm is fundamentally affected by topography, vegetation cover and built elements/structures within the landscape. A zone of the theoretical visual influence should be estimated using a Digital Terrain Model (DTM) and specialist software – e.g. ArcGIS 3D Analyst.

Generally this theoretical visual impact zone is likely to over-estimate the spatial extent of visibility of a wind farm, mainly due to the simple topographic model that ignores the complex natural and man-made elements in the

surrounding landscape. Therefore it is likely, that actual visibility on the ground is less than that indicated by the theoretical visibility zone, but anyway it is

When estimating impacts using visibility studies for offshore wind turbines, it is relevant to consider the effects of curvature of the earth on turbine visibility. The influence of curvature on visibility is most marked in low-lying areas, such as at sea level, whereas it becomes less pronounced with elevation on land. A 150m high turbine would no longer be visible to an observer at sea level at a distance of approximately 52km due to the amount of earth curvature between the viewer and the turbine (DTI, 2005).

Based on planning for a turbine height of 100 metres to 150 metres (to tip of blade) the DTI (2003) identified a range of visual significance thresholds for offshore wind farms. These thresholds were

- <13km possible major visual effects;
- 13-24km possible moderate visual effects;
- >24km possible minor visual effects.

However the prescribed distances should not be considered as definite but more as guidelines. The visual effects vary considerably with changing lighting and weather conditions (DTI, 2005). Also the spatial arrangement of the wind farm has effect on the visual impression. Bishop (2002) analysed the how far from a proposed wind farm we do need to consider possible visual impact, how we measure the contrast between a new element like a wind farm and its surroundings, and finally the effects of distance and atmospheric dispersion. Bishop (2005) found that in areas with completely transparent skies, visibility modelling out to 20 – 30 km is justified, but effects beyond 20 may be rare and depend on exceptional viewing conditions. Under normal conditions the visual effect may have dropped to 1 person out of 5 at a distance of 10 kilometres.

In addition to the pure visual appearance in the land- or seascape, wind turbines generate some nearby visual effects. A wind turbine casts shadows when the sun is shining. In windy, sunny weather, an area of the turbine's surroundings will be affected by rotating shadows from the blades. In Northern Europe the area lying to the south of a wind turbine will never be affected by shadow from the blades. The shadow, which takes the form of a rapid change between direct light and shadow, depends on the distance between wind turbine and neighbours, the turbine's hub height, and the length of the blades (Danish Energy Agency, 2009).

The critical times for shadow occur mainly in the early morning and late evening, with long shadows at a greater distance from the wind turbines than the neighbour distance requirement of four times the total height of the wind turbine. The impact of shadow is calculated as the total number of hours annually that a neighbour is subjected to shadow and will vary with seasonal changes in the weather. It is recommended – but not required - that the calculated normal distribution of shadow hours for neighbours not exceed 10 hours a year.

Wind turbine blades must have a smooth surface to be able to produce optimally and repel dirt, but accordingly the blades can produce reflective flashes (Danish Energy Agency, 2009). However, the reflective effect of the blades will typically be halved during the wind turbine's first year of operation. Besides the municipalities - in their planning - can set requirements for anti-reflective treatment of the blades.

There is no EU legislation regulation on the various visual impacts from wind energy, but will most often be handled as part of an Environmental Impact Assessment.

7 Spatial planning

Land-use planning is generally considered a national matter according to the so-called subsidiarity principle, as stated in Article 175 of the EU Treaty. Therefore there is no direct EU legislation regarding spatial planning. However during the nineties the European Commission launched several initiatives regarding spatial planning. The first initiative was the paper on a European Spatial Development Perspective – ESDP (European Commission, 1999), which aims at a balanced and sustainable development of the European territory by working for economic and social cohesion, wise management of the natural resources and cultural heritage, and a more balanced competitiveness of the European territory.

Recently there has been a shift from land based wind energy plants to offshore wind parks. This development necessitates a holistic integrated planning in the coastal zone. From 1996 to 1999, the European Commission operated a Demonstration Programme on Integrated Coastal Zone Management (ICZM) designed around a series of 35 demonstration projects and 6 thematic studies. This programme was aimed to:

- Provide technical information about sustainable coastal zone management
- Facilitate a broad debate among the various actors involved in the planning, management or use of European coastal zones
- Obtain consensus regarding the measures necessary in order to stimulate ICZM in Europe.

Based on the experiences and outputs of the Demonstration Programme the Commission in year 2000 adopted two documents:

- A Communication from the Commission to the Council and the European Parliament on "Integrated Coastal Zone Management: A Strategy for Europe" (COM/00/547 of 17 Sept. 2000)
- A proposal for a European Parliament and Council Recommendation concerning the implementation of Integrated Coastal Zone Management in Europe (COM/00/545 of 8 Sept. 2000). This Recommendation was adopted by Council and Parliament on 30 May 2002.

The Communication explains how the Commission will be working to promote ICZM through the use of Community instruments and programmes. The EU Recommendation outlines steps, which the Member States should take to develop national strategies for ICZM. The national strategies are due for spring 2006 and should involve all the coastal stakeholders. The European Commission has set up the following eight principles for good management of the coastal zone:

- Principle 1: A broad overall perspective (thematic and geographic) which will take into account the interdependence and disparity of natural systems and human activities with an impact on coastal areas.

- Principle 2: A long-term perspective which will take into account the precautionary principle and the needs of present and future generations.
- Principle 3: Adaptive management during a gradual process which will facilitate adjustment as problems and knowledge develop. This implies the need for a sound scientific basis concerning the evolution of the coastal zone.
- Principle 4: Local specificity and the great diversity of European coastal zones, which will make it possible to respond to their practical needs with specific solutions and flexible measures.
- Principle 5: Working with natural processes and respecting the carrying capacity of ecosystems, which will make human activities more environmentally friendly, socially responsible and economically sound in the long run.
- Principle 6: Involving all the parties concerned (economic and social partners, the organisations representing coastal zone residents, non-governmental organisations and the business sector) in the management process, for example by means of agreements and based on shared responsibility.
- Principle 7: Support and involvement of relevant administrative bodies at national, regional and local level between which appropriate links should be established or maintained with the aim of improved coordination of the various existing policies. Partnership with and between regional and local authorities should apply when appropriate.
- Principle 8: Use of a combination of instruments designed to facilitate coherence between sectoral policy objectives and coherence between planning and management.

McKenna et al. (2008) have organises the eight principles into three groups based on their different targets: strategic principles, local principles, and procedural principles.

Strategic principles

- The first and most important of the strategic principles are the recommendation of adopting a broad holistic perspective - advocating for taking a 'systems' approach to ICZM due to the interaction between the physical, biological, cultural and socio-economic processes shaping the coastal zones. The delineation of the coast according to administrative or jurisdictional boundaries does not facilitate effective ICZM. Therefore, it is important to take a more wide-ranging perspective, which traces coastal influences to the extent of their natural and/or social boundaries (Ruppect Consult, 2006).
- The second strategic principle addressing the long-term perspective encouraging ICZM strategies that consider the future generations and long-term impact assessments of management decisions is responsible for the sustainability dimensions of integrated coastal zone management. This

requires taking into account the well-established precautionary principle (McKenna et al., 2008).

- The third strategic principle takes outset in the natural processes and ecosystems of the coastal zone, in order to mitigate potential negative impacts of coastal engineering – e.g. coastal defences.

Local principles

- Besides taking the wide-ranging perspectives – spatially and temporally, it is necessary to compliment the approach by addressing the local specificity and the great diversity of the European coastal areas. This will make it possible to respond to their practical needs with specific solutions and flexible measures. The downside of local specificity is that, in practice, it is too often used as an excuse for special pleading the self-interest of individuals or small groups at the expense of the public good or long-term sustainability (McKenna et al., 2008).
- The second of the recommendations among the local principles is concerned with involving all the parties in the management process, for example by means of agreements based on shared responsibility. It is generally recognised that collaborative planning involving all stakeholders in the formulation and implementation of ICZM plans can increase the accountability. However, this principle does not introduce anything new because public participation is already required according to several legal frameworks like for example the Water Framework Directive and the Environmental Impact Assessment Directive.
- The third local principle aiming at adaptive management means adjusting the ICZM process as problems and knowledge develop.
- Adaptive management during a gradual process, which will facilitate adjustment as problems and knowledge develop, constitutes the third local principle. This emphasizes the need for a sound scientific basis concerning the evolution of the coastal zone.

Procedural principles

- While the principle on participation ensures the involvement of all stakeholders in the development and implementation of ICZM, there is also a need to ensure support and involvement in the process by all responsible administrations - horizontally (between government departments) and vertically (between local, regional and central government).

- Effective implementation of ICZM involves the utilisation of multiple instruments including a mixture of legislative measures, policy programmes, economic incentives, technology solutions, research, voluntary agreements and education. The mix to be applied depends on the specific situation, which will differ according to: the geographic area, the nature of the issues to be addressed, the level of participation

and cooperation among stakeholders, institutional structures, the legal basis of the initiative and the level of political and financial support available (Ruppert Consult, 2006).

During 2006 and the beginning of 2007 the Commission reviewed the experience with the implementation of the EU ICZM Recommendation. The Commission Communication of 7 June 2007 (COM, 2007) presents the conclusions of this evaluation exercise and sets out the main policy directions for further promotion on ICZM in Europe. Many of the suggestion from the ICZM process are elements in the Marine Policy of October 2007, where the European Commission presented its vision for an Integrated Maritime Policy for the European Union (European Commission, 2007). The EU Marine Policy aims at enhancing Europe's capacity to face the challenges of globalisation and competitiveness, climate change, degradation of the marine environment, maritime safety and security, and energy security and sustainability.

Existing planning frameworks have a largely terrestrial focus and often do not address how coastal development may affect the sea and vice-versa. We must address the challenges that emerge from the growing competing uses of the sea, ranging from maritime transport, fishing, aquaculture, leisure activities, off-shore energy production and other forms of sea bed exploitation.

November 2008 the European Commission adopted the Communication Roadmap on Maritime Spatial Planning: Achieving Common Principles in the EU (European Commission, 2008 a). Marine Spatial Planning is a holistic process that builds on the ecosystem-based approach and aims to secure sustainable development balancing economic, social and environmental objectives. Maritime Spatial Planning (MSP) is a key tool to implement the new Integrated EU Maritime Policy. Marine Spatial Planning is different from terrestrial planning constantly operation in a three-dimensional environment and has to simultaneously address activities that take place (a) on the seabed; (b) in the water column; and (c) on the water surface (Schaefer, 2009).

The Directive 2008/56/EC for establishing a framework for community action in the field of marine environmental policy is the environmental pillar of the Integrated Marine Policy European Commission, 2008 b). This so-called Marine Strategy Framework Directive requires Member States to achieve good marine environmental status by 2020, to apply an ecosystem approach, and to ensure that pressure from human activities is compatible with good environmental status. Member States are required to cooperate where they share a marine region or sub-region and use existing regional structures for coordination proposes, including with third countries. According to Article 13 of the Marine Strategy Framework Directive the Member States are obliged - in respect of the region concerned – to identify measures, which need to be taken in order to achieve or maintain good environmental status. However, in special occasions a Member State may identify

instances within its marine waters were the environmental targets couldn't be achieved through measures taken by the Member State (Article 14). This requires very good explanations and must be approved by the European Commission.

Offshore wind parks will inevitably have some adverse impacts on nature, which has to be mitigated through appropriate design, construction and operation methods. A recent study shows that the placement of offshore wind turbines gives the potential for habitat creation, which may thus be regarded as compensation for habitat lost (Wilson and Elliot, 2009). Using current design criteria and construction methods, the analysis here indicates that the net amount of habitat created by the most common design of offshore wind turbine (the monopole) is up to 2.5 times the amount of area lost through the placement, thus providing a net gain even though the gained habitat may be of a different character to the one that lost. That habitat creation results in the production of biologically important areas, and hence the ability to increase marine productivity as compensation for losses elsewhere, as indicated by the Marine Strategy Framework Directive.

8 Conclusion and Recommendations

Since the early 1970ties with the rebirth of wind energy there has been a gradual increase in the recognition that wind energy can contribute to a more sustainable society based on renewable energy. The first so-called oil crisis began in 1973, and enhanced the efforts for being less dependant on imported oil. Many countries increased their investments in nuclear energy, but some countries – not at least Denmark – put serious focus on further development of wind energy through national subsidies. The wind turbines at that time were rather small compared with today's huge 3+ MW wind turbines, and the general public was quite positive for the expansion of wind energy.

This development continued for the next more than 20 years. Just before the end of the twentieth century a growing concern for climate change – and not at least its impacts on the global environment and economy – entered the political agenda. The adoption of the Kyoto protocol in 2005 put concrete and significant reduction commitments on the countries that have ratified the protocol. According to the Kyoto protocol Denmark for example is obliged to reduce its greenhouse gas emissions by 21% compared to the reference year 1990. This is a huge challenge, which requires a combination of more efficient energy use plus a transition from fossil based energy to renewable energy. Wind energy is expected to play a major role in this transition, and the emergence of new huge 3 MW wind turbines will contribute to reach this goal.

The general focus on sustainability and environmental protection during the previous 25 years – as agreed upon by the Agenda 21 from the World Summit in Rio de Janeiro in 1992 - has encouraged the use of renewable energy and thus facilitated the rapid growth of wind energy globally – and not at least in Western Europe. However, the same focus on sustainability and environmental protection has put a lot of constraints on the further expansion on wind energy. Several international and particularly EU legal instruments and policies have set up obstacles for new wind energy projects.

The legal obstacles at international and EU level regarding Nature Conservation are defined by the Birds and Habitats Directives, the RAMSAR Convention, the HELCOM Convention, and the Bern Convention. Although the areas protected by these legal frameworks represent large areas of the European territory and adjacent seas – and inevitably will exclude some areas with large wind energy potential from being utilised, the nature protection obstacles are not the biggest challenge. Their geographical locations are available for download from the European Environment Agency as Natura 2000 maps, and these areas can easily - at least partly – be excluded in an initial screening process.

Noise from wind turbines is another problem facing the developers of new wind farms. The rotating rotor blades produce noticeable noise, which must be addressed in the design process of new wind farms. The World Health

Organisation and the EU Noise Directive have defined the levels of acceptable noise, and the wind farm developer must follow these noise limits. The noise effect decreases dramatically with distance form the wind turbine, and with proper planning this should not be a major challenge.

The current trend for new wind farm development are large off-shore installations like Horns Rev Wind parks in the North Sea and the planned Kriegers Flak in the Southern Baltic Sea, which are located far away from residential areas. The legislation related to nature protection also covers the sea area, but a main advantage of placing new wind parks at sea is that the are no people living in the neighbourhood of the wind turbines. However, the developer needs to address the special legal frameworks and rules at sea – primarily the shipping routes, risk for collision etc., but anyway there is much more room for placing new large wind parks off-shore, and at a greater distance from human settlements.

The concrete legislation defining the locations for new wind energy narrows the space for new installations, but can be handled by careful handling and detailed data put into a geographical information system. However, the biggest challenges in modern wind energy development seem to be the various visual effects of large wind turbines. Although there is no direct EU regulation regarding the visual effects of wind turbines, powerful legal instruments can be utilised by citizens and NGO's to obstruct or delay new wind turbines. First, the Environmental Impact Assessment, which in practice is needed for all new wind farms today due to the size of the turbines and the size of the wind farms. Carrying out an Environmental Impact Assessment can be a rather lengthy process, where particularly the outcomes of the required public consultations are unpredictable, and the developer may totally loose control over the process. For very large projects the developer even have to carry out a Strategic Environmental Assessment. Quite recently – Summer 2011 – the Danish Government wanted to establish a Wind Energy Test Centre in North-Western Jutland consisting of 5 - 7 very large (250 m) land based wind turbines, which will be visible up to 55 km from the test centre. The required Environmental Impact Assessment was carried out, and the project was given strong support from the local authority (Thisted municipality). However, some local stakeholders and NGO's were very much against the test centre, and errors and omissions were identified in the Environmental Impact Assessment, but this didn't changed the premises for locating the test centre at the proposed site. Nevertheless, some local people occupied the site, and the work on establishing the Test Centre began under protection by the police (www.nationalttestcenter.dk)! All in all a sad situation and very bad publicity for wind energy.

Most of the legislation mentioned above are transposed into national legislation by new laws or through changes and amendments to existing laws, and this EU based legislation must be handled together with the national legislation, national protected sites, cultural heritage, regional plans, local plans etc., and altogether

this may make a confusing mixture of rules, which can be difficult to understand and handle for the authorities, the wind farm developers, and the general public. Below, we will present some recommendations on how the handle the obstacles in order to make the planning and permission process as efficient and transparent as possible.

Recommendations

In order to navigate successfully between the various obstacles against wind energy development, we end this study by given some recommendations. This is not an easy task due to the complexity in designing and planning new large wind farms. Nevertheless, the above analysis gives rise to a set of principles, which can be useful to follow for new wind energy projects.

1. Information management

A crucial premise for successful wind energy development is transparency and confidence between the various stakeholders – from developers over authorities to citizens. This is the obvious lesson learnt from several wind energy projects during the last 10 years.

Inform and involve the public as early in the process as possible. Resistance from the general public is the most important obstacle for new wind energy plants, and the citizens have great power through the Environmental Impact Assessment process – and indirectly through the authorities and politicians. Therefore make an information campaign to the local people, and describe the aim of the project in not too technical terms. Remember not to hide anything for the citizens or local authorities. The confidence will be lost, if some critical information are revealed at a later stage. Create contact with NGO's, which can be valuable in the approval process by getting support instead of resistance.

2. Data acquisition and Multi-criteria analysis

Collect all data relevant for the project – and particular for the Environmental Impact Assessment. It can be a time consuming and costly process, but compared with the huge costs to establish a new large wind farm these costs are of minor importance. Acquire all the data needed for defining areas suitable for the new installation, get all data for identifying legal obstacles, and combine all the information within a geographic information system. Hereby the developer can choose between a limited number of locations, which fulfils as well the physical foundations (e.g. wind potential and geological conditions), as the rules defined by the various legislation and spatial planning. Having potential alternatives strengthens the developer in the negotiations with the authorities, which quite often have positive attitudes to new bigger construction works in their own municipality – because this create jobs, although sometimes only for a limited number of years.

Following these two recommendations, which can be seen as supporting each other, the developer cannot be sure of success, but at least be well prepared for the approval stage, which is one of the most challenging obstacles for establishing new wind energy installations. However, besides these legal obstacles the developer needs connection to the grid system, with different rules in the various EU Member States. Furthermore, the financial and economic crisis has set up new challenges for financing the huge costs for new larger wind energy parks. This fact is clearly demonstrated by the recent fall of the Vestas share quotation. Finally, there is not any longer the same concern globally on protecting the Earth against climate changes. It seems that nearly everyone has given up on this issue, and without this as a driver, it is uphill for renewable energy. The financial and economic crisis has taken the agenda with all leaders around the world, and we have to be on safe ground again before not at least the European Union can prioritise renewable energy – hereunder wind energy again.

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