Near-shore wind power - protected seascapes, environmentalists' attitudes, and the technocratic planning perspective

Wolsink, M.

DOI
10.1016/j.landusepol.2009.04.004

Publication date
2010

Document Version
Author accepted manuscript

Published in
Land Use Policy

Definitive draft paper as presented at the workshop. Officially published in
Land Use Policy (2010) vol.27(2) 195-203

Near-shore Wind Power - Protected Seascapes, Environmentalists' Attitudes, and the Technocratic Planning Perspective

Maarten Wolsink *

This paper has been presented at the ***European Science Foundation Exploratory Workshop "Emerging Energies, Emerging Landscapes: Revisioning the Past, Constructing the Future"***. Paris June 6th to 8th, 2007
* Department of Geography, Planning and International Development Studies
University of Amsterdam
Nieuwe Prinsengracht 130
NL- 1018VZ Amsterdam
Email: M.P.Wolsink@uva.nl

Summary

In contested wind farm developments, the dominant issue concerns scenic impact and the landscape at the proposed site. The number of large wind power schemes that have failed is growing. The case analysed here is a near shore wind farm in the Dutch part of the Wadden Sea. In 2001 this was the largest wind project ever proposed in the Netherlands (278 MW), but it failed. The government refused to negotiate with civil society organisations representing various landscape values, primarily with the WaddenVereniging and its allies.

The often suggested idea that siting wind farms offshore could solve the problems encountered onshore is naïve and far too simple. Siting issues offshore are just as relevant as onshore, as this case study illustrates. As most current offshore developments, the case also concerns a near-shore development. It would have been highly visible in an iconic landscape. In such cases, the main dialogue is similar to onshore schemes, which is about impact on the landscape, or 'seascape', as perceived by the public. The paper provides an historic landscape description of the area, highlighting significant natural, ecological and cultural heritage and its importance for tourism and the rural economy. Some of these have high identification values. The acceptability and the assessment of different qualities in relation to wind farm siting are analysed with a survey among members of the WaddenVereniging, the national environmental organization for the protection of the Wadden region. The analysis reveals that these environmentalists believe that there are suitable sites for wind turbines in a sensitive area like the Wadden. However, the spatial layout that was chosen by the developers was based on a landscape assessment of the governmental architect. This was a highly technocratic, top-down decision that did not take account of the landscape preferences of the public. This decision evoked its opposition, and eventually, the WaddenVereniging succeeded in generating sufficient national political support to scupper this project.

Keywords

Wind power; Near-shore; Siting; Environmentalists; Landscape values; Landscape identity

1. Introduction

1.1 Social acceptance issues

Successful implementation of new technologies requires socio-political acceptance. Acceptability of renewable energy revolves around two key issues. The first key issue is the willingness in society to invest in renewable energy facilities. At first sight this primarily seems an economic issue, but particularly in the take-off phase of new technologies the key question is more about the willingness to change institutional conditions in such a way that these conditions foster and support initiatives to invest. As long as wind energy is largely a niche market, the will and capacity to set favourable institutional conditions for its development, is likely to remain the crucial factor in socio-political acceptance (Toke et al., 2008; Bohn and Lant, 2009). The second key issue concerns the institutional conditions for how society (public as well as private actors) is dealing with all the non-energy issues associated with the investment and siting decisions of renewable energy facilities (Agterbosch et al., 2009). These issues may vary for different energy technologies, but they are important in all cases. For wind power, the most important issues concern questions linked to the site of the wind turbines: the environmental quality of the location and the landscape that is affected at the site. Landscape is considered the part of the environment that is the human habitat as it is perceived and understood through the medium of our perceptions (Bell, 1999). Nature and landscape are strongly entangled in perceptions, and as will be shown in this paper, the strong commitment and knowledge about the ecological qualities of the landscape is shaping the perception of the landscape (van den Berg and Vlek, 1998). It is mainly the perceived qualities of the site that determine the acceptability of wind turbines.

Several misunderstandings exist about social acceptance, in particular among the proponents of wind power. Social acceptance has often been taken for granted on the basis of evidence that a wide section of the population supports the application of renewables in principle. However, research has repeatedly pointed at complexity of acceptance issues at a more operational or project level and at issues that were easily overlooked. The tendency to neglect those issues, and the restraint to adapt renewable energy policies to overcome the problems, marks the poor level of socio-political acceptance of renewable enrgy innovation (Wüstenhagen et al., 2006). Investors that have tried to establish wind power facilities have faced many impediments related to socio-political and community acceptance. Environmental constraints for building wind farms could be avoided by going offshore, at least this has often been suggested (e.g. Tong 1998).

1.2 Acceptance offshore

Because of all problems with actually establishing onshore wind capacity, there has been a strong policy drive to look at offshore wind power (Jay, 2008). This can also bee considered as an example of the general tendency to take refuge in still unproven applications when current technologies are facing barriers. The idea that issues of acceptance could be avoided by going ‘over the sea and far away’ is actually rather naïve (Haggett, 2008). Offshore wind farms would face less public resistance, but these “expectations of the industry and policy makers may be ‘overly optimistic’” (Jay, 2008:3). Beside the fact that in offshore implementation developers have to deal with other stakholders, for example fishermen (Gray et al., 2005; Michler-Cieluch et al., 2009) offshore wind power is rom a technological perspective rather different from onshore. The ‘marinisation’ of turbines, needed because they suffer from saline atmospheric conditions (causing corrosion) adds significantly to the installation cost. Weather conditions are much harsher and the foundation of the turbines is very different and more complex. These factors require wind turbines of a stronger, different and more expensive design. At the same time, maintenance and other associated costs such as grid connection are also much higher than the equivalent onshore costs, as offshore sites make the logistics of maintenance more expensive. Hence, the development of offshore wind lags about 20 years behind on-shore and there is not yet much experience with it. The first schemes have all been planned very close to the coast. The first ones were semi-offshore, such as the wind farms at Zeebrugge in Belgium (1985) and Blyth in Northumberland in the UK (Still, 2001). Both were built on a pier at the harbour. The first large real offshore wind farms were Danish and date from 2001 (Middelgrunden, 40MW; Baltic Sea) and 2002 (Horns Rev, 160MW; NorthSea). These are still located close to the coast.

Studies have shown time and again that it is the type of landscape in which the turbine is sited that is the most determining factor in acceptance of wind power. This is the experience onshore, but as long as wind power is near-shore and still visible from the shore, it can be expected that landscape is still essential (Bishop and Miller, 2007; Ladenburg, 2008). The possibility to achieve a positive fit between local landscapes and wind turbines may be very subjective indeed (Lothian, 1999), but nevertheless the issue of the perceived fit of turbines to the landscape at the site is by far the most important factor in the contrasts between views on wind power implementation (Ellis et al., 2007; Breukers and Wolsink, 2007b). The idea that acceptability offshore will be greater and easier also includes the assumption that offshore wind power schemes would avoid the issue of destroying the landscape (Danielson, 1995). However, why would ‘seascapes’ be less determining public acceptability, in particular when most offshore

schemes are still near-shore? Because the visibility of moving objects remains a key factor close to the coastline, the 'seascape' impact particularly applies to near-shore wind farms and several studies of near-shore wind power have at least already produced evidence that social acceptance is inevitably a topic here. In the acceptability discussions the crucial factor of the impact on the seascape has indeed come to the fore (Firestone et al., 2009; Gonzalez and Estevez, 2005; Ladenburg, 2009).

1.3 Research question and method

Currently, offshore wind power is actually taking-off, and some of the projected schemes are huge compared to most onshore wind farms. For example, England is a country that has been relatively unsuccessful in achieving onshore wind capacity (Toke et al., 2008) but it has started an ambitious program for wind energy offshore (Jay, 2008). Another example is Norway, a country also with hardly any installed capacity onshore, but with three huge offshore wind farms planned in Møre and Romsdal County on the west coast. The Havsul I, II and IV offshore schemes add up to 1500 MW. The Havsul II site alone would become the largest offshore wind farm anywhere with its 800MW capacity. One of the main criteria for site selection there has been close proximity to the coastline (Havgul, 2008). As it is still common practice to select sites not far from the coast, these schemes can better be called 'near-shore'. Currently the Netherlands is also planning several marine wind farms near the North Sea coast (with two recently built), but these are not the first schemes. A large near-shore scheme was projected in the Wadden Sea in 2001, but that project failed. This case is analysed in this paper, addressing the question: What were the major factors causing the failure and how are these factors connected to landscape and other social acceptance themes?

The decision making process was analysed based on documents, interviews, and recorded participation in and independent committee advising the main opposing stakeholder. This was an environmentalist organisation, which will be described below, that faced an internal crisis about the wind power issue. In that crises a representative sample survey was carried out among the members, and these data are also used for analysis.

2. The Wadden 'seascape'

About half of the economically feasible wind energy potential in the Netherlands is located in the north and northwestern part of the country. The largest part is situated around the Wadden Sea wetland, an ecologically important area of shallows and small islands extending along the coast of Germany and Denmark. The landscape qualities of this area are crucial to wind power developments. The visibility of turbines is creating perceptual and attitudinal salience, but then the importance of landscape or seascape for acceptability is particularly at stake in cases of generally highly valuable landscapes. This is clearly relevant for the Wadden landscape, with high scenic and ecological values. It is a very young and highly dynamic landscape, and therefore we start with a brief description of the emergence of it.

Strong natural and social forces continuously changed the shape of the coast and the qualities of the landscape of the current Netherlands. In Roman times, the appearance of the Wadden region was entirely different from as it currently is. Whereas the frontier of the Roman Empire was situated along the main branch of the river Rhine, from the mouth of the Rhine to the northern part of what currently is 'Ost-Friesland' in the German state of Lower-Saxony, Germanic tribes called *Frisians* lived scattered in small communities. The main part was barely accessible country at sea level that was frequently flooded. The coastline showed several creeks and bays, with only one inlet leading to the inland Flevomeer (Flevo lake). Since that time, sea level rise increasingly caused serious floods that swept the coast and the Frisian country. In the middle ages, these people continued to defend themselves against the frequent floods by throwing up dwelling mounds. These early works of flood protection were followed about 1000-1200 by the first dikes to defend larger areas against floods. Many of these early water infrastructure works are still existing and make up iconic landscape elements that are essential to the region's cultural heritage (Lancewadplan, 2009).

The coastline began to gain its current shape (fig.1), with a string of islands on both sides of the original creeks and between the islands and the mainland extensive shallows that fall dry during low tide. The increasing forces of the sea and the ongoing floods caused the inlets and creeks to grow larger and formed permanent inland lakes which grew in size. With some strong storms and high tides during the 13th and 14th centuries, the Flevo Lake grew into the inland *Zuiderzee* (Southern Sea). This sea became lake IJsselmeer in 1932, when it was separated from the Waddensea by the large 32km *Afsluitdijk* (fig.1).

The Wadden area is currently an international ecologically highly valuated wetland, although human impact in the last centuries has been great in particular concerning the frequent reclamation of salt marshes (de Jonge et al., 1993). With the strong tidal movements in and out of the inlets between the islands and large shallows falling dry twice daily, the Wadden Sea is an area of great biodiversity. It is the world's largest sand and mire chain wetland in

moderate climate zones, stretching out from Texel, alongside the northwest coast of Germany to Esbjerg at the southern part of the North Sea coast of Denmark. It is crucial to several rare species of birds, in particular aquatic birds and migrants from Africa to the north of Norway, Siberia, Canada and Greenland (Drenth et al., 2003), to fish for which the Wadden Sea is an important 'delivery room' (Lotze, 2005) and to some sea-mammals such as seals. The wetland of the Wadden Sea encloses shallows, tidal marshes, estuaries, beeches, dunes, and special on-shore habitat of rare species on the islands. Some of the globally most valuable ecosystem services are delivered (Costanza, et al., 1997), such as refugia, biological control, sediment retention, and recreation.

Figure 1. The Netherlands' part of the Wadden area.
South of the 'Afluitdijk' the northern part of the IJsselmeer (former Zuiderzee). The white line is the proposed dyke in 1965.

3. Environmental protection

3.1 Formal institutions

Reflecting the enormous value of the ecosystem functions, its protection by the Dutch state is an international obligation in many ways. It is protected through a range of national and international laws and treaties. Large parts are included in the planning instruments of habitat-networks and greenways that are developed in several European countries (Opdam et al., 2006; Van Haaren and Reich, 2006) and in the similarly designed EU Natura 2000 network (Chilla, 2007). In principle, the EU Wild Birds and Habitats directives protect all places that are important to ecologically valued species in the area. Furthermore, the protection of the Wadden area is internationally founded in the Wadden-treaty of Denmark, Germany and the Netherlands, that was implemented through the establishment in 1978 of the Common Wadden Sea Secretariat (CWSS, 2008). Other general international agreements that affect the protection of the wetland regarding wind power applications are the 1971 Ramsar Convention on Wetlands of International Importance, the 1979 Bonn Convention on the Conservation of Migratory Species of Wild Animals, the 1995 AEWA Agreement on the Conservation of African-Eurasian Migratory Water birds, and the 1979 Bern Convention on the Conservation of European Wildlife and Natural Habitats (Scott, 2006).

Large parts of the Wadden Sea itself, as well as large uninhabited parts of the islands are nature reserves and Special Protection Areas on terms of nature protection legislation. For the entire region, including a broad onshore zone, a so-called planning Planning Core Decision (PKB) sets the rules and conditions for all regional spatial developments. The PKB is an instrument of the national government with the status of a law and it has to pass the parliament. Although none of the institutional rules strictly controls the siting of wind turbines, in all siting processes the rules

of natural protection legislation, spatial planning and the PKB are framing the schemes and they define the conditions for the decision making process.

3.2 Civil society

The foundation of this extensive and multi-level nature and landscape protection by the state lies within civil society. The history of current protection starts with the establishment of a national environmental organization for the protection of the Wadden Sea. The WaddenVereniging ('Wadden Society'), or the National Union for the Protection of the Wadden Sea as it was originally called, was founded as a reaction to a large infrastructural development proposed in 1965 by several authorities. It was proposed to connect the islands of Terschelling and Ameland with the mainland by a large new dyke (fig.1). The initiative to oppose this project started with a letter to a newspaper by a 16-years old student. As often, the authorities and the planners perceived the opposition as typical obstruction by a narrow-minded group merely protecting its backyard. They were typecast of 'ignorant', 'selfish' protests by affluent immigrants and second house owners suffering from a drawbridge mentality and obstructing local and regional development, the kind of arguments that are usually applied to typecast any place protective action as not-in-my-backyard. This is rather common in cases of infrastructure decision-making (e.g. Wolsink, 2006a, with the example of wind power developments), and it has also shown to be an important factor in the turn towards more ecologically and resilience oriented water infrastructure as well (Disco, 2002; Wolsink, 2006b). Eventually, the dyke project turned out to be a catalyst, creating vigilance among the public whose concerns were actually much broader, and the place protective action manifested itself in environmental attitudes (cf. Vorkinn and Riese, 2001). The people that founded the WaddenVereniging were moved by ecological, landscape, and cultural concerns, and they felt essential values were threatened by ongoing developments and by government policies. The organization was immediately shaped to cover objectives far beyond the regional interests itself and it was established at the national level. With the emergence of the first wave of environmental awareness in the late 1960s and early 1970s, they succeeded to put the ecological and landscape values of the Wadden Sea high on the political agenda. From the seventies onwards, the WaddenVereniging has been a important actor (about 50,000 members) with a strong network and with political influence on all policy developments and decisions connected to the Wadden region.

3.3 Environmental issues: cockles, gas, and turbines

One of the three main environmental issues that were put forward by the environmentalists concerns the fishing activities in the Wadden Sea, that traditionally have largely focused on shrimps and shellfish. Ecological degradation manifested itself when the oyster (*Ostrea edulis*) disappeared in the early 1950s due to over-fishing. Since then shellfish fishery has predominantly targeted cockle (*Cerastoderma edule*) and mussel (*Mytilus edulis*) populations (Imeson and Van den Bergh, 2006). However, these practices have been challenged for ecological reasons by the environmental movement, because of the disturbance of the soil and the fact that shellfish is important as nourishment for many birds. The WaddenVereniging headed the political lobby with strong allies such as the national Bird Conservation Society (over 100,000 members) and the largest environmental organization in the Netherlands, 'Nature Monuments' (one million members).' In the German part of the Wadden, the breeding of mussels is also challenged, and there the issue is linked with an experiments to relocate mussel-breeding to the Northsea by linking it to offshore wind power (Michler-Cieluch et al. 2009).

The largest conflict in the 1990s concerned the exploration and exploitation of natural gas below the Wadden Sea. The exploitation is challenged for several reasons, in particular because the possible impact of soil subsidence would be great, since the character of the shallows-landscape fully depends on the fact that the soil is at sea level (Dijkema, 1997). Furthermore, impact of polluting hazards and visual impact of exploitation facilities was feared. The process of permitting the NAM (Dutch joint venture of Shell and Exxon) started in 1992. Much publicity was generated and a wide public discussion started. The WaddenVereniging led a coalition of environmental organizations, supported by local communities in particular on the Wadden islands, against the proponents. The latter emphasized that expected gas yields were high, whereas the development of new techniques, for example drilling under the Wadden from the mainland could prevent major impacts on the environment. The NAM worked on an optimistic scenario and expected to start drilling in winter 1997 (Marquenie and Verburgh, 1998). Although the environmental movement effectively prevented the permission for a long time, the work could start in 2005, based on a deal in which about 800 million Euros of the profits should be paid by the NAM for nature protection activities and ecological improvement projects. One of the main measures is the abolishment of cockle fishing by buying out the rights of the fishers.

The third main issue in the Wadden region concerned wind power. In the 1990s the WaddenVereniging challenged a growing number of wind power schemes. On land many solitary turbines were built by farmers, but on the islands and near the coastline only some small and one large windfarm were built in harbour and industrial areas (e.g. the

Delfzijl seaport), as all others were prevented by successful appeals by the attorney (a staff member) of the WaddenVereniging. In the view of the organization, wind turbines strongly affected the openness of the landscape. Particularly important was the supposed impact on the cultural heritage of the hundreds of prehistoric and medieval mounds in the provinces of Frŷslan and Groningen (for example Lancewadplan, 2009). For the WaddenVereniging such sites were reasons to oppose almost any turbine.

The general oppositional tendency was disputed, illustrating once again that wind power is a typical dilemma of 'green' preferences conflicting with environmental values, particularly in sensitive areas as the Wadden. Many members are rooted in a broader environmentalism that also emerged from the anti-nuclear movement and they are also concerned about energy issues and climate change (Breukers and Wolsink, 2007a). Their support for renewable energy made them challenge the rigid policy the WaddenVereniging of refusing almost any kind of wind power developments. This caused a strong internal conflict in 1997, when the board as well as the staff were split and eventually some members of staff were fired. In an effort to escape from the dilemma, external experts were asked to advise on a new policy line. This committee carried out research among the members of the WaddenVereniging, which provided the data that are analysed in this paper.

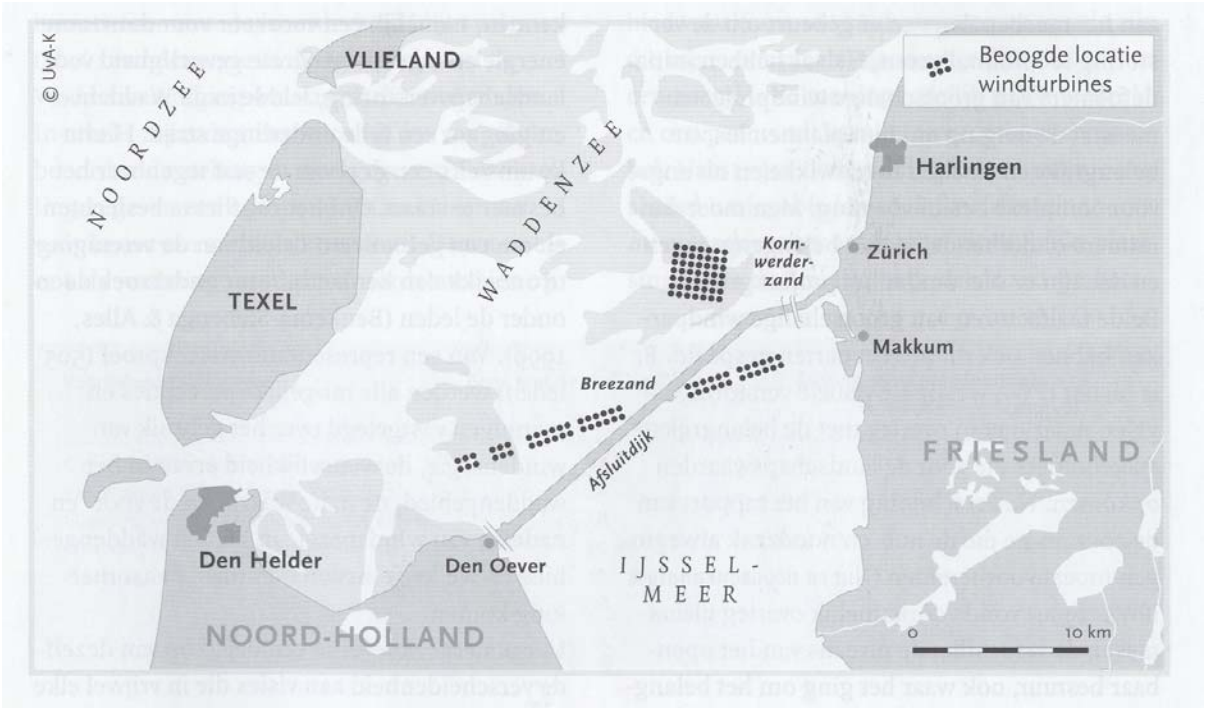

Figure 2. The proposed spatial arrangement of the near-shore 278MW wind farm IPWA in the Wadden Sea and IJsselmeer.
("Beoogde locatie windturbines" = proposed site of wind turbines)

4. The IPWA near-shore wind farm

4.1 The near-shore scheme

The idea for a wind farm alongside the Afsluitdijk was born in 1987, when the National Spatial Planning Agency (RijksPlanologische Dienst) made a visualisation of rows of tall wind turbines seen from a car driving on the main road on the dyke. It became a serious option when about ten years later the technology of large turbines had been much improved, which made such a wind farm an economically feasible option. Moreover, in the 1990s the wind power policy had not been successful, because of its focus on energy companies and large-scale implementation and the lack of an effective policy for the siting of wind turbines. The monopoly approach became apparent in particular in the large scale 'Wind Plan' that was carried out by energy companies with taxes collected on consumer bills. This limited the co-operation to energy companies and provinces, an effort that completely failed (Breukers and Wolsink, 2007a). The new scheme of BLOW (Administrative Agreement National Development of Wind Power) was a covenant set up in 2000 between the national and regional governments. It set a target of 1500 MW installed capacity for 2010, specified in provincial quotas of installed capacity. The provinces of Frŷslan and North-Holland

looked at the Wadden Sea as an option to achieve a large part of their quota. The IPWA scheme (Interprovincial Wind Farm Afsluitdijk) was prepared at the end of the nineties and the project was proposed in 2001. It was a collaborative initiative to build 278 MW by 2 provinces, 4 municipalities, Nuon (power company) and 3 national ministries (Economic Affairs; Housing, Spatial Planning & Environment; and Agriculture, Nature and Food Safety). Some other stakeholders were consulted, among those the WaddenVereniging, they were no longer invited when they indicated that they would not commit themselves to acceptance the IPWA beforehand. As a result, no societal stakeholders were involved in the planning phase of the project. Under the elitist model of neo-corporatist decision-making that still prevails in the Netherlands (Van Waarden, 1992) it is rather common practice that the collaboration in planning remains limited to official tiers of government and the selected developer. Only an external expert advisory committee was established to inform the decision-making process and define the 'need and necessity' of the project for the coalition of developers. This report concluded that the Afsluitdijk wind farm was vital to the generation of sustainable energy in the Netherlands (IPWA, 1999).

4.2 Alternative siting options

In the planning process an extensive Environmental Impact report was made (IPWA, 2001). After the screening phase in the Environmental Impact Assessment, needed for a large offshore wind farm like this in such an environmentally sensitive area (Gill, 2005), the scope of the EIA was determined. Regarding the sensitivity and the strong civil society protection forces, an extensive list of criteria and potential environmental impact was composed. Under the Dutch EIA procedures no public nor stakeholder participation is required at the scoping phase, which usually means that actors involved in scoping tend to make choices that they expect to prevent delays and risks of confusion. As Snell and Cowell (2006) state, it is not uncommon in scoping that the actors involved justify the exclusion of the public and their representatives, because it is perceived premature and it might not contribute to decision-making efficiency. However, as the alternatives that are assessed are defined during scoping and described in the guidelines, crucial choices are often made in this phase. These may later become contested, and this is what happened in the IPWA case.

In the IPWA planning, some potential impact factors established in the screening were used to limit the development of alternative siting options to three. These were the 'Image Quality 1', which became the final proposal (fig.2), and the two rejected alternatives 'Image Quality 2' and the alternative most favourable to the environment (fig.3). The labels of these alternatives were apparently chosen based on the visual impact on the landscape. Particularly striking, however, is the full absence of real siting alternatives. All three alternatives consist of several separate clusters or lines of turbines in the Wadden Sea and the IJsselmeer. There were no alternatives for a design alongside the Afsluitdijk, neither north nor south of the dyke. These were excluded on technological grounds, such as 'potential safety issues', including road traffic and recreational air traffic (IPWA, 2001a, p.28). An alternative option of turbines solely in the Ijsselmeer, avoiding the Habitats-directive area of the Wadden Sea, was not defined either. Hence, the most important decisions, about the landscape type of the site, were made in the scoping phase. These choices, made rather premature without consultation, have later become major impediments for successful planning, because they were not acceptable to societal stakeholders.

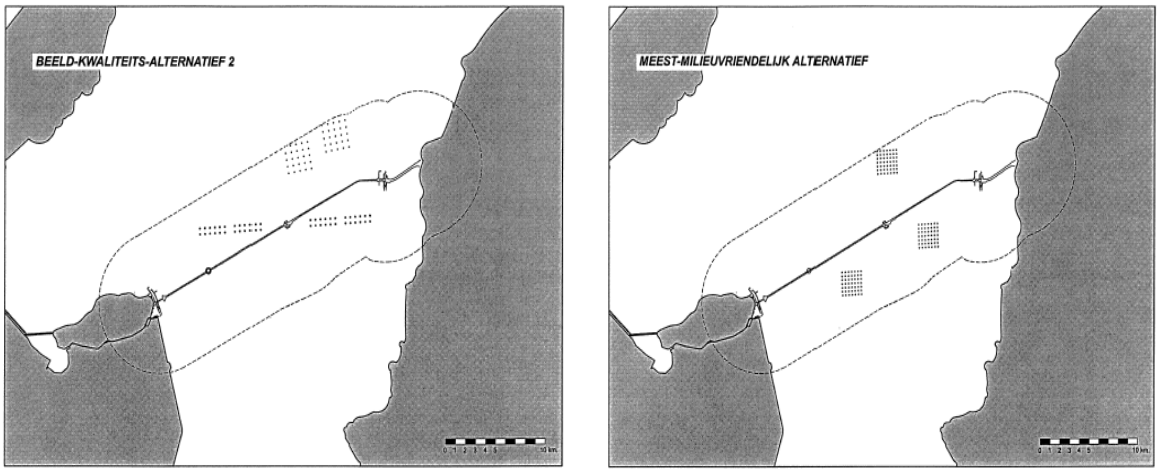

Figure 3. Two alternatives defined in the EIA: 'Image quality alternative2', 294 MW (left) and the legally mandatory 'Alternative most favourable to the environment, 294 MW (right).
(Source: IPWA, 2001a, EIS; provinces of North-Holland and Fryslan).

In the preparation of the EIS, the differences in environmental impact such as on birds, nature reserves, mussels, seals, etc. appeared rather small. Eventually, the choice between the three developed alternatives was made based on a judgement of the Government's official State Architect and his decision was based on visual assessment only. His assessment literally states that according to the Image Quality Alternative 1 "the linear design justifies the linearity of the Afsluitdijk, which leads obviously to an increased readability of the situation" (IPWA, 2001b, p.5). Setting aside that it is rather enigmatic what the meaning of this phrase could be, there is no reference whatsoever in the documents to any perception-based method that is used. According to Parsons and Daniel (2002) and Lothian (1999) in such cases it is crucial to apply a method that assesses landscape quality interaction as it is actually perceived by the viewers.

Several civil society groups, led by the WaddenVereniging, immediately challenged the final decision. An analysis of the acceptability assessments of the members may clarify why.

5. Acceptability as perceived by members of the WaddenVereniging

5.1 Conditional environmentalists' acceptance

To investigate the most important questions for the members of its most prominent environmental protection group, a survey was held among them. For that purpose, a classification of nineteen different landscape types covering the entire area was presented in the survey. These do not reflect a landscape typology, but a list of single criteria, which can range from generic or specific linear man-made features and built-up elements, to land uses and different water bodies in the area. These nineteen types are defined in a way that they would be meaningful for the respondents. The survey questions concerned:

- The general support for or rejection of wind power developments in the area. This was measured with a strong reliable 6-item scale (Cronbach's α=.83; Wolsink, 2007).
- A separate assessment of each of the nineteen landscape types in terms of its acceptability for siting wind turbines.

Furthermore, because the board of the WaddenVereniging wanted to develop a new approach to the application of wind power in the entire region, the objective of the survey was to find explanations for the varying acceptance levels among the members. Several scales were used to measure perceptions of energy issues, environmental issues, and design factors, such as hub-height of turbines, size of wind farms, and siting patterns. As regards the first question, the position that was supported by the majority of the members was conditional acceptance in selected areas. An analysis of the factors explaining the variance in the general acceptability is given in Wolsink (2007). In summary, the survey showed that these pre-defined landscape characteristics were the dominant factor in the respondents' acceptability of windfarms. This fully overshadows any other factor, including general perceptions of implementing wind power or other energy sources, for example the contribution of wind energy to slowing down climate change. Other insignificant explanations for support for or resistance to wind power developments in the area are the visual factors of size and how to design wind power facilities (Wolsink, 2007, table 3 p.2698). These results confirm the familiar pattern of the dominance of the landscape issue in that is usually found in acceptability studies of wind energy (recent example: Johansson and Laike, 2007).

5.2 Largely varying acceptability of sites

Because of this dominating influence of landscape quality on proposed turbine sites, we will focus on the strongly deviating assessments of the predefined landscape types. Even from the point of view of affecting the quality of the landscape and the consequences for the chosen location, most members of the WaddenVereniging think that there will still be suitable wind turbines sites, even in a sensitive area like the Wadden Sea. The majority rejected about half of these landscape types (fig.4). Two examples are the dunes along the North Sea coast and the landscape around tows and villages, but we will see these two are rejected for different reasons. Some other locations were considered suitable places for wind turbines by about half the members, and some by a clear majority. Industrial areas and military training grounds, both of which are harshly criticized by environmentalists, were generally found acceptable. As regards other types, the majority of members who do not oppose turbines in the Wadden region tend to view sites in some other landscapes acceptable as well, and some of these suitable sites offer many opportunities to generate large quantities of wind power capacity. Remarkable, in particular in relation to the IPWA scheme described in the previous sections, turbines sited alongside the 32 km Afsluitdijk, which separates the Wadden Sea from the IJsselmeer, were generally considered fairly acceptable. Nevertheless, the Inter Provincial Wind farm Afsuitdijk was immediately contested by the WaddenVereniging. This raises the question why they did this while the members seem to accept wind turbines alongside the Afsluitdijk.

The variability in the acceptability of wind turbines is enormous, as is illustrated in figure 4. There we can see that the judgements do not simply follow one pattern. Acceptability of wind turbines in a landscape is not simply one-dimensional. The quality of distinguished landscape types can be described by several different variables, and these may be of varying significance for a personal assessment of acceptability regarding wind turbines. In figure 5 the first two dimensions of a multiple scale analysis (Proxcal) are presented for the acceptability judgement on the nineteen landscape types. This was an analysis of similarities between the judgements. The one-dimensional acceptability of landscape types can be recognized in figure 5 from above left (rejection) to right below (acceptance). The most important first dimension can be interpreted as a reflection of the acceptability of siting turbines regarding the degree to which landscapes are viewed as 'spoiled' or 'unspoiled'. On the second dimension the acceptability seems to reflect the proximity of landscape types to places where people frequently stay.

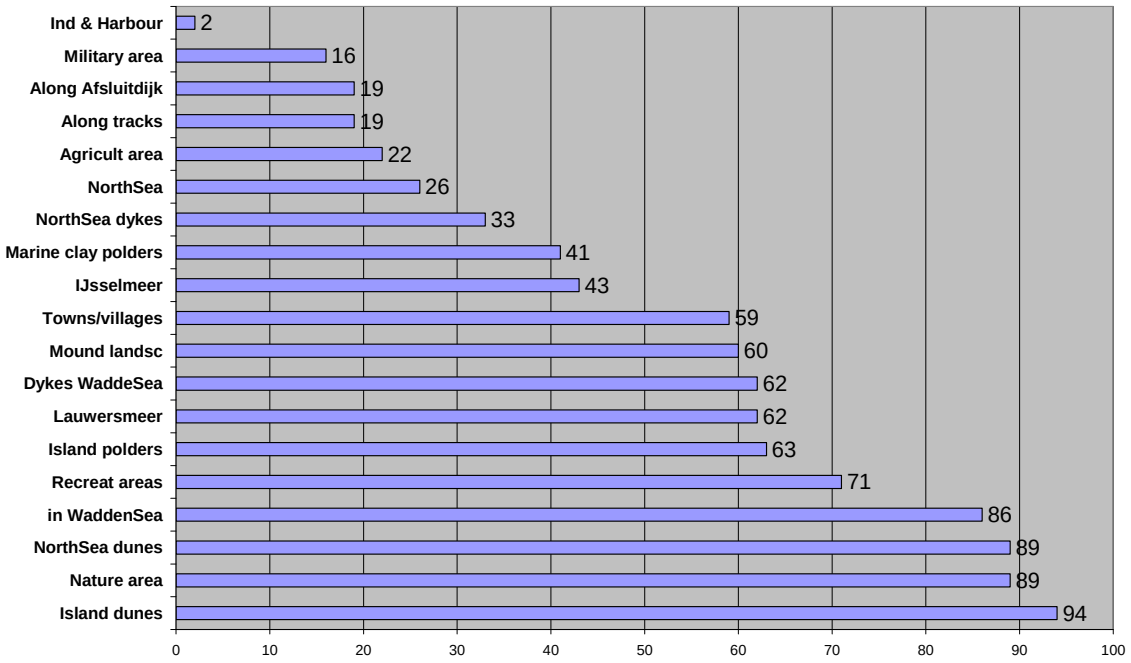

Figure 4. Percentage of WaddenVereniging members rejecting wind turbines sited in Wadden areas with different landscape types
(position 4,5 from five-point scale from 1 'fully acceptable' to 5 'fully unacceptable'; N = 535; median of the neutral position '3.0' between North Sea Dykes and Marine clay polders).

5.3 Similarly assessed landscape types

The judgments about acceptability regarding wind turbines can also be approached from the other side, not looking at the variety among the judgment but at the similarities. Figure 5 also shows the result of a cluster analysis that is grouping types that are assessed fairly similar. Landscape types that have minimal differences in acceptability ratings are grouped within one cluster according to minimal variance within clusters and maximal variance between clusters. A hierarchical cluster analysis (Ward's method) revealed that a presentation of four clusters seems most appropriate, and in the next step a relocation analysis (variance criterion) was carried out on four clusters:

- The largest cluster represents ten landscapes, which are all types that are in use by civilians, such as 'tracks' (railways, roads, waterways), villages and towns, recreational areas, polders on the Wadden islands, marine clay polders, and other areas that are in use for agricultural purposes. At first sight two landscape types in this cluster seem to be different. The Lauwersmeer is a former small inlet that has been dyked and poldered about three decades ago. This is why it is probably assessed like other polders, whereas the assessment is also close to ecologically valued areas, which can be explained by the fact that a part of this former estuary is currently a nature reserve. The mound landscape is apparently classified as landscape that is close to residential areas and polders. Many mounds are actually close to dwellings or still in use for buildings.
- The second cluster is representing four landscape types that are clearly rejected for wind power. These are all highly ecologically valued landscapes, such as dunes along the North Sea, on the islands, other nature

protected areas. Striking is the fact the Wadden Sea itself is judged similarly to other places of high ecological value. These are fully rejected for siting wind turbines (fig.4).

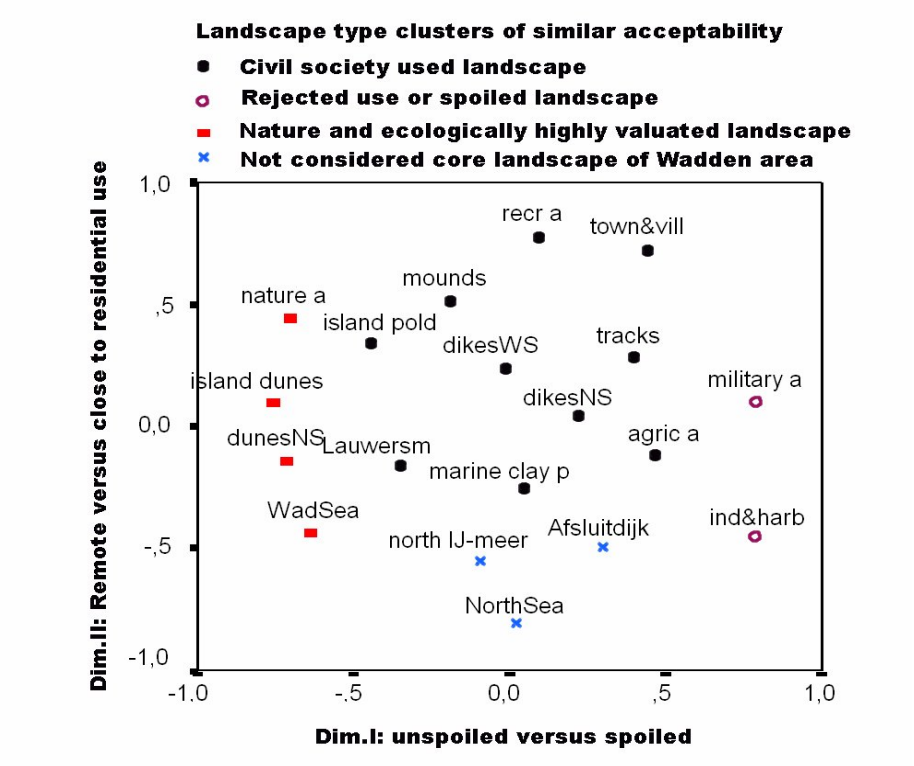

Figure 5. Two dimensional scaling and cluster analysis of 19 landscape types.
Proximity scaling (PROXCAL, Norm. raw stress .061) using Squared Euclidian Distances (N=535; Scaling factors: I: 1.07; II: .91)
Cluster analysis: Ward's method (variance criterion).

- The third cluster represents three landscape types that are fairly peripheral to the ecological values in the Wadden area. These include the North Sea, the IJsselmeer, and the Afsluitdijk.
- The fourth small cluster is representing types that are viewed as already modified and insensitive for turbine siting, so these are considered highhly acceptable: harbours and industrial areas.

The physical and spatial complexity of landscape has clear consequences for the social acceptability of wind power. These complexities, combinations of built environment, places of scenic value, ecological value, significance to infrastructure etc., must be taken into account when wind power schemes are developed. The IPWA scheme was clearly not based on a good understanding of how people perceive the landscape, and why. In the EIA process no investigation was included on the complexities of landscape perceptions. There was neither a reference to such investigations regarding the acceptability of wind turbines. Consequently, the perceptions of members of the WaddenVereniging, that have strong feelings of identification with the landscape in the area, are fundamentally different from the choices that were made in the IPWA proposal.

The IPWA proposed three locations. Two of these were situated in the Wadden Sea, a landscape type that was convincingly rejected by the environmentalists and in terms of suitability for windfarms it is perceived similar to nature protection areas (fig.5). The third site is the north of the IJsselmeer, which is perceived as more peripheral to the values associated with the Wadden, and its acceptability as a site for wind turbines is moderate (fig.4). The most striking fact, however, is the perception of the landscape type that is not used at all in the IPWA scheme, because it was excluded in the scoping phase. The Afsluitdijk is similarly assessed as the IJsselmeer and the North Sea, as being peripheral to what members valued about the Wadden area. Its acceptability for wind turbines to the environmentalists (fig.4) is fully neglected. Although the IPWA is named after the Afluitdijk, the turbines are not sited alongside this dyke but precisely on a location that is considered too sensitive.

6. Discussion and conclusion

The case illustrates major factors causing failure of establishing a large near-shore windfarm in the Netherlands. Onshore, the main determinants of social acceptance of wind power schemes are always connected to landscape issues. In offshore or near shore cases, the landscape (seascape) is used by other stakeholders than the ones involved onshore, but certainly not with less vested interests and less contrasting values. Onshore the acceptability is strongly informed by factors such as institutional fit to policies and politics, markets in different sectors, intra-firm acceptance etc. (Wüstenhagen et al., 2007), and to (co-)ownership and community involvement. The first near-shore windfarm worldwide, Middelgrunden in Denmark, was a community owned wind farm. 'Sense of ownership' (Warren and McFadyen, 2009, this issue) and community involvement seem also important in cases of coastal communities (e.g. Jay, 2008). Within the issues that people in such communities highly value, the question how to fit turbines to the type of landscape overshadows other aspects, even the other visual and scenic factors such as the design of wind turbines, lay out of the wind farms, and the number and the size of turbines (Burrall, 2004; Wolsink, 2007; Johansson and Laike, 2007). The factor of positively connecting the new kind of energy generation with the landscape (or seascape), remains crucial. New landscape representations emerge with the development of renewable energies, and planning and decision-making must find ways to create synergy between the two (Nadaï and Labussière, 2009 this issue). Although some of the acceptance issues mentioned above may become manifest differently offshore, they certainly do not vanish.

In the case of the IPWA, the obvious stakeholder to include in the process was the WaddenVereniging, an organization with member that fully identify themselves with the Wadden Sea. The landscape type was the strongest reason for the members to determine whether they would oppose a wind turbine development or not. Because they were not involved in the planning of the IPWA proposal, and neither any sense of local (or even regional) ownership was created, the WaddenVereniging only considered the IPWA as a threat and opposed to it. Although a threat of wind turbines is always highly determined by their visibility, the survey showed that eventually the landscape types that should be most protected according to the members of the WaddenVereniging, all concern ecologically highly valued and sensitive sites. The survey also showed that turbines are not considered a threat in all types of landscape. If landscape types had been selected that most members consider as sites suitable for wind turbines, the situation that the turbines are seen as threatening could have been avoided.

Once all alternatives in the planning phase were located at unacceptable locations, negotiations about the most important issue, how to create a positive fit between the landscape and the turbines, were impossible. Planners like to focus such discussions on lay-out and design of the wind farm (colour, hight, thickness, or number of turbines), but this is not a major factor affecting acceptability (Wolsink 2007). The consequence is, in particular, that once a discussion about a proposal for a wind farm is started, the process can be fruitful only if the 'real issues' are taken into account and negotiated. 'Real issues' are all those raised by the participant actors, not the ones selected from the planners officer's perspective. And the 'real issue' in wind farm decision-making is the landscape 'in the eye of the beholder' (Lothian, 1999). Hence, actors with strong ideas about landscapes suitable for wind turbines, because they hold a strong commitment and bring in their knowledge (van den Berg and Vlek, 1998), should be involved in the phase that in the planning decisions are taken. The wide variety of acceptability of different landscape types in this study is only new evidence of that fact, and recently Ladenburg (2009) presented similar evidence of the importance seascapes in a study on two offshore windfarms in Denmark. Variation in this factor can be created only if the actual site can be discussed in relation to a range of alternative sites. If planners, investors and authorities are not prepared to do so, concerned stakeholders and the public may easily feel that the main issue is not being discussed seriously, and the proponent will have to face the consequence of straight opposition.

The involvement of other stakeholders in decision-making may also enclose the strategic creation of alliances. The acceptability offshore will also become dependent on the possibilities to create alliances with other interest that exist at sea. An interesting example is a study on the options to create wind farms that also apply marine cultures of *Mytilus edulis* (mussels; Michler-Cieluch et al., 2009). The alliance in this case should have been with the part of society that is most commited to the area, the enevironmental movement. In the IPWA case, hewever, there was neither room for involvement, nor for building alliances.

In principle, the EIA process provides opportunities to include such approaches that stimulate mutual learning among actors (Saarikoski, 2000). This approach was clearly not applied in the planning and the EIA process of the IPWA, in which the list of actors involved in the process of framing the project was limited to tiers of government and a power company. This style of planning in not uncommon in the Netherlands. The exclusion of actors that are unmistakenly major stakeholders was a choice that is rooted in a corporative tradition, that also exists in other domains of environmental decision making (Wolsink, 2004). The Dutch EIA system has only obligations for consulting the public after the major framing decisions are made, not for participation in the early phases of planning. In this case, the result was that the largest wind power development ever proposed in the Netherlands (278 MW) failed. The government almost exclusively relied on a planning model that has been effectively characterized

by Snary (2004) as the “planners’ officers perspective”. This one-dimensional planning perspective still remains the dominant approach in Dutch infrastructure planning. It includes easy assumptions about the motives of all potential opponents: residents merely 'protecting their 'turf'', exclusively focusing on their 'backyard', instead of being motivated by place identity (Devine-Wright, 2009; Van der Horst, 2007), and community commitment (Wolsink and Devilee, 2009). In line with this planners' perspective, the most important societal stakeholders were not included in the planning process, but this case study demonstrates once again the consequences of planning the wind farm top-down and centralized. The top-down approach, combined with the exclusion of crucial actors led to disregard of the values that were represented by those excluded actors, whereas the options for their conditional support were neglected. Subsequently, they used their strategic influence to obstruct the entire project. Eventually, the refusal at the governmental level to apply a planning style for renewables that effectiveley includes communities and significant stakeholders and also creates sense of ownership, may be considered as a lack of social acceptance of renewable energy innovation at the socio-political level (Wüstenhagen et al. 2007). It confirms what has already been observed in many countries, that the development of wind power highly depends on the degree to which planning regimes stimulate or impede collaborative approaches to the development of wind power schemes (Hedger, 1995; Lund, 2000; Aitken et al., 2008). Currently, among researches there is growing consensus that this is one of the strongest factors determining the success of wind power deployment (Cowell, 2007; Wolsink, 2007; Toke et al., 2008; Agterbosch et al., 2009), and this probably also applies to offshore planning (Jay, 2008). International comparison reveals that planning systems that favour collaboration of local and regional actors and economic support systems that stimulate the involvement of communities in local projects have astrong influence on success rates (Breukers and Wolsink, 2007b). Although the stakes are different, our case shows that these conclusions also seem to hold for near-shore wind power.

In the development of the alternatives in the IPWA, it was the planning officers’ perspective that determined the approach of the process of scheme development. Besides the choice for a limited, closed arena, this approach was illustrated by the technocratic way the ultimate choice between the three alternatives was made. Although it has been known for a long time that this approach is counterproductive on most occasions, governments in many countries show a low acceptance of this part of renewable energy innovation’s requirements. The model of ‘rational’ top-down planning of wind power is still propagated by developers, authorities and policy makers, and it is also applied in current schemes of large near-shore wind power (Havgul, 2008). In the Wadden Sea case, this emphasis eventually resulted in a total failure. It can be expected that the idea that wind farms at sea are a way to escape the troubles of building wind farms onshore, combined with the technocratic top-down approach for planning, will result in many more of such failures in the coming decade.

Acknowledgements

Data were collected by the University of Groningen by order of the special advisory committee of the WaddenVereniging, and by the author who was a member of the committee. Furthermore, the author thanks Dan van der Horst and two reviewers for valuable comments.

References

Agterbosch, S., Meertens, R.M., Vermeulen, W.J.V., 2008. The relative importance of social and institutional conditions in the planning of wind power projects. *Renewable and Sustainable Energy Reviews* 13 (2), 393-405.

Aitken, M., McDonald, S., Strachan, P., 2008. Locating ‘power’ in wind power planning processes: the (not so) influential role of local objectors. *Journal of Environmental Planning and Management* 51 (6), 777-799.

Bell, S., 1999. Landscape: Pattern, perception and process. Routledge, New York.

Bishop, I.D., Miller, 2007. Visual assessment of off-shore wind turbines: The influence of distance, contrast, movement and social variables. *Renewable Energy* 32 (5), 814-831.

Bohn, C., Lant, C., 2009. Welcoming the wind? Determinants of wind power development among U.S. states. *The Professional Geographer* 61 (1), 87-100.

Breukers, S., Wolsink, M., 2007a. Wind energy policies in the Netherlands: Institutional capacity-building for ecological modernisation. *Environmental Politics* 16 (1), 92-112.

Breukers, S., Wolsink, M., 2007b. Wind power in changing institutional landscapes: An international comparison. Energy Policy 35 (5), 2737-2750.

Burrall, P., 2004. Putting wind farms in their place. *Town and Country Planning* 73 (2), 60-63.

Chilla, T., 2007. The political relevance of discourses on space. The example of the EU nature conservation policy. *Erdkunde* 64 (1), 13-25.

Costanza, R., D'Arge, R., deGroot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'Neill, R.V., Parueleo, J., Raskin, R.G., Sutton, P., van den Belt, M., 1997. The value of the world's ecosystem services and natural capital. *Nature* 387, 253-260.

Cowell, R., 2007. Wind power and 'the planning problem': The experience of Wales. *European Environment* 17 (5), 291-306.

CWSS, 2008. Common Wadden Sea Secretariat of the Trilateral Wadden Sea Cooperation, Wilhelmshaven (D) <cwss.www.de> accessed 29/12/2008

Danielson, O., 1995. Viewpoint: large-scale wind power in Denmark. *Land Use Policy* 12 (1), 60-62.

de Jonge, V.N., Essink, K., Boddeke, R., 1993. The Dutch Wadden Sea. A changed ecosystem. *Hydrobiologia* 265 (1-3), 45-71.

Devine-Wright, P., 2009 in press. Rethinking NIMBYism: The role of place attachment and place identity in explaining place-protective action. *Journal of Community & Applied Social Psychology* 19, doi:10.1002/casp.1004

Dijkema, K.S., 1997. Impact prognosis for salt marshes from subsidence by gas extraction in the Wadden Sea. *Journal of Coastal Research* 13 (4), 1294-1304.

Disco, C. 2002. Remaking "Nature": The ecological turn in Dutch water management. *Science, Technology & Human Values* 27 (2), 206-235.

Drent, R., Both, C., Green, M., Madsen, J., Piersma, T., 2003. Pay-offs and penalties of competing migratory schedules. *Oikos* 103 (2), 274-292.

Ellis, G., Barry, J., Robinson, C., 2007. Many ways to say 'No', different ways to say 'Yes': Applying Q-methodology to understand public acceptance of wind farm proposals. *Journal of Environmental Planning and Management* 50 (4), 517-551.

Firestone, J., Kempton, W., Krueger, A. 2009. Public Acceptance of Offshore Wind Power Projects in the USA. *Wind Energy* 12 (2), 183-102.

Gill, A.B., 2005. Offshore renewable energy : Ecological implications of generating electricity in the coastal zone. *Journal of Applied Ecology* 42 (4), 605-616.

Gonzalez, M.I., Estevez, B., 2005. Participation, communication and negotiation in environmental conflicts: Offshore wind energy in the Trafalgar Sea area. *Arbor-Ciencia Pensamiento y Cultura* 181 (715), 377-392.

Gray, T., Haggett, C., Bell, D., 2005. Offshore windfarms and commercial fisheries in the UK: A study in stakeholder consultation. *Ethics, Place and Environment* 8 (2), 127-140.

Haggett, C, 2008. Over the sea and far away? A consideration of the planning, politics and public perception of offshore wind farms. *Journal of Environmental Policy and Planning* 10 (3), 289-306.

Havgul, 2008. Havsul – Ren kraft fra nordvest. http://www.havsul.no/files/oversiktskart.pdf accessed 28/12/2008.

Hedger, M.McKenzie, 1995. Wind power. Challeges to planning policy in the UK. *Land Use Policy* 12 (1), 17-28.

Imeson, R.J., van den Bergh, J.C.J.M., 2006. Policy failure and stakeholder dissatisfaction in complex ecosystem management: The case of the Dutch Wadden Sea shellfishery. *Ecological Economics* 56 (4), 488– 507.

IPWA, 1999. Nut en Noodzaakanalyse IPWA ('Utility and necessity analysis') Advisory Commity Borger, Resource analysis, Delft.

IPWA, 2001a. Windpark Afsluitdijk, Planologisch Basisdocument en MER deel 1 en 2. Provinces of North-Holland and Friesland (CD-ROM).

IPWA, 2001b. Letter to the Minister of Economic Affairs. Provinces of North-Holland and Friesland (CD-ROM)

Jay, S.A., 2008. *At the margins of planning. Offshore wind farms in the United Kingdom.* Ashgate, Aldershot.

Johansson, M., Laike, T., 2007. Intention to respond to local wind turbines: the role of attitudes and visual perception. *Wind Energy* 10 (5), 435-451.

Ladenburg, J., 2008. Attitudes towards on-land and offshore wind power development in Denmark; choice of development strategy. *Renewable Energy* 33 (1), 111-118.

Ladenburg, J. 2009. Visual impact assessment of offshore wind farms and prior experience. *Applied Energy* 86 (3), 380-387.

Lancewadplan, 2009. http://www.lancewadplan.nl/fileadmin/lancewad/pdf_files/Westergo_kaart.pdf accessed 14/1/2009

Lothian, A., 1999. Landscape and the philosophy of aesthetics: is landscape quality inherent in the landscape or in the eye of the beholder? *Landscape and Urban Planning* 44 (4), 177-198.

Lotze, H.K., 2005. Radical changes in the Wadden Sea fauna and flora over the last 2,000 years. *Helgoland Marine Research* 59 (1), 71-83.

Lund, H., 2000. Choice awareness: The development of technological and institutional choice in the public debate of Danish energy planning. *Journal of Environmental Policy and Planning* 2 (30), 249-259.

Marquenie, J.M., Verburgh, J.J., 1998. Impact assessment on exploration drilling in the Wadden Sea. *The Netherlands Journal of Hazardous Materials* 61 (1-3), 393-396.

Michler-Cieluch, T., Krause, G., Buck, B.H., 2009. Reflections on integrating operation and maintenance activities of offshore wind farms and mariculture. *Ocean & Coastal Management* 52 (1), 57-68.

Nadaï, A., Labussière, O., 2009. Wind power planning in France (Aveyron), from state regulation to local planning. *Land Use Policy* 26 (3), 744-754.

Opdam, P., Steingrover, E., van Rooij, S., 2006. Ecological networks: A spatial concept for multi-actor planning of sustainable landscapes. *Landscape and Urban Planning* 75 (3-4), 322-332.

Parsons, R., Daniel, T.C., 2002. Good looking: in defense of scenic landscape aesthetics. *Landscape and Urban Planning* 60 (1), 43-56.

Saarikoski, H., 2000. Environmental impact assessment (EIA) as collaborative learning process. Environmental Impact Assessment Review 20 (6), 681-700.

Scott, K.N., 2006. Tilting at offshore windmills: Regulating wind farm development within the renewable energy zone. *Journal of Environmental Law* 18 (1), 89-118.

Soerensen, H.C., Hansen, L.K., Hammarlund. K., Larsen, J.H., 2001. Experience with strategies for public involvement in offshore wind projects. *International Journal of Environmental and Sustainable Development* 1 (4), 327-336.

Snary, C., 2004, Understanding risk: The planning officers' perspective. *Urban Studies* 41 (1), 33-55.

Snell, T., Cowell, R., 2006. Scoping in environmental impact assessment: Balancing precaution and efficiency? *Environmental Impact Assessment Review* 26 (4), 359-376.

Still, D., 2001. Offshore Wind at Blyth. *Renewable Energy* 24 (3-4), 545-551.

Toke, D., Breukers, S., Wolsink M., 2008. Wind power deployment outcomes: How can we account for the differences? *Renewable and Sustainable Energy Reviews* 12 (4), 1129-1147.

Tong, K.C., 1998. Technical and economic aspects of a floating offshore wind farm. *Journal of Wind Engineering and Industrial Aerodynamics* 74, 399-410.

van den Berg A.E., Vlek, C.A.J., 1998. The influence of planned-change context on the evaluation of natural landscapes. *Landscape and Urban Planning* 43 (1-3), 1-10.

van der Horst, D., 2007. NIMBY or not? Exploring the relevance of location and the politics of voiced opinions in renewable energy siting controversies. *Energy Policy* 35 (5), 2705-2714.

van Waarden, F., 1992. Dimensions and types of Policy Networks. *European Journal of Political Science* 21, 29-52.

von Haaren, C., Reich, M., 2006. The German way to greenways and habitat networks. *Landscape and Urban Planning* 76 (1-4), 7-22.

Vorkinn, M., Riese, H., 2001. Environmental concern in a local context. The significance of place attachment. *Environment and Behavior* 33 (2), 249-263.

Warren, C.R., McFadyen, M., 2009. Does Community ownership affect public attitudes to wind energy? A case study from south-west Scotland. *Land Use Policy* 27, doi:10.1016/j.landusepol.2008.12.010

Wolsink, M., 2004. Policy beliefs in spatial decisions: Contrasting core beliefs concerning space-making for waste infrastructure. *Urban Studies* 41 (13), 2669-2690.

Wolsink, M., 2006a. Invalid theory impedes our understanding: a critique on the persistence of the language of nimby. *Transactions Institute of British Geographers* 31 (1), 85-91.

Wolsink, M., 2006b. River basin approach and integrated water management- Governance pitfalls for the Dutch Space-Water-Adjustment Management Principle. *Geoforum* 37 (4), 473-487.

Wolsink, M., 2007. Planning of renewables schemes. Deliberative and fair decision-making on landscape issues instead of reproachful accusations of non-cooperation. *Energy Policy* 35 (5), 2692-2704.

Wolsink, M., Devilee, J., 2009. The motives for accepting or rejecting waste infrastructure facilities. Shifting the focus from the planners' perspective to fairness and community commitment. *Journal of Environmental Planning and Management* 52 (2), 217-236.

Wüstenhagen, R., Wolsink, M., Bürer, M.J., 2007. Social acceptance of renewable energy innovation: An introduction to the concept. *Energy Policy* 35 (5), 2683-2691.