The Effects of Wind Power on Human Interests

A Synthesis

MARIANNE HENNINGSSON, SOFIA JÖNSSON, JOHANNA BENGTSSON RYBERG, GÖSTA BLUHM, KARL BOLIN, BOSSE BODÉN, KRISTINA EK, KARIN HAMMARLUND, INGA-LENA HANNUKKA, CARINA JOHANSSON, SANNA MELS, TOM MELS, MATS NILSSON, ERIK SKÄRBÄCK, PATRIK SÖDERHOLM, ÅSA WALDO, INGEGÄRD WIDERSTRÖM AND NIKLAS ÅKERMAN

REPORT 6545 • JANUARY 2013

VINDVAL

The Effects of Wind Power on Human Interests

A synthesis report

Johanna Bengtsson Ryberg[2], Gösta Bluhm[3], Karl Bolin[4], Bosse Bodén[5], Kristina Ek[6], Karin Hammarlund[7], Marianne Henningsson[1], Inga-Lena Hannukka[8], Carina Johansson[9], Sofia Jönsson[1], Sanna Mels[9], Tom Mels[9], Mats Nilsson[3,10], Erik Skärbäck[7], Patrik Söderholm[6], Åsa Waldo[11], Ingegärd Widerström[12], Niklas Åkerman[13]

1. Linnaeus University, Department of Psychology, Kalmar
2. Environmental Protection Agency, Stockholm
3. Karolinska Institute, Environmental Medicine, Stockholm, Sweden
4. KTH, Royal Institute of Technology, Stockholm
5. Mid Sweden University, Economy, Östersund
6. Luleå University of Technology, Environmental Finance / Economics, Luleå
7. Swedish University of Agricultural, Human Geography / Landscape Architecture, Alnarp
8. Vattenfall, Stockholm
9. Gotland University, Human Geography, Visby
10. Stockholm University, Environmental Psychology, Stockholm
11. Lund University, Sociology, Lund
12. Consultant, Wilark AB, Kalmar
13. Linnaeus University, School of Economics, Kalmar

SWEDISH ENVIRONMENTAL
PROTECTION AGENCY

Order
Phone: + 46 (0)8-505 933 40
Fax: + 46 (0)8-505 933 99
E-mail: natur@cm.se
Address: Arkitektkopia AB, Box 110 93, SE-161 11 Bromma, Sweden
Internet: www.naturvardsverket.se/publikationer

The Swedish Environmental Protection Agency
Phone: + 46 (0)10-698 10 00, Fax: + 46 (0)10-698 10 99
E-mail: registrator@naturvardsverket.se
Address: Naturvårdsverket, SE-106 48 Stockholm, Sweden
Internet: www.naturvardsverket.se

ISBN 978-91-620-6545-4
ISSN 0282-7298

Electronic publication
Cover photos: Image archive and Marianne Henningsson

NORDIC ECOLABEL
341 506
Printed Matter

Preface

There is a great need for knowledge concerning the impacts of wind power on humans, landscapes, the marine environment, birds, bats and other mammals.

Previous studies of these environmental impacts have lacked an overall view of the effects. This has led to deficiencies in the processes surrounding the establishment of new wind farms. Vindval is a knowledge programme undertaken as a collaboration between the Swedish Energy Agency and the Swedish Environmental Protection Agency. Its aim is to gather and communicate scientific knowledge about the impacts of wind power on people and the natural environment. The programme continues until 2013.

Vindval comprises some 30 individual research projects, together with four synthesis projects. Syntheses are prepared by experts, who compile and assess overall research results and experience regarding the effects of wind power in four different areas – humans, birds/bats, marine life and terrestrial mammals.

The results of this research and synthesis work will provide a basis for environmental impact assessments and for the planning and permitting processes associated with wind power installations. Vindval requires high standards in the review and approval of research proposals, in order to ensure high-quality reports. The same high standards apply to the reporting, approval and publication of research results from the projects.

This report was written by Johanna Bengtsson Ryberg, Gösta Bluhm, Karl Bolin, Bosse Bodén, Kristina Ek, Karin Hammarlund, Marianne Henningsson, Inga-Lena Hannukka, Carina Johansson, Sofia Jönsson, Sanna Mels, Tom Mels, Mats Nilsson, Erik Skärbäck, Patrik Söderholm, Åsa Waldo, Ingegärd Widerström, Niklas Åkerman.

This report is a translation of the previous report in swedish "Vindkraftens påverkan på människors intressen" (Naturvårdsverket report no 6497). Translated by Sofia Jönsson.

The contents of the report are the responsibility of the authors.

The Vindval Programme, January 2013

Summary

The aim of the project The Effects of *Wind Power on Human Interests* is to describe, analyse and value research on how wind power may affect human interests, and to present: 'what we can say based on what we know today". The report addresses managers, officials, wind power projectors and also the general public. Research on how wind power may affect health, economy and businesses, and the landscape is analysed. The process of gaining approval for wind power connected to the above mentioned interests is also studied and valued. The report begins with aims and targets (Chap 1), and discusses issues connected to people´s interests. The method is described and the participating researchers are presented. Then the following four themes are analysed: *Health* (Chap 2): noise, shadows, reflexes, and light; perceptions of annoyance; sleep disorder; symptoms; illnesses; worry. *Economy and businesses* (Chap 3): labour market effects; external costs; effects on other market sectors (e.g. tourism, recreation and reindeer industry); effects not valued by the market; property prices; ownership and co-operatives; compensation mechanisms. *Landscape* (Chap 4) discusses: landscape analysis and planning; perceptions of landscape values; natural and cultural environments; leisure and recreation. *Acceptance and support* (Chap 5) discusses issues on: the opposition by the public (attitudes and participation); institutional relations (planning and consultation); public participation; communication; code of conduct. Discussion, analyses, conclusions, recommendations and gaps of knowledge are included in Chapter 6.

Wind power is a renewable energy source. As a part of decreasing global warming, there is a huge need for developing such energy sources. Wind power is expanding in Sweden, as well as in Europe and in other parts of the world. In Sweden, the goal is to reach 50 % renewable energy by 2020. Wind power is expanding most in China, USA and in India. In Europe, Germany and Spain have the largest number of wind power plants. The expansion of wind power affects people´s interests differently depending on whether the person is a land owner, a permanent resident, summer resident or a tourist. These interest groups perceive and use the landscape in different ways. A person seeking for tranquility and calmness may be disturbed by a wind power plant, whereas aland owner views a wind power plant as a source of income.

In Sweden, most people are positive about renewable energy. Enquiries made by the SOM Institute (Society, Opinion, Media), in 2010, showed that 87 % of the public believed that wind power is environmentally friendly. 57% were very, or rather, positive about a wind power establishment in their own municipality. 40 % percent were positive or rather positive about wind power plants close to their own home (13 % very positive, 27 % rather positive) or close to their summer house (14 % very positive, 26 % rather positive). People may have both positive and negative attitudes towards wind power. If a wind power establishment is planned in a landscape that people have special Relationship with, the attitudes towards wind power may become negative or

sceptical, even by someone who has a positive attitude towards wind power in general. The visual impact may be an important factor contributing to negative attitudes towards wind power, if a wind power plant is established in the near surroundings.

An individual's ability to influence the wind power process also influences the attitude.

HEALTH AND ILLNESS

Noise is the most frequently discussed issue within the field of health, and it also comprises the largest field of research. Sounds from wind power plants may be perceived as annoying. The disturbance mostly depends on repeating throbbing, pounding, swishing sounds occurring when the rotor blades pass through the air. The visual effect, including moving shadows and flicker from wind power plants, may increase the disturbance effect. Wind power noise is more annoying than traffic noise at the same equivalent sound levels. One contributing reason for this may be, except for the visual effect, that wind power plants are often established in areas having low background sounds. Noise from wind power is measured at the house facade at a wind speed of 8 m/sec on 10 m height. The noise is varying depending on the time of day, on the weather and on wind conditions. The perceived exposure is supposed to be more annoying during evenings and nights.

Up at the rotor blade level, the wind can be very strong at night, whereas the wind decreases at ground level. This reinforces wind power noise and decreases masking sounds. The throbbing, swishing sound from wind power plants has its essential energy within the frequency field of 500–1,000 Hz. The plants also generate low frequency sounds (20–200 Hz) and infrasound (1–20 Hz) as a consequence of the turbulence and the pressure fluctuations at the blades, and at pressure compressions when the blade is passing the tower. Research agrees on the fact that wind power plants are generating infrasound levels, at living areas, far below audible levels. Today, no scientific evidence could be found supporting that infrasound at these levels could contribute to noise disturbance or to other health effects.

In the low frequency field (20–200 Hz), the wind power plant generates sounds that in many situations are audible. This is not unique to wind power, but is valid for most noise sources in society, for example road traffic noise. The proportion of low frequency sounds from wind power plants will increase as the turbines become bigger. The National Board of Health and Welfare stated standard values for sounds with high low frequency levels indoors. It is important that these levels are not exceeded.

The Environmental Protection Agency´s standard value for wind power noise in living areas is 40 dBA, which refers to sounds from wind power plants outside the living area, at the wind speed of 8 m/sec and at 10 m height. Studies on perceived wind power noise in Sweden and in the Netherlands showed that approximately 10–20 % of people living within the interval of 35–40 dBA from a wind power plant reported annoyance (rather annoyed or very annoyed) by sound from wind power (e.g. levels below the standard value of 40 dBA) and 6 % reported that they were very much annoyed. A correlation between self-reported sleep disorder and wind power sounds is reported, but there are also results showing no correlation.

Shadows from the rotor blades can be perceived as disturbing. Shadows appear at certain times in sunny weather. Reflexes from the rotor blades and continuous lighting can also be perceived as disturbing. Houses that are located in places north west to north east of a wind power plant are most affected by shadow disturbances. There are technical solutions to eliminate such effects.

Statements such as wind power causing 'vibroacoustic disease", 'wind power syndrome" and damage to the inner ear due to infrasound effects, are statements with no scientific evidence.

The importance of distance to noise disturbance and other effects of wind power is not entirely analysed. The actual distance is easy to measure but its significance of the perceived annoyance is more difficult to map. In Sweden, as for example in France, standard values are not based on distance, but on the calculated sound level at the façade.

ECONOMY AND BUSINESSES

Wind power establishments create jobs, especially during the building phase. It must be underlined that wind power establishments compete with other industries and activities, and may consequently displace jobs in other parts of the economy. Both Swedish and American research show that the number of jobs has increased significantly. If there is not enough local labour, labour from other areas 'outside' is used, meaning that consumption takes place elsewhere. Research shows that it is important to use local resources, especially in sparsely inhabited rural municipalities. Havsnäs wind power park created 250 local jobs per year (in total 1,000 jobs/year, all external effects included), and 13 permanent jobs (Autumn 2011). Including the external effects, the permanent jobs are estimated to be doubled.

Workers who daily commute to their home town, are not spending their income at the working place and thus create a sort of 'leakage". No local services or goods are used by the wind power company. This mainly concerns small communities or municipalities, whereas middle sized or larger communities/ municipalities can use local labour and thus avoid economic 'leakage".

Regarding the effects of wind power establishments on tourism and recreation, there is no clear picture. Visitors seeking untouched and unspoiled nature, where the travel itself is an objective, are often more annoyed by wind power plants in the landscape than individuals who visit a music or sport event. If the travel is barely a means of reaching a goal, the surroundings do not mean so much. A study from Scotland showed that 20–30 % of visitors preferred a landscape without wind power plants. The same visitors did, however, not react as negatively to wind power in the landscape as they did to mobile masts and hydro electric plants. In woodlands, where commercial tourism is generally week, industrial representatives assess the positive short-term economic effects of large-scale wind park project effects as a necessity (though not sufficient) for the tourism industry in the long run. In those cases where land owning and entrepreneurship go hand in hand, acceptance for a development is strong, as well as the opinion that the wind power park may create extensive values for tourism and strengthen the attractiveness of the area.

The impact of wind power establishments on property values were analysed in several research projects. The researchers did not find any significant differences in property prices between properties situated far from, or close to wind power parks respectively.

Several investigations made by 'choice experiments', that is, people's willingness to pay, analysed separate attributes, such as renewable energy or the landscape picture. The results showed, amongst other things, that people living in cities were willing to pay higher prices for electricity from wind power than were people living in the countryside. When choosing between what kind of 'green energy" they prioritised the highest, the willingness to pay, was highest for sun power (19–22 euros per month); then wind power (13–16 euros per month). People also prefer offshore wind power over coastal wind power and wind power in mountains. People also prefer small groups of wind power plants over separate plants and larger wind power parks.

Wind power and local ownership is highly accepted by local inhabitants. The local community is favoured by incomes generated by locally-owned wind power plants. Ownership can be performed in different ways, for example by investing in the plant, or by creating a cooperative.

Comprehensive evaluations of compensation forms for non-marked priced effects of wind power projects are lacking, that is, effects that in some way have an impact on human habitat. In Germany though, a compensation system is created. In Sweden, and in several other countries, there are initiatives like the so called 'bygdepeng" (money to the local community) which can contribute to increased acceptance. Such voluntary solutions require negotiations between the organisation and/or the land owner and the projector.

There are no general solutions and each separate organisation or land owner must make an agreement with the projector. It is likewise up to each separate Sami village to negotiate economic compensation for the loss of grazing land in the mountains.

LANDSCAPE

Landscape and landscape perceptions are complex issues as the same physical landscape can be interpreted, perceived and reflected on in different ways by different actors, in different social positions. The comprehensive physical plans of the municipalities should include wind power planning. An early dialogue with the public increases the understanding of different opinions and arguments, and can reduce conflicts. Since August 2009, large wind power establishments are conditioned only by support of the Swedish Environmental Code. If a municipality assesses that there is a competition of the land, a detailed plan could be established. The European Landscape Convention focuses on a holistic view of the landscape.

The landscape convention predicts possibilities for public participation in landscape planning. Authorities from different areas need to cooperate in order to reach a holistic landscape view. Researchers agree upon the fact that an early public participation in a wind power process can make conflicts visible from the beginning and then it is easier to reach a common solution. With an open process there are more possibilities of creating trust and reliability. Landscape analysis is a method used for mapping the landscape. The landscape character, perceptions, design, power and identity are factors dealt with within this method. Research shows that there is a gap between the expert's view of the landscape on the one hand, which can be technical and formal, and the public´s perception of the landscape on the other hand, which is in turn often based on emotional aspects. The expert landscape perspective is not necessarily more neutral, or more rational, than the non-expert´s interpretation of the landscape. Differences between the above-mentioned groups are emotions, thoughts and interpretations and power conditions and result in consequences for how the landscape is managed in practice.

Landscape analysis is, as a method and tool, strongly dependent on expert knowledge. The expert perspective has been given too much space and it has consequently led to a poor connection between the landscape analysis and wind power plans. The method must therefore be developed towards a direction which enables dialogue with the public, and creates a balance between different types of knowledge and different interests.

The landscape can be perceived in different ways. The *landscape character* is of great importance, i.e. what a landscape looks like, which qualities are included and whether wind power 'fits in". People usually prefer wind power in areas already containing other activities, and there is a general will to preserve untouched (virgin) land, grazing land and to 'protect the countryside from the city". Another important aspect is the *visual impression*. Researchers

claim that the visual effect causes a great amount of worry, especially early in the planning process when alterations in the landscape are suggested.

The above mentioned questions should be given more space in the planning process. Distance to wind power plants can influence parts of the perception. A wind power plant may be perceived as negative close to the living area,

but may be perceived as interesting at further distances. *Identity* deals with the way people feel about a place, like place identity (the feeling of belonging to a place) and place attachment (emotional connections such as comfort and well-being). A place can be of great importance to an individual, i.e. as a childhood environment, as a long-term summer home, or as a recreational area. An alteration of such a place can create anxiety and insecurity. The above-mentioned perspectives, which affect human habitats, must be taken into consideration in the planning process as well as in the landscape analysis. In order to map or measure qualities in a landscape, quantitative methods need to be combined with qualitative ones, such as interviews with people living close to proposed wind power plants. Wind power establishments can be disturbing, in areas perceived as peaceful. Such environments are important for recreation and thus also for public health. Peaceful and calm environments close to people´s homes are very valuable for human well-being. In this aspect, wind power plants may be perceived as disturbing elements, but not necessarily in all situations. A range of other factors are influential on people´s well-being, and therefore no definite conclusions can be drawn.

ACCEPTANCE AND SUPPORT

Knowledge of wind power as a renewable energy source needs to be explained and communicated in an open, clear and respectful way. Knowledge of attitudes is basic in order to understand how to stimulate a constructive dialogue about the effects of wind power on landscapes. Fundamental values, identity and experiences, affect the attitude towards wind power. A wind power establishment creates changes in the landscape, sometimes leading to uncertainty, anxiety and stress. An individual can either accept the changes or become increasingly stressed. Therefore, an early and constructive dialogue is important. Within the methodology of landscape analysis, different examples of successful public participation methods and dialogues are presented. Dialogue forums such as 'touring interviews" (**gåturer**), is one of the methods suggested.

In this chapter, an example of how to perform a landscape analysis is given. Social contexts, landscape functions for different actors and existing social networks can be used when mapping people's opinions and interests. These should be integrated in the planning process for separate constructions in municipal as well as regional planning. The concept of NIMBY (Not In My Back Yard) is frequently discussed in wind power contexts and in other planning situations. NIMBY is explained as a person being positive towards wind power in general but negative towards establishments close to his/her living area. Wind power opposition cannot, however, solely be explained by NIMBY. There is a need for more thorough analyses in order to describe and consider people´s feelings about a change in their living environments. There are also other factors that can explain wind power opposition.

A quality control of dialogue and participation can contain questions such as:

- Participation: were all relevant actors and questions identified?
- Suitability: was the participation good and was enough time allocated?
- Focus: were the aims regarding participation clear and concrete?
- Openness: was the process carried out in a friendly and understandable way?
- Resources: did the process include enough numbers of staff?
- Feedback: did the process generate any answers?
- Appropriation: did the methods serve the aim and the actors in a good way and thus create a legitimate process? Such checklists can assist managers, officials and projectors when following up a dialogue process, for instance, the results of a 'touring interview" (**gåtur**).

A dialogue can profitably take place in an already existing network i.e. in a group of landowners, recreational organisations and in a group of affected residents. In networks where people already know each other, have the same fundamental values and trust each other, there are good prerequisites for achieving mutual solutions. The possibility of everyone telling their opinion is greater when the group is small. This may be one way of avoiding conflicts.

CONCLUSIONS AND RECOMMENDATIONS

A wind power establishment is a complex process since it contributes to a positive development of renewable energy but, at the same time, alters people's living environments. We have to deal with both global and local questions and this can be difficult for an individual to relate to. The attitude towards wind power often deals with the way a person feels about the landscape and what relationship he/she has to it; landowners, property owners, permanent residents, summer residents or tourists. Different people perceive and use the landscape in different ways. A majority of people are positive towards wind power (87 % according to the latest SOM enquiry) but when wind power establishments are planned close to their homes, the attitude is sometimes negative or sceptical (also known as the NIMBY effect). This is, however, not the entire explanation of attitudes towards wind power, and there are other factors also having an impact.

- It is important that the effects of wind power at global, regional and local levels are discussed and defined in every separate planning process.
- Individuals who can view wind power plants are more annoyed by noise from the turbines than individuals who cannot view them. Wind power plants are often placed in environments including low background sounds, and consequently the noise is sometimes experienced as disturbing.
- People are worried about how noise and shadows affect human health. Research shows that there are no major health effects related to wind power, but sleeping disorders due to wind power noise cannot be eliminated, and this fact has to be further investigated.
- The visual impact on the landscape, as well as concerns for noise pollution, are the two subjects most frequently discussed at wind power establishments.
- Research has shown, so far, that there are no negative effects on property prices, but more research is needed.
- Employment increases during the building phase and if local labour is used, a positive economic effect on the entire local community will appear.
- Tourism can be affected both positively and negatively. The way wind power plants are perceived in a landscape partly depends on the purpose of the visit. Someone who seeks quietness and tranquility is more disturbed by a wind power establishment than someone who practices sports or other activities.

- More knowledge is needed on how the public can create extended values in their community due to wind power establishments. Knowledge of how to create networks should increase.
- How does wind power change the landscape character (landscape design and qualities)? Does wind power fit in the landscape? How is the natural and cultural environment affected? In what way is the personal living environment affected and the personal relationship to the landscape? Research shows that many people want to protect 'their" environment from changes. People suggest that wind power is constructed in areas that already contain other constructions or industries.
- Landscape analysis, as a method, deals with both natural values, cultural values and perceived values in the planning process, but knowledge of how perceived values should be considered and managed needs to increase. Since perceived values are difficult to measure and quantify, a dialogue with the public (i.e. different groups or already existing networks) early in the planning process is recommended. A combination of quantitative methods (mapping, GIS analysis, enquiries) and qualitative methods (interviews, stories, 'touring interviews" (**gåturer**) and so on) may result in a comprehensive mapping of people's perceptions, and thus concretise social values.
- There is a need for a reinforcement of the landscape analysis ability to concretise, handle and manage the public's landscape perceptions.
- It is also recommended to clarify the roles of wind power projectors and authorities, when communicating with the general public. Who is responsible for what?
- A very early dialogue with the residents is recommended and with other people directly affected by a wind power establishment in the nearby area. Many municipalities show that it is successful to include dialogue in the landscape analysis. A number of municipalities have already created dialogue forums (i.e. **'touring interviews" gåturer**) in order to obtain the experiences of different communities. The outcomes of such good examples should be broadcasted and used in the planning process of wind power establishments.
- An open, clear, respectful dialogue is a key element in the planning process.

Contents

1. Introduction

This synthesis project is included in the Vindval research program which is a collaboration between the EPA and the Energy Agency. Vindval aims, amongst other things, to create a knowledge base for environmental impact assessment and approval processes for wind power. Vindval also produces and conveys facts about wind power's impact on people, wildlife and the environment. Vindval has previously presented reports on the effects of anchoring, acceptance and resistance (Klintman & Waldo, 2008), for planning and communication offshore wind power (Mel & Aronsson, 2010) and on public attitudes and involvement in the establishment of offshore wind power (Waldo & Klintman, 2010). Vindval has also made a compilation of the programme's research between 2005 and 2009 (EPA, 2010a).

This report summarises, analyses and evaluates existing international and national research on wind power's impact on human interests. People's interests in the areas of health, economy and businesses and landscapes (natural and cultural) are discussed in this report. The report also treats research on public participation in wind power projects and what the interaction with designers and planners looks like. Attitudes and perceptions of wind power projects is a recurring theme throughout the report.

The report begins with its aims and purpose (Chapter 1.1) and a chapter about wind power as a renewable energy source (Chapter 1.2). Thereafter, a chapter about wind power and human interests (1.3) and actual and perceived distances to wind power is presented (1.4). Methodological considerations are included in Chapter 1.5 and a presentation of the members in the synthesis panel is made in Chapter 1.6. The introductory chapter ends with contents and structure of the report (Chapter 1.7). Thereafter – the four main areas are addressed:

Health and illness (Chapter 2)
The following issues are discussed: Noise, shadows, reflections and light, annoyance, sleeping disorders, symptoms, deceases, anxiety.

The following issues are not addressed: work environments, safety, magnetic fields, and environmental economical effects on health.

Economy and businesses (Chapter 3):
The following issues are discussed: employment effects, external costs, effects on other businesses (tourism, recreation, reindeer herding), non-market valued effects, property prices.

The following issues are not discussed: wind power constructing, transportation roads.

Landscape (Chapter 4):
The following issues are discussed: landscape analysis and planning, landscape experience values, natural and cultural environments, outdoor activities and recreation.

The following issues are not discussed: natural scientific research on effects on ecological connections.

Acceptance and support (Chapter 5):
The following issues are discussed: attitudes and participation, institutional relations (planning and consultations), public participation, communication, Code of Conduct. The chapter does not discuss how trial and permission processes works.

The results of discussions made by the synthesis panel (based on research and other knowledge) are then presented, including conclusions and recommendations for how different aspects of the wind power process can be managed (Chapter 6).

1.1 Aim and purpose of the report

The purpose of the report was to summarise, analyse and evaluate existing international and national research on wind power's impact on human interests. A specific challenge identified by the research program Vindval is that administrators and planners have no access to conventional knowledge about wind power's effects on human interests. This lack of knowledge hampers case management. Better access to valued knowledge is therefore one of Vindval's high priority needs. From Vindval´s needs analysis, which was conducted in autumn 2009, it emerged that:

> 'The lack of guiding knowledge for administrators seems primarily due to lack of access to existing knowledge. That is, it is not the need for new research that is emphasised but rather the practical access to existing knowledge and experience. Administrators lack syntheses and research that is valued and practically applicable. It does not seem reasonable for administrators to look at studies and research and themselves understand the implications of the results. It calls for interpretations of the research and limit values as well as clear guidelines being developed in the same way as, for example, noise levels in traffic areas. There is a need for adequate planning tools. Knowledge sources are perceived as numerous and diverse and it is difficult for administrators to know who to turn to. There is no uniting place for valued and practically applicable knowledge. Too little guidance and skills development are occurring. There is a need for coordination of knowledge and information from the authorities and with companies and planners. There is a need to build decision-making at multiple sources of

knowledge, so that decisions are perceived as more neutral and credible. A number of reasons that come up show a need of access to valued knowledge in several core issues in the planning process, such as location, impacts during construction and operation, impacts on business activities, etc. Application instructions for administrators at all levels are needed. There is potentially a limitless amount of facts to consider, but administrators need to know what facts should be considered and how much?" (Synthesis work within Vindval, Vindval, 2009, p.3).

During a workshop in autumn 2009, there was an attempt to map and identify the areas of human interests that wind power can be seen to influence and often gives rise to debate in the establishment process. This work led to the following matrix:

Four main areas:

Health: –noise –shadows –work environment –safety –anxiety –magnetic fields	**Economy and businesses:** –property values –tourism –benefits (incl. community benefits) –local businesses –taxes and leasing revenues –compensation
Landscape: –landscape analysis –experiences –recreation –cultural environment –natural environment	**Acceptance:** –communication –consultations –experiences –boundaries –marketing plans –own product (e.g. for entrepreneurs)

Figure 1.1 shows the four main areas within the project 'The Effects of Wind Power on Human Interests" that emerged in Vindval´s needs analysis (Vindval 2009, p 5).

In spring 2010, a synthesis panel of researchers from different disciplines as well as experts in wind power was established. The synthesis panel´s commission in 2010 and 2011 was to, based on scientifically published articles, authority reports, case studies and other so-called 'grey literature" (e.g. court decisions), compile and evaluate existing knowledge (national and international) of wind power's impact on human interests based on *what we know today.*

As an initial work the synthesis panel made a revision of the matrix (see Figure 1.1 above), which is the basis for this report. The different subject areas' content can be deduced as follows (Figure 1.2):

Health and illness – Health and Illness – Noise – Shadows, reflexes and light – Annoyance – Sleeping disorder – Symptoms and diseases, anxiety (The chapter does not address work environment, safety, magnetic fields, environmental economical effects)	**Economy and businesses** – Employment effects – External costs – Effects on other businesses (tourism, recreation and rein deer) – Non-market valued effects – Sharing and cooperatives – Compensation mechanisms (The chapter does not address construction issues, transportation roads and so on)
Landscape – Landscape analysis and planning – Experience values – Natural and cultural environments – Outdoor activities and recreation (The chapter does not address natural scientific research on the effects on ecological connections)	**Acceptance and support** – Public opposition (attitudes and participation) – Institutional relations (planning and consultation – Public participation – Communication – Codes of conduct (The chapter does not address trials and authorisation processes)

Figure 1.2. Revision of topic content (Project Implementation Plan, 2010). The different areas overlap.

1.2 Wind power – a renewable energy source

The report 'Our Common Future" (WCED, 1987) was the result of several years of negotiations between governments on environment and development in the world. The concept of 'sustainable development" was founded and, according to the Brundtland Commission's, a sustainable development is 'development that meets present needs without compromising the ability of future generations to meet their own needs" (WCED, 1987). Several conferences were conducted and strategies were developed for how countries should work towards sustainable development (UNCED in 1992, the Millennium Declaration in 2000; WSSD, 2002). Another conference will be held in Rio de Janeiro in 2012.

One of the major issues in global negotiations, is climate change and the need to develop renewable energy sources (IPCC International Panel on Climate Change, 2007; UNEP Outlook 4, 2007). Global warming has caused the Earth's average temperature to increase since 1900. Since 1976 (the last 35 years), the average temperature on Earth has increased three times as much as during the entire 1900s. The ten warmest years ever have occurred since 1990 (Harper, 2011; IPCC, 2007). Climate change is not necessarily linear, but changes can occur suddenly. Current temperature increases faster than before and increases in temperature lead to adaptation difficulties for animals, plants and people (IPCC, 2007). The consequences of global warming affect all individuals, communities and ecosystems in different ways and with varying degrees of strength (Harper, 2011; IPCC, 2007). Causes of climate change are, according to the IPCC (2007), greenhouse gas emissions and combustion of fossil fuels.

A strategy to slow global warming is to develop renewable energy sources, with wind power as an example. China, the U.S., Germany, Spain and India were the countries in the world with the highest installed capacity of renewable energy in 2008 and wind industries in these countries, including throughout Europe, continue to grow (Arent et al., 2011). In Europe, Germany and Spain were, at the end of 2010, by far the biggest in terms of wind power production (capacity MW) (EWEA The European Wind Energy Association, 2011, www.ewea.org 28-08-2011). Wind power is a renewable and efficient energy source because it produces electricity directly. Wind power does not create carbon emissions during the operation and it uses wind as an infinite and free resource. Wind power establishments often arouse emotions, both positive and negative. Some people are positive towards wind power because it can contribute to financial gain for people who are shareholders in the wind power and to the increased employment of a city or a region where wind power is established. Others may experience a concern about how wind power can affect one's health, the economy and the landscape. According to the European Parliament and the European Council Directive, EU member states should by 2020 reduce greenhouse gas emissions by 20%. Twenty percent of the energy will be renewable and energy efficiency will increase by 20% by 2020 (European Parliament and Council Directive, 2009/28EG).

1.2.1 Wind power in Sweden

Sweden's share of renewable energy is to be 49 per cent in 2020, according to EU directives. The goals that have been set by the Swedish Parliament are higher: 50% renewable energy by 2020. Sweden's share was 44.7% in 2009 (Swedish Energy Agency, 2010a). Wind power is part of the renewable energy, solar power and biofuels are other examples.

In 2003, wind power made up 0.5% (0.63 TWh) of the total electricity production in Sweden, which in a normal year is about 150 TWh. In 2010, 3.51 TWh of wind electricity was produced (Swedish Energy Agency, 2010b) (see Table 1.1). By Week 38, 2011, calculated at 52 weeks back (rolling basis), production of electricity from wind power was 5.25 TWh (Swedish Energy Agency, 2011a, b, www.svenskenergi.se 28-09-2011).

Table 1.1. Energy sources and produced TWh 2009–2011.

Energy source	Produced TWh		
	2009*	2010*	2011, Week 35 (52 weeks back)**
Water power	65,3 TWh	66,2 TWh	63,2 TWh
Wind power	2.5	3.5	5.25
Nuclear power	50.0	55.6	58.4
Other heat power	15.9	19.7	17.7
Total net production of electricity, TWh	133.7	145.0	144.5

*Source: Energy Agency 2010.

** Source: Svensk Energi (2011a,b) www.svenskenergi.se 2011-09-28.

Electricity production is dominated by water power (45.7 %) and nuclear power (38.3 %), CHP 8.9 %, CHP in industry 4.4 %, wind power 2.4 % and remaining 0.6 % is completing energy sources (Swedish Energy Agency, 2010a). In the beginning of the 1990s there were only a few wind power plants in Sweden compared to 1665 in 2010 (Swedish Energy Agency, 2010a). During 2010, one (1) wind power plant was built each day (Abrahamsson, 2010). A wind power plant with a good wind location and an effect of 3 MW can produce 7,500 MW a year which corresponds to the electricity demands of 1,500 houses (Swedish Board on Housing, Building and Planning, 2009).

Several of the Swedish environmental quality goals can be related to wind power projects (Environmental Council, 2010). These environmental quality goals include: Reduced Climate Impact; Fresh Air; Flourishing Lakes and Streams; Balanced Marine Environment, Flourishing Coastal Areas and Archipelagos; Sustainable Forests: A Varied Agricultural Landscape, Magnificent Mountain Landscape, Good Built Environment; Rich Diversity of Plant and Animal Life. Since wind power is a renewable energy source, it can thus affect climate and air positively. Acidification and eutrophication decrease (EPA, 2010b). Oceans, forests, farmland and mountains are affected by wind power and these environments, as well as people's interests and experiences in such environments, can be affected positively or negatively. Wind establishments also have an impact on biodiversity. The Swedish Board of Agriculture's Handbook for natural environments around wind turbines (Swedish Board of Agriculture, 2011) offers suggestions for the construction of new habitats by wind power plants. People's living environments may also be affected in different ways in terms of noise, disturbed natural and cultural experiences, and other annoyances. Vindval's synthesis projects on the effects of offshore wind power, effects on land mammals and the effects on birds and bats are presented in other reports.

1.3 Wind power, human interests and attitudes

Forestry, farming, hunting, outdoor activities and recreation are interests that sometimes cooperate and sometimes compete with each other and with wind power. How much people are disturbed by wind turbines may depend on how they use the landscape. A landowner, a property owner, a permanent resident, a summer residence or a tourist experience and use the landscape differently. Anyone looking for peace and quiet may feel disturbed by wind power plants, whereas for those who are landowners, power plants may be a source of income (National Board of Housing, 2009, see also Chapters 3 and 4, this volume). It is important that wind power developers and administrators can understand the general public's situation. A person can have a positive attitude towards wind power and renewable energy, but the positive attitude may not agree with how the person reacts to a wind farm nearby (Wolsink, 2007). How people react and act may depend on the values of opinions on wind power in general, thoughts and feelings, knowledge about wind power and what other people in the area think. Human behavior is also influenced by the extent to which they can influence a wind power establishment (Ajzen, 1988, 1991; Eagly & Chaiken, 1993; Kaiser & Scheuthle, 2003; Kaiser, 2006; Johansson & Henningsson, 2011).

According to Eagly and Chaiken (1993), an attitude is a psychological state in which people evaluate a particular event either positive or negative. An attitude is divided into an intellectual part, the emotional part and a behavioural part. A strong desire to act in accordance with his/her attitude, does not result in the person doing it in practice. People often defend behaviour that is perceived as difficult to change (Ajzen, 1988; Eagly & Chaiken, 1993; Kaiser & Scheuthle, 2003; Kaiser, 2006).

Knowledge about attitudes and how they are formed is important when talking about change, as wind power is in the landscape. By understanding the factors that create an attitude and a behaviour, one can also understand how people's attitudes can be addressed (Eagly & Chaiken, 1993; Johansson & Laike, 2007).

Attitudes to global issues of environment and sustainable development can give an idea of how people think about energy issues in general. In 2008, an attitude survey was conducted in 27 countries in Europe. The results showed that, when it comes to environment and sustainable development, people were mostly concerned about 1) Climate change 57%, 2) Water pollution 42%, 3) Air pollution 40%, 4) Disasters caused by human 39% (European Commission, 2008).

A Swedish study on attitudes towards sustainable development showed that people prioritised the following statements as the most important to the individual and his/her family: 'Everyone should be able to breathe clean air. Emissions that pollute the air and which deplete the ozone layer will be reduced. Clean energy sources must be developed." A total of 160 interviews were conducted with politicians, municipal officials and the public in four counties in south-eastern Sweden. They had to consider 20 statements about sustainable development. The second most important statement was 2) 'Better environment for better health. Health and environment are interrelated. If the environment of the world becomes healthier, people are also healthier." Then followed by 3) 'Protect and conserve fresh water. Fresh water is a scarce commodity in many places. The water must be protected and used so that it is not contaminated." 4) 'Reducing the use of toxic chemicals. Chemical products can cause damage to both health and environment. They must be managed so that they do not cause accidents or are disseminated in nature." 5) 'Protecting coast and sea against pollution. Coast and sea must be protected from polluting emissions" (Lindstrom & Küller, 2008). The study involved questions on perceived responsibility. On the issue they felt was most important (clean air) they replied that personal responsibility was low. There was no relationship between what is important in that 'Everyone should be able to breathe clean air" and personally perceived responsibility (Auhagen, 2001; Lindstrom & Küller, 2008; Uzzell, 2000). Responsibility for the above question was mainly transferred to governments and global organisations (see Chapter 4 on social dilemmas local – global). Respondents felt greater personal responsibility for issues about water, health and toxic chemicals than what they experienced for clean air and to protect coasts and oceans.

Hedberg (2011) at the SOM Institute (Society Opinion Media) has investigated attitudes towards wind power in Sweden. Four studies during the 2000–2010 have been merged (about 6,200 respondents). The combined results show the following (see Table 1.2).

Table 1.2 shows replies to a number of statements on wind power. Answers shown as a percentage.

Statement	Wrong	Neither wrong or right	Right	No opinion
Wind power is environmentally friendly	4	9	87	4
Wind power makes landscapes ugly	39	23	38	5
Wind turbines are noisy	48	31	21	13
Electricity from wind power is expensive	28	38	34	18

Most thought that wind power is environmentally friendly. About 40% felt that wind power makes the landscape ugly, whereas the same number thought that the statement was incorrect. One fifth (21%) thought that wind turbines are noisy, whereas almost half felt that that statement was incorrect.

Additional questions were asked about people's attitudes on how wind turbines should be placed in the landscape (about 6,000 respondents) (see Table 1.3). Results should be interpreted with caution, as some counties include few respondents (Hedberg, 2011).

Table 1.3 shows answers to a number of questions on attitudes towards wind power. Answers shown in per cent.

Question	Very positive	Fairly positive	Neither positive nor negative	Fairly negative	Very negative
How do you feel about wind power establishment in your municipality *	31	26	22	10	11
How do you feel about wind power establishment close to your permanent home**	13	27	32	14	14
How do you feel about wind power establishment close to your holiday home**	14	26	31	14	15

*applies for the years 2005–2008, question was now asked 2009 and 2010.

**applies for the years 2000–2010, results from five surveys have been combined.

Nearly 60% of the respondents were positive or very positive towards the establishment of wind power in the municipality. Regarding wind turbines next to their own homes or holiday homes, 40% were positive or very positive about this, whereas 30% were somewhat or very negative. On the statement that wind power means a very low risk to human life and health, 81% responded that the statement was correct (Hedberg, 2011) (see Chapter 2).

Swedish people's knowledge of and attitudes to energy issues have been investigated by Damsgaard & Byman (2009). About 1,000 people participated in the survey. The study showed that three out of four people say they have changed their behaviour to reduce their energy use during the last five years. The reason for this is that they want to contribute to a better environment (64%). The high energy costs were the second most important reason (Damsgaard & Byman, 2009).

A study on the causes of resistance to wind power showed that it can be linked to the visual experience of wind power in the landscape and to people's own attitudes towards wind power in general. To counter opposition to wind power, Johansson and Laike (2007) argue that the attitude to wind turbine effects on aesthetics and recreation should receive focus in planning. It is also important that local people feel that wind turbines fit into their surroundings. Wolsink (2007) argue that a pronounced positive attitude towards wind power does not necessarily mean that one perceives wind power as a positive feature of the landscape. There can be many underlying factors that influence attitudes (Ajzen, 1988; Eagly & Chaiken, 2003) (see further studies on environmental valuation in Chapter 3). People's sense of 'their" landscape is, however, on a deeper level. They often identify themselves with a place and each individual's experience of that particular place is therefore an important issue to be included in the planning for wind power (see Chapter 4). The European Landscape Convention emphasises the social dimension in its definition of the landscape. A landscape is 'an area, as perceived people, whose character is the result of the action and interaction of natural and/or human factors" (Council of Europe, 2000 Art. 1a) (see also Chapter 4 and 5 on the ELC). The Commission stresses the importance of a holistic approach to landscape.

Wind power and other renewable electricity production can receive support in the form of certificates (see Annex 1). Those energy sources covered by the Electricity Certificates Act (SOU 2003:113) are: wind energy, solar energy, wave energy, geothermal energy, biomass energy, small scale hydro power and peat in CHP plants. Almost all European countries have some form of support for renewable energy (REN21 Renewable Energy Policy Network for the 21st Century 2011, www.ren21.net 13-09-2011). It is worth pointing out that hydro and nuclear power was expanded with government support.

1.4 Actual and experienced distance to wind power plants

The distance to a wind turbine or a wind farm can affect how the local residents or the concerned experience their surrounding environment. According to Pedersen et al. (2004) people feel more disturbed by wind turbines if they hear and see them at the same time than if they just hear the sound (see also Chapter 2). Actual distance of a wind turbine is easy to measure, but to measure the experience of the distance and the disturbance is more difficult. In Sweden there are no national rules on distances between wind turbines and residential buildings. Distance depends on the sound curve's estimated expansion to 40 dBA. 40 dBA is a benchmark for industry at night and therefore also applies for wind power. This curve often determines the distance to the wind turbine that can be 400 m, 500 m and/or 600 metres.

The Swedish Board on Housing, Building and Planning (2009) argue that it is just noise, shadows, and effects on the landscape which are mainly relevant to the assessment of an appropriate distance from residential buildings. It's rare that wind turbines are built closer than 800 m in Sweden today. Since wind turbines are becoming more powerful and getting larger, they also become more efficient and quieter which, according to the Swedish Board of Housing, Building and Planning, can lead to noise becoming less important and shadow effects becoming more important in terms of factors for localisation (Swedish Board of Housing, Building and Planning, 2009). As early as in municipal comprehensive plans, the above issues are discussed with the public, which a number of municipalities in Sweden already have done, such as Falkenberg and Gotland. It is important that such questions are raised early in the planning process. According to the Board, 212 municipalities and 15 county administrative boards have made wind power plans with financial support from the State (via The Swedish Board of Housing, Building and Planning). Several of the remaining municipalities have made wind power plans without support from the Swedish Board of Housing, Building and Planning. The municipality should always raise localisation issues in the plans but some municipalities have chosen to work with these issues in more detail than others (Swedish Board of Housing, Building and Planning, 2011a, personal communication).

Shift reforms which have been implemented in different ways in different countries are showing differences in the distribution of residences in the landscape. In Germany, the villages were kept largely intact, which is why there are large contiguous file landscapes for wind power groups at a relatively far distance from residences. In Sweden, villages were shattered and farms were moved out to the centre of their new lands. To a certain extent, but not as consistently, villages in Denmark and England were also shattered (Skärbäck, 2011). Denmark has the densest frequency of wind power stations with more than eight units in the western parts where the wind blows the most, but is also less affected by shift reforms (Birk Nielsen, 2002).

Basic studies on visual effects and distance were carried out in Denmark in the 90s (Environment and Energy Ministry 1994, 1996). The distance between wind farms and residential buildings has also been studied in Skåne in Sjöbo municipality (Skärbäck & Fagerström 2004; Skärbäck, 2010).

International and national studies point to the importance of choosing the right place, from a visual point of view and with regard to the identity and values of the place, and the importance of public participation in planning and decision making, often in the form of financial participation (see in particular Chapters 3, 4 and 5). In order to increase the opportunities to see the landscape as a whole and to understand and take into account the various interests in the landscape, methods of dialogue and communication are required (see Chapter 5).

1.5 Methodological considerations

1.5.1 Procedure and material

The 18 researchers of the synthesis panel have met on several occasions in both physical meetings and web meetings. The panel has jointly decided on labour division, schedules and implementation plans. The reference group, consisting of representatives from wind energy companies and regional and local authorities, was invited to some meetings. The reference group has also reviewed and commented on drafts of the report. All researchers in the synthesis panel have read the documentation and everyone has been able to contribute with information to their own group and to the other researchers.

The main data collection took place during the period 2010-07-01–2011-07-01. Research that was published later than this has in some cases also been considered. Research is presented continuously and therefore there may be some new relevant research that is not included in this report (see Section 1.5.4 regarding uncertainties).

During the work, the synthesis panel focused on internationally published research on wind power's impact on human interests in the areas of Health and illness; Economy and businesses; Landscape and Anchorage. When there has not been internationally published research in some area, the panel has used international and national reports (e.g. authority reports) and other literature (consultant reports and environmental judgments) which they considered relevant. Some case studies are also presented in the report. Each report has been carefully reviewed, analysed and assessed by the synthesis panel (see Table 1.4).

To search literature the synthesis panel has used the universities' databases. All the researchers in this study had access to such databases. The public debate about wind power in society has been followed by the media and researchers in the synthesis panel have participated in a number of national conferences on wind power.

Some of the articles that have been reviewed, analysed and evaluated in this report come from international journals such as: Wind Energy;

Environment, Development and Sustainability; Journal of the Acoustical Society of America; Noise & Health; Journal of Frequency, Noise, Vibration and Active Control; Energy Policy; Ecological Economics; International Journal of Tourism Research; Wind Power Installation, Cost and Performance Trends; Planning Theory; Environmental Policy and Governance; Land Use Policy; Landscape and Urban Planning; Journal of Environmental Psychology; Landscape Research; Journal of Environmental Planning and Management; Journal of Community and Applied Social Psychology; Planning Theory & Practice; Qualitative Research in Psychology.

Additional reviewed, analysed and valued literature is: International and national published books on theories of planning and on attitudes, behaviour and communication. These theories have been linked with wind power in different ways.

When it comes to international and national reports from international organisations such as the UN, the IPCC, and authorities like the National Board of Health and Welfare, the Environmental Protection Agency and the Energy Agency, this information has mostly been used as facts in the report, and also become the subject of analysis and new recommendations.

The report also includes some case studies that describe the process for wind power available today in Sweden. The case studies are given as examples of the dialogue process with the public. There is a mixture of interdisciplinary research, academic research mixed with case studies, which the synthesis panel believes is important to get a holistic view of the 'The effects of wind power on human interests."

Table 1.4. Description of material being used in the report 'The Effects of Wind Power on Human Interests".

Material	Introduction	Health and Illness	Economy	Landscape	Acceptance
Internationally published artcles	9	28	19	65	33
National authority reports	2	7	16	21	11
International authority reports	7	4	9	3	3
Books	6	3	7	19	12
Reports from organisations	5	8	15	1	2
Case studies			1	1	3
Other*	2	1	4		

*e.g. conference papers, personal communication, business journals.

1.5.2 Generalisation

When it comes to the generalisability of the findings in the report, it has sometimes been difficult to make comparisons because different methods are used in different countries. These include employment effects of wind power in Sweden and the United States, or the study of the impact on property prices.

Noise from wind turbines may also be difficult to generalise because countries have different benchmarks.

The landscape is different in different countries. We have chosen to present research from e.g. Scotland and Wales because the examples give a good description of wind power's impact on the cultural landscape. Wind power is relatively new in Sweden, existing research can be valuable even for Swedish conditions.

Since dialogue is a central part of this project we have chosen to make a more detailed presentation of some municipalities' successful dialogue processes. Several other municipalities' dialogues with the public in wind energy matters can be found in the Swedish Board on Housing, Building and Planning report *Medborgardialog om vindkraft* (Swedish Board on Housing, Building and Planning, 2011b).

1.5.3 Delimitations

- The panel has not gone into technical issues i.e. how wind turbines are built, the land use associated with transportation, work or construction of wind turbines.
- The report does not address risks from icing.
- The panel has not analysed the environmental economic impacts linked to health.
- Scientific research on the impact on ecological systems, animals and plants are not discussed in this report.
- Trial and authorisation processes are affected indirectly as dialogue and communication with the public is normally included in the consultations required by law. Information about trial and authorisation is available in Swedish on Vindlov's (2011) website: www.vindlov.se under Steg för steg. Vindlov is a web site for trial issues in wind energy matters.

1.5.4 Uncertainties

New research may have been published after this report was completed. The results in this report can be interpreted and measured in different ways depending on the interest and commitment in the wind power issue. People's perceptions of wind power are a complex and comprehensive process to investigate, because different people can look at the same landscape and experience different things. Self-reported experiences of wind power can vary depending on a number of background factors, such as the relationship to the location, their own values, and other people's influence. Within the synthesis panel, which consists of different research directions, there is also room for different interpretations of the results. This has been discussed at several meetings between panel participants, who through these meetings have made common conclusions.

The synthesis panel has tried to explain and define the key terms in the report. It is primarily written for the target groups: administrators at authorities and municipalities, wind power developers, NGOs (non-governmental organisations), but also the general public. There are linguistic variations between chapters because different researchers have been working on different parts of the report.

1.6 Project leadership and participants

The project 'The Effects of Wind Power on Human Interests" was ongoing in the period May 2010 – February 2012. The following people have participated in the project:

Health and illness
Mats E. Nilsson, Associate Professor, Environmental Psychology, Stockholm University/Karolinska Institutet
Gösta Bluhm, Associate Professor, Environmental Medicine, Karolinska Institutet
Karl Bolin, Tech Dr., Acoustics, Royal Institute of Technology
Johanna Bengtsson Ryberg, Med Dr, Environmental Protection Agency

Economy and businesses
Ingegärd Widerström, Consultant and former county architect
Patrik Söderholm, Professor of Economics, Lulea University of Technology
Kristina Ek, PhD, Environmental Economics, Luleå University of Technology
Niklas Åkerman, PhD, Economics, Linnaeus University, Kalmar
Bosse Bodén, PhD, Economics, Mid Sweden University, Östersund

Landscape
Tom Mels, Associate Professor Human Geography, University of Gotland
Sanna Mels, Master in Human Geography, University of Gotland
Erik Skärbäck, Professor, Landscape Architecture, Swedish Agricultural University
Carina Johansson, PhD, Ethnology, University of Gotland

Acceptance and support
Karin Hammarlund, Ph Lic, Human Geography, Swedish Agricultural University
Åsa Waldo, PhD, Sociology, Lund University
Inga-Lena Hannukka, Projector, Vattenfall

Project leaders
Marianne Henningsson, PhD, Environmental Psychology, Linnaeus University, Kalmar
Sofia Jönsson, Master in Environmental Science, Linnaeus University, Kalmar

1.7 Contents and deposition of the report

The report presents and analyses research on wind power's impact on human health and illness, the economy and businesses, the landscape and people's participation in the establishment process. Some information is repeated in several sections and this is because many issues are integrated, especially Chapter 4 and Chapter 5.

Health and illness (Chapter 2)
Noise and its effects on residents in terms of annoyance and sleep disorder.
Research in the area of self-reported sleep disturbances.
Research on noise from the rushing, swishing or thumping sound that occurs when the rotor blades pass through the air. Low frequency sound, infrasound.
Disturbance caused by shadows, and reflections from the rotor blades.
Annoyance and health effects.

Economy and businesses (Chapter 3)
Employment effects of wind power projects and how an establishment can affect tourism and other interests.
Economic aspects of a wind farm. Willingness to pay. Is it better with offshore wind power than land based?
Wind power's impact on property prices.
Wind power's total external costs in comparison to other forms of power.
Research on locally-owned wind turbines as well as compensatory mechanisms. How to compensate a landowner or reindeer owner when land is utilised for wind power?

Landscape (Chapter 4)
Landscape analysis method, i.e. a mapping of natural and cultural landscapes and how it can be used in wind power planning.
Expert perspectives and dialogue with citizens.
Decision-making and planning.
Power problem and participation as a central part of the planning process.
The European Landscape Convention and how it can be used in planning.
Holistic approach to landscape design, the importance of a cross-sectoral approach. Natural and cultural environments, recreation and outdoor activities.

Acceptance and support (Chapter 5)
The concept of attitude linked to people's reactions to changes in the landscape and to the perceived opportunities to participate in the planning process.
Ways to implement a wind power establishment.
Knowledge of attitudes and knowledge needed to stimulate a constructive dialogue about the wind power impact on landscape.
The importance of a transparent planning process with local knowledge.
Changes at the community level that can improve the ability to comply with the European Landscape Convention.

1.8 Thanks

Thanks to landscape architect Henrik Olsson, Ramböll Sverige AB, for help with pictures to the chapter Acceptance and Support and for participation in the chapter of Landscape. Thanks also to those who have read and commented our text during the work. Your comments were very valuable and helpful to us.

2. Health and illness

The chapter summarises the state of research on the effects of wind power on human health. The term 'health" is used here as defined by WHO i.e. health is not merely to be understood as the absence of disease but a state of well-being (WHO, 1948).

The compilation is based on a literature review that was conducted over aone-year period ending in April 2011. The literature search of scientific articles was done in PubMed, Psychinfo and Science Citation Index. A search was also made of articles from the Inter-Noise and Wind Turbine Noise conferences. Authority and consultant reports were localised through the reference lists of published articles and on the Internet search engines (Google, Google Scholar). Finally, information was gathered through personal contacts with researchers and noise consultants working with wind noise.

The chapter first describes the exposure to noise (2.1) and shadows (2.2) and then provides an overview of research on the possible effects of these exposures, divided into annoyance (2.3), sleeping disorder (2.4), and severe symptoms and diseases (2.5).

2.1 Noise

BOX 1. Glossary for this chapter:

Noise: Unwanted sound.

dB: decibel, Sound pressure level expressed in a logarithmic scale.

dBA: Sound pressure level corrected with a so called A filter that takes into account varied sensibility for sound in different frequencies. Low frequency sound is for example experienced as weaker than sound in the middle register at the same physical sound pressure level.

dBC: Correction of sound pressure level with a so called C filter, developed for sound with high levels. The variations of the hearing's sensibility for different frequencies are smaller at strong sound than at weak sound.

dB LAeq,T: Equivalent A-weighted sound level during a certain time period, T-Equivalent level is the average sound level during a certain time period. LAeq24h means an average sound level during 24 hours, for example.

Hz: Unit for sound frequency that indicates number of oscillations per second.

Infrasound: Sound with frequencies below 20 Hz.

Low frequency sound: Sound in the frequency area of 20–200 Hz.

Frequency area: Noise is usually broad band, i.e. contains sound energy of different frequencies (unlike a sinus tone that only contains sound energy of one frequency). A broad band sound is therefore characterized over a given area of frequencies e.g. 1–20 Hz (infrasound) or 20–200 Hz (low frequency sound).

Current guidelines for wind noise at residences are 40 dBA, which refers to noise from wind turbines outside the home with a wind speed of 8 m/s at 10 m height at the downwind (National Board of Housing, 2009). In some areas where the noise environment is particularly important and natural sounds predominate, such as mountains and archipelagoes, the value should be less than 40 dBA. Some wind turbines produce sound with tonal components (clearly audible tones). In such cases, the guideline value should be 5 dBA units lower, because sound with tonal components is perceived as more intrusive than other sounds. The clearer the tone can be perceived, the more intrusive sound is perceived (Box 1 defines the various concepts about sound and noise, Box 2 gives examples of noise levels).

The National Board on Health and Welfare´s guidelines on indoor noise is 30 dBA (LAeq, T) for sound without tonal components. For sound with tonal components it is 25 dBA. The National Board on Health and Welfare also has guidelines for sound with high levels in the low-frequency range, where the values are specified for individual frequency bands between 31.5 and 200 Hz (values from 56 to 32 dB should not be exceeded) (National Board on Health and Welfare, 2005)

Wind turbine sound occurs when the rotor blades pass through the air. Turbulence from the blades trailing edge (so-called 'trailing edge noise") generates a pulsing 'whoosh" sound that has its main energy in the frequency range of 500–1,000 Hz (van den Berg, 2005).

This pulsing 'whoosh" sound is the main cause of noise pollution, which is supported by studies that asked residents about the nature of the wind sounds they hear in their homes. E. Pedersen & Waye (2004) found that swishing, whistling, resounding and pulsating was the sound characteristics correlated highest with self-reported noise disturbance. Similar descriptions of the sounds were also found in a qualitative interview study with 15 individuals (E. Pedersen, et al., 2007).

Wind turbines also generate low-frequency sound (20–200 Hz) and infrasound (1–20 Hz) due to turbulence and pressure fluctuations at the blade and the pressure compressions when the blade passes the tower. Concerns about the health effects of low frequency noise from wind turbines have led to a number of studies carried out, which are described below. In conclusion, the sound levels in the low-frequency and infrasonic range is no higher than for many other common noise sources in the environment (Levent Hall 2006; van den Berg, 2004a; Nilsson et al., 2011).

It is agreed that the infrasound generated by wind turbines have levels far below what is audible, even at close range and to an even greater extent from the plants to living areas (Jakobsen, 2005; Levent Hall, 2006; Madsen & TH Pedersen, 2010; Møller and CS Pedersen, 2010; O'Neal et.al., 2011; van den Berg, 2004a). The infrasound levels measured from wind turbines do not seem to be higher than the infrasound levels people are exposed to daily from other sources in the environment (Levent Hall, 2006). They are also far below the Swedish guidelines for infrasound levels in work environments, which are 5–10 dB above levels where infrasound becomes audible (Swedish Work Environment Authority; SWEA, 2005). There is currently no evidence that infrasound (1–20 Hz) at these levels contributes to noise pollution or have other health effects (SWEA 2005).

In the low frequency area (20–200 Hz) wind power plants generate wind sound which in many cases is audible. This is not unique to wind power, but applies to most sources of noise in the community, such as road traffic noise for example. However, there have been fears that the percentage of low frequency noise from wind turbines in the future will increase as the plants get bigger. This was demonstrated in a Danish study with measurements of 14 turbines with power >2 MW compared with 33 smaller plants (Madsen & TH Pedersen, 2010). There are shared opinions however, on how the results from this study should be interpreted, see Møller & CS Pedersen's compilation (2010).

Some research has been done on low frequency noise and structural engineering. Lindkvist and Almgren (2010a) shows in a study, partly based on Danish data, that the low frequency indoor noise from wind turbines normally does not exceed the Board's guidelines (National Board of Health and Welfare, 2005), if outdoor levels of 40 dBA are managed. Persson (2010) questioned their conclusion because building technology in Denmark differs from that in Sweden. In Denmark, they often build houses of stone whereas Swedish houses are mostly built of wood. Lindkvist and Almgren (2010b) points out in their reply that it is the windows that plays the greatest role for transmission of low-frequency sounds, and this weighs up the differences between wood and stone.

Estimates of wind noise in the living environment are based on the situation 10 metres high and 8 m/s wind speed. The actual exposure may vary significantly from these estimates and it is mostly due to the large variations in weather conditions over the day and season. Van den Berg (2004b) shows that stable atmospheric conditions during the evening and night can lead to increased levels of wind turbine sound. At the same time the levels of background noise decreases. Measurements were made over a long period showing that noise from wind turbines can vary up to 15 dB between night and day at the same wind speed at 10 m height. These results are important when discussing potential effects of wind power on sleep (see below, Section 2.4). Icing of the blades is another factor that can increase sound.

Box 2 **Examples of sound at different dBA levels** (after Hygge, 2005, in Johansson & Küller, 2005)

dBA level	Example of sound
20	Very, very quiet bedroom, night time
40	Week radio music
60	Office, loud speaking
80	Goods train or heavily traffic highway 15 m away
100	Motorcycle
120	Launching jet plane, 60 m away
140	Pain threshold, close to launching jet plane

2.2 Shadows

There are no fixed values for shadow effects from wind turbines. However, it has in practice been developed a recommendation originally from Germany (Regulation WEA-Schattenwurf-Hinweise). It means that the maximum possible shadow time of disturbance sensitive buildings should not exceed 30 hours per year and that the actual shadow period should not exceed eight hours per year and 30 minutes a day. A permit decision under the Environmental Code can be stipulated under this practice. The regulating authority may then decide that the plant should be turned off at certain times (National Board of Housing, 2009).

When it's sunny weather and when the sun is low, wind turbines generate rotating shadows on the ground. The rotor blades obscure the sun about one to two times per second, which can be disturbing, both outdoors and indoors. This disturbance is hard to avoid other than by staying indoors with the blinds drawn down during the period of disturbance. Disturbance time may not exceed 30 minutes per day, and a total of eight hours per year (National Board of Housing, 2009).

The risk of being affected by shadows depends on location and distance from the wind turbines. Houses situated north east to northwest of the wind power plant are most affected by disturbance from shadows. Shadows can be seen up to 1.5 km from the turbines, but at this distance shadows are diffuse. On close range the shadows are sharper and hence more disturbing (National Board of Housing, 2009).

Sensors on wind turbines is a technique used to reduce shadowing. The plant is turned off during the time the disturbance is expected to last. It is not for more than one hour per day, and of course only on days with both sun and wind. Despite this technical solution, there are reports of shadow disturbance (Bjorkman & Jalming, 2009, F. van den Berg et al., 2008), which may indicate that the technology does not protect fully or is not sufficiently used.

Wind turbines are equipped with warning lights for aviation. These are on around the clock and can of course be seen as a disruptive element in the landscape. For more information about wind power's impact on the landscape see Chapter 4.

2.3 Annoyance

Noise is measured in questionnaire studies in which residents make an overall assessment of how disturbed or troubled they were by a particular source of noise for a certain period of time (ISO, 2003). The relationship between noise annoyance and noise levels from wind power has so far been studied in three cross-sectional studies. A Swedish study of 351 people was conducted in 2000 (E. Pedersen & Waye, 2004), a second Swedish study of 754 people was conducted in 2005 (E. Pedersen & Waye, 2007), and a Dutch study of 725 people was conducted in 2007 (E. Pedersen et al., 2009). These three studies are not independent of each other, since the Swedish researchers have been involved in all studies.

The three studies used the same question to measure annoyance (in the Dutch study, translated into Dutch): 'State for each of the following inconveniences if you notice or are disturbed by them, when you are outside your home," followed by a list of possible inconveniences including wind noise. The question was answered on a five-point scale with the options 'do not notice", 'notice, but not disturbed", 'disturbed very little," 'quite disturbing" and 'very disturbing". Proportion of 'noise disturbance" (U.S. 'annoyed") was defined as the percentage who answered 'disturbed pretty much" or 'very disturbed". Percentage 'very disturbed by noise" (U.S. 'highly annoyed") was defined as the percentage who answered 'very disturbed".

Figure 2.1 (below) shows the results from the three wind power studies, combined for the two Swedish studies (white bars) and separately for the Dutch study (grey bars). The calculations do not include respondents who had shares (or other economic gain) in wind power, since they reported much lower annoyance than those who had no personal economic interest in wind power (E. Pedersen et al., 2009). The studies show a clear correlation between the calculated levels of wind noise and percentage disturbed. Among residents with exposure in the range of 35–40 dBA (outdoors at the facade) i.e. those exposed to noise just under the Swedish benchmark for wind noise, the proportion disturbed by noise (annoyed) in the Swedish studies was about 10% and about 20% in the Dutch study. The proportion of very disturbed by noise (very annoyed) was about 6% in the Swedish and the Dutch study.

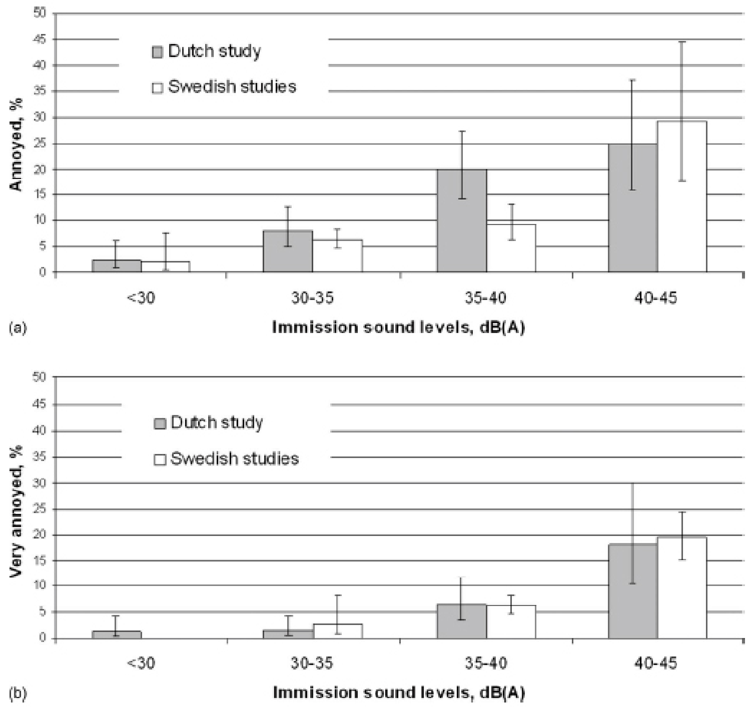

FIG. 2. Proportions of respondents annoyed (a) and very annoyed (b) by wind turbine noise outside their dwellings in four sound level intervals in the Dutch study (only respondents who did not benefit economically, $n=586$) and the Swedish studies ($n=1095$), with 95% confidence intervals.

Figure 2.1. Percentage of residents who felt that they were (a) 'annoyed" or (b) 'very annoyed" by wind noise, at various levels of wind noise outdoors at the facade (estimated level). Results from three studies (Pedersen et al., 2009).

To get an idea of what these units mean, one can compare it to the proportion of road traffic noise disturbance, the source of noise that most affects people in Sweden (Nilsson & Eriksson, 2009a; WSP, 2009). Such a comparison shows that the proportion disturbed by wind noise at the benchmark 40 dBA (outdoors at the facade) is comparable to the proportion disturbed at the corresponding benchmark for road traffic noise, 55 dBA (LAeq24h outdoors at the facade). For example, a study among 2,496 residents in Sweden's three largest cities, showed that about 7 per cent of residents with facade exposure in the range of 50–54 dBA (LAeg24h outdoors at the facade) and approximately 10% of residents in the range of 55–59 dB was disturbed by noise of road traffic (Nilsson & Eriksson, 2009b, this study used the same cut-off point for the definition of 'annoyance" as in the three wind studies above). This comparison supports the current benchmark for wind noise is reasonable in relation to the corresponding benchmark for road traffic noise outside the facade. The same conclusion was reached in a new Danish compilation (TH Pedersen, 2011), where the disturbance at 39 dBA wind noise was compared to the noise at the Danish benchmark for road traffic noise, 58 dB LDEN (which roughly corresponds to the Swedish benchmark of 55 dB).

Note that these comparisons refer to the *proportion* of exposed people who feel disturbed by noise. Of course, the number of people who are disturbed by road traffic noise is significantly larger than for the wind noise, since the number exposed to wind turbine noise is marginal in comparison to the number exposed to road traffic noise (according to WSP, 2009, approximately 1.7 million Swedes are exposed to road traffic noise above 55 dB LAeq, 24h).

Although wind and road noise causes approximately the same proportion disturbed at the current benchmarks, it is clear that wind power is more annoying than road traffic noise at *similar equivalent noise level* (relates to annual mean average for road traffic and at 8 m/s at 10 m height for wind). At 40 dBA (LAeq, 24h) wind noise, disturbances are significant, while the proportion disturbed by noise at 40 dBA (LAeq, 24h) transport noise is significantly lower (see e.g. Miedema & Oudshoorn, 2001; Ohrstrom et al., 2006). There are several possible explanations for this:

(1) Wind turbines are often built in environments with low background level. This means that even low levels of noise from wind turbines are perceptible and therefore potentially disturbing. Studies of road traffic noise are often made on residents in larger cities, where background levels are approximately 10 to 15 dBA higher than in rural environments.

(2) Repetitive pulsing sound is perceived as more disturbing than continuous sound with the same frequency content and average sound level (Kantar Elis & Walker, 1988; Zwicker & STALL, 1990). This also applies to wind noise (Seunghoon et al., 2011) and may be a contributing factor to why wind turbine noise can be disturbing even at relatively low sound levels.

(3) Wind power's visual intrusion in the landscape may affect the assessment of annoyance. This is supported by the fact that the proportion of annoyed among residents who actually see the wind power plants is significantly higher than among residents who do not see the plants, at the same average noise exposure (E. Pedersen et al., 2009). Wind turbines can be seen as an unnatural component of the landscape and one hypothesis is that the wind turbines, to a greater extent than many other noise sources, captures visual attention. This may result in an increased focus on the noise. Disturbance of moving shadows and flicker from wind turbines may possibly also increase the propensity to report noise disturbance.

(4) Noise from wind turbines is calculated for a given situation (8 m/s at 10 m height), while estimates of traffic noise refers to a daily average. Values of wind and traffic noise are therefore not directly comparable. The calculation models for traffic noise are more developed than those for wind noise. Therefore, it is conceivable that the predicted levels of wind noise underestimate the actual exposure to a greater extent than for traffic noise. There are higher demands on noise from wind turbines than from road traffic.

Figure 2.2. Wind turbines at the horizon (Photo: Marianne Henningsson).

There are no scientific publications on disturbance of shadows, reflections and lights from wind turbines. However, there is a thesis from the University of Halmstad (Bjorkman & Jalming, 2009), based on data from the two Swedish cross-sectional studies mentioned above. These studies included, apart from questions about noise pollution, questions about shadow annoyance. Around 8% of the 1,095 participants in the two studies said that they noticed the shadows from wind turbines. The proportion of those who noticed and/or were annoyed by shadows increased systematically with the estimated maximum shadow time per day, from about two per cent of residents exposed to less than 10 minutes per day to about 33 per cent for residents with more than 24 minutes per day. The proportion who said they were fairly or very annoyed by shadows also increased systematically with increased shadow time, up to about 10 per cent among residents with the most shadow time. The current Swedish benchmark for shadows is based on a German study that reports that people who have been exposed for more than 15 hours of shadow time per year felt that their quality of life had deteriorated significantly (Pohl et al., 2000, quoted in Bjorkman & Jalming, 2009).

2.4 Sleep disorder

Sleep disorder is a serious effect of noise, because good sleep is essential for physical and mental health and well-being (WHO, 2009). It is therefore important to evaluate the effects of wind power noise on sleep. WHO says in its latest guidelines that levels outside the facade should not exceed 40 dB LAeq at night to ensure undisturbed sleep, even with the bedroom window slightly open (WHO, 2009). The previous recommendation by WHO was 45 dBA LAeq (WHO, 2000).

If the benchmark 40 dBA LAeq for wind noise is maintained, WHO benchmark 40 dBA LAeq at night is probably not exceeded, which should mean full protection against sleep disturbance. It is however important to note that this refers to the actual exposure of the residents' bedroom window. Studies of van den Berg (2004b) suggest that the calculated levels may be higher at night. The measurements were made with conventional methods for noise emissions. Stable atmospheric conditions in evening and night result in increased levels of wind noise while the levels of background noise decrease. Long-term measurements show that the noise from wind turbines can vary up to 15 dB between night and day at wind speeds of 3–4 m/s at 10 m height (van den Berg, 2004b). This means that you cannot safely make the conclusion that the benchmark 40 dBA protects fully against sleep disturbance, as benchmarks are not based on measurements of actual situations, but only based on estimates of 8 m/s at 10 m height.

The questionnaire studies conducted give no clear picture of the relationship between wind turbine noise and self-reported sleep disturbance. In a compilation of the three wind studies conducted, E. Pedersen (2011) found a significant correlation between the calculated noise levels and self-reported sleep disturbance in the first Swedish study and in the Dutch study, but not in the second Swedish study. In a study in New Zealand researchers compared the perceptions of quality of life among a group of people living within 2 km of a wind farm with a group who lived in the same kind of landscape without wind power. The study showed that those who had wind power within 2 km reported lower sleep quality and described the environment as less restful (Shepherd et al., 2011). It cannot be excluded that there is a link between wind turbine noise and sleep disturbance. It is also not possible from these studies, based on self-reported sleep disturbance, to comment on the effects on sleep quality that individuals are not aware of, such as impact on sleep depth (see e.g. WHO, 2009).

2.5 Symptoms and diseases

The book 'The Wind Turbine Syndrome" (Pierpont, 2009) is sometimes cited as an argument for wind turbine noise causing a variety of serious symptoms. This is an interview study with 38 individuals from 10 families living near large wind turbines (1.5–3.0 MW). Several of the informants reported severe symptoms, including sleep disturbance, headaches, tinnitus, dizziness, nausea, panic attacks and palpitations, symptoms that had developed after the wind power plants being built near their homes.

Pierpoint's interpretation of the results is that the reported symptoms are due to low frequency noise and vibrations from wind turbines affecting people's sense of balance (Pierpont, 2009). The study provides for a number of reasons no evidence for this. For example, there are no acoustic measurements of wind noise, there is no comparison group of people with no or low exposure to wind power and there is a lack of measurements of the informants' health status prior to the wind power plants being built (health status before the turbines were erected was estimated retrospectively). Pierpoint's results, being based on a very small sample, are contradicted by the results of the cross-sectional studies conducted with more than 1,600 people (see above, Section 2.3). In these studies, no clear link between wind turbine noise and corresponding symptoms were found, apart from general annoyance (E. Pedersen, 2011).

Alves-Pereira and Castelo Branco (2007a) has argued that infrasound and low frequency sound cause 'vibroacoustic disease" (Alves-Pereira and Castelo Branco, 2007b; Castelo Branco & Alves-Pereira, 2004). The authors mention a variety of symptoms, including increased risk of epilepsy and cardiovascular effects. This has not been noted by other researchers, although this group has been campaigning for vibroacoustic disease the last 20–30 years in various articles (mainly conference papers). The problem seems only to be relevant at very high occupational exposures, such as aviation mechanics (Castelo Branco & Alves-Pereira, 2004), hardly at low dosage from wind turbines. Discussion of vibroacoustic disease remains at a hypothetical stage and evidence of problems related to wind turbine noise are missing.

Salt & Hullar (2010) have published a compilation of research on infrasound and physiological effects on the inner ear. The article has the word 'wind turbines" in the title, but it deals almost exclusively with inner ear function and provides a thorough review of the organ of hearing and which parts can be affected by infrasound. The outer hair cells are mentioned as particularly sensitive to infrasound also at inaudible levels. The article's last pieces mention that wind power generates high infrasound levels, with reference to three articles, two of which are not relevant to exposure in the residential environment (Jung & Cheung, 2008; Sugimoto et al., 2008). No reference is made to the published literature reviews (e.g. Jakobsen, 2005; Leventhall, 2006), which show that the infrasound levels that people are exposed to by wind power is moderate and not higher than from many other sources in the surrounding environment. Overall, there is no evidence that Salt & Hullar's (2010) results are relevant for risk assessment of wind turbine noise.

Harding et al. (2008) discusses the risk for epileptics. If the rotor blades obscure the sun more often than three times per second (3 Hz), there is some increased risk of seizures for people with photosensitive epilepsy. However, this is not relevant for modern wind turbines, which move more slowly and obscure the sun 1–2 times per second. Smedley et al. (2010) points out, however, that there may be a risk for small wind turbines that block sunlight more than three times per second.

There have been no epidemiological studies of wind turbine noise and cardiovascular risk. However, a number of studies in recent years have demonstrated a correlation between elevated blood pressure and road traffic and aviation noise (Babisch, 2008; Babisch & van Kamp, 2009; WHO, 2011). There are also some studies that have shown a link between road traffic noise and increased risk of myocardial infarction (Babisch et al., 2005; Selander et al., 2009). An increased risk was observed for exposures above 50 dBA (WHO, 2011), i.e. significantly higher than the current benchmark for wind turbine noise. This suggests that the relationship between transportation noise and cardiovascular disease cannot be applied to wind turbine noise. On the other hand, it is believed that the effects on the cardiovascular system may be stress-related and triggered by noise and sleep disturbance (Babisch, 2002). Wind turbine noise is causing annoyance and possibly sleep disorder, which means that you cannot completely exclude the effects on the cardiovascular system after prolonged exposure of wind turbine noise, despite the relatively moderate levels (<50 dBA LAeq).

2.6 Conclusion

Wind power plants are perceived as disturbing by some residents in the vicinity. The main source of disturbance is the noise, but also moving shadows formed when the rotor blades obscure the sun.

Annoyance (noise disturbance) is primarily due to the repeated rustling, swishing or thumping sound that occurs when the rotor blades pass through the air. This sound has its main energy in the midrange, and is no more low frequency than other common sounds in the environment, such as noise from road traffic. Wind power generates infrasound with levels far below what is audible.

The proportion of disturbed increases with sound levels from the turbines. At levels just below the current Swedish benchmark of 40 dBA (outdoor by façade, 8 m/s at 10 m height with a tailwind) about 10–20% say that they are disturbed, and about 6% that they are very disturbed by wind turbine noise.

These proportions are comparable to the proportion of road traffic noise disturbance at its corresponding benchmark, 55 dBA (LAeq24h outdoors at facade), indicating that the current benchmark for wind turbine noise is reasonable from a disturbance point of view.

At the same sound level, the proportion of disturbed by wind turbine noise is higher than for many other noise sources in the environment. What causes this disparity is not clear. Important factors are likely that wind power plants often are built in areas with low background level and that they also have a negative impact on the visual landscape.

Moving shadows that occur at certain times when it's sunny weather can be perceived as very disturbing, both outdoors and indoors. There are techniques that can reduce such effects, but because complaints exist, it appears that this technique does not protect fully or is not used sufficiently.

Besides disturbance of noise and shadows no apparent health effects of wind power have been proven so far. Correlations between wind turbine noise and self-reported sleep disturbance have been reported in some studies, while other studies found no such correlation. Claims that wind power creates the risk of 'vibroacoustic disease", 'wind power syndrome" and harmful infrasound effect on the inner ear lacks evidence. Studies of traffic noise in recent years have found evidence for a correlation between traffic noise exposure and risk of cardiovascular disease. Corresponding studies of wind turbine noise are missing.

3. Economy and businesses

Box 3. Glossary for this chapter:
Direct employment: Employment effects in the construction and operating phase such as jobs for construction workers, installers, service technicians and administrative personnel.
Indirect effects: Indirect employment effects in the supply chain. Jobs at subcontractors is often classified as an indirect effect.
Induced effects: Employment effect that is based on people affected by direct and indirect employment effects getting an increased purchase power. Could be increased consumption of food, clothing and other goods and services.
Employment multiplier: Displays the ratio of the total increase in employment (direct, indirect and induced) and the direct employment. This number gives an indication of the total number of jobs created in the community for every direct job created.
Direct methods for economic valuation: Economic environment valuation method that utilises conditions in existing markets (e.g. property) to evaluate environmental effects.
Indirect methods for economic valuation: Economic environmental valuation method based on existing connections in order to quantify the value of the environmental benefits and/ or costs on an established market. Property value method is an example of an indirect relationship between the price of properties with different features and price on the real estate market. Measured in economic units.
Choice experiment: Method for relating the various positive and negative attributes to each other through choices. By varying the properties and making of a series of choices, different factors can be evaluated in relation to each other.
Property value method: Analysis of data from the real estate transactions, where factors such as distance to nearby wind farms are compared to price variation. Price effects can then be used for appreciating the various factors environmental cost.

This chapter discusses wind power's economic impact on humans and human activities. The first part (Sections 3.1–3.2) addresses some important regional economic impacts of wind power establishments. There is a discussion of both the positive employment effects (Section 3.1) and whether potentially negative effects can affect other industries (Section 3.2). The analysis is based on existing research that highlights effects on employment and on other industries (such as tourism, recreation, herding) that in some sense are competing for resources claimed by wind farms.

Other chapters of this report deals with various environmental and health impacts of wind power (Chapter 2) and in the scientific literature available today, we see more and more examples of studies that attempt to put a monetary value on these non-market price effects. Section 3.3 outlines a number of such studies, and the findings show how large wind power's total environmental costs are (in comparison with other types of energy sources) and the environmental effects that contribute most to this total.

This chapter's third part (Sections 3.4–3.5) discusses different strategies for creating local acceptance of wind power establishments and to achieve significant positive effects on the local and regional economy. This issue is also addressed in other chapters of the report (for example, Chapter 5), but in this section we focus on the analysis strategies that include various types of financial incentives. In Section 3.4 we discuss experiences of various forms of ownership, such as cooperatives, and timeshares, while Section 3.5 deals with different forms of compensation directed to the local community in connection with the establishment. Information about certificates, see Appendix 1.

3.1 Effects of wind power establishments on employment

It should be emphasised that wind power projects are competing for public resources alongside other industries and activities, and therefore can 'crowd out" activities in other parts of the economy. The labour force is distributed between industries depending on how profitable they are. Wind power's impact on other sectors of society will return in Section 3.2. First, we outline some key concepts that recur in the regional economic impact analyses. Section 3.1.1 provides an overview of a selection of national and international analyses of the employment effects, and can be read as a mere summary of each study. Part 3.1.2 summarises the main insights from these studies.

Two phases of a wind power project create local and/or regional employment. In the *construction phase*, when the wind power plant is built, jobs in construction and installation are created. In the *operational phase*, technicians and administrative staff are employed. As this report has focused on the effects of an establishment, which can be said to be local and/or regional, we devote little attention to the employment created, for example in the production of turbines.

The professional categories mentioned above are examples of *direct* employment. The construction and operation phase will also generate new jobs through *spin-off effects*. In analyses, spin-off effects are often divided into *indirect* and *induced* effects. In such a division, potential impacts on employment in companies in the supply chain are taken into account, for example, a concrete producer that supplies material to a building contractor, which is an example of an *indirect* effect. Other sectors of the economy can benefit from an increased household consumption of various goods and services as a result of increased purchasing power among those who are employed both directly and indirectly. This is usually categorised as an *induced* effect. In summary, indirect employment effects arise in companies in the supply chain, while induced employment effects arise in industries not directly linked to the wind power establishment. The size of these indirect and induced effects is quantified through so-called *multiplier effects* that indicate the size of the ratio of the total increase in employment and direct employment. An employment multiplier of e.g. 1.5 thus indicates that 0.5 additional jobs are created for every direct job created. A common analysis of regional economic impact analysis, applied frequently in the studies we summarise in Section 3.1.1, is to use the so-called *input-output models*, which simply declared describe the relationships (flows) between sectors of the economy. One example is the so-called IMPLAN model (IMpact analysis for PLANning) that is widely used in the U.S. for this type of analysis.

A study of the positive employment effects of wind power shows different outcomes, depending on the project size, but also because of the study's geographical boundaries. If the study is limited to the local level, such as a municipality, employment effect size depends not least on the local ability to deliver the goods and services demanded. A wind farm near a larger community with a diverse business community is probably better placed to meet such a demand than a small community with a limited number of industries. This also means that one should be careful not to draw too far-reaching conclusions from single studies. Many of the empirical studies referenced below, have been made other countries (especially the U.S.) where conditions differ from those in Sweden.

3.1.1 Analyses of employment effects

Jämtland County municipalities (2010) presented a paper on political will from the Association of Local Authorities and municipalities in Jämtland. They indicated that the direct economic impact of large investment in wind power would generate substantial positive impact on employment in local economies in the short term. Calculations performed by the 'Node for labour supply in Strömsund" (in the Network for wind power) showed that 48 wind turbines in the wind farm (á 2 MW) created 250 temporary regional FTEs (with spin-off effects around 1,000) and 13 permanent local jobs. To the local utility, a countryside subsidy of 360,000 SEK/year and compensation to local landowners and businesses (such as reindeer herding) can also be added. With all the spin-off effects included, it is estimated that the lasting employment effect would be the double.

Northwest Economic Associates (NEA) (2003) analysed the regional economic impacts of wind power on behalf of the National Wind Coordinating Committee in the United States. Three case studies of existing wind farms, built in the countryside during the late 1990s in the United States, are described. The case studies documented and analysed local and regional economic impacts generated by wind power projects during both the construction and operation phase. The analysis showed that:

- a 107 MW wind farm, which was established in Minnesota, gave rise to a total of eight local jobs during the construction phase, with the greatest impact on the trade and service sectors. 19 new jobs were created locally to manage the operation and maintenance of the wind farm. When the indirect effects were added, their analysis indicated that a total of 31 jobs were created locally as a result of the operational phase, with the greatest impact on the trade and service sectors.
- a 25 MW wind farm, which was established in Oregon, gave rise to a total of four local jobs during the project construction phase. The modest local employment effect was due to a large proportion of the labour force during construction commuted daily from nearby communities and therefore spent their wages locally. The biggest

local impact during the construction phase occurred in the company which supplied concrete to the construction project. NEA estimated that the operational phase gave rise to a total of six local jobs with the greatest impact in the trade and service sectors.

- a 30 MW wind farm in Texas gave rise to a total of 26 local jobs. The population was less than 3,000. According to NEA, a large part of the labour force was recruited from outside, and was temporarily living in the region during the construction phase. Thus helping to an increased demand in the commercial and service sectors. About 6 jobs were created in the operation and maintenance of the facility and the NEA estimated that the total increase in employment, including indirect effects, was 11 new jobs locally as a result of the operational phase.

ECONorthwest (2002) (an economic consulting firm in the U.S.) analysed the regional economic impact of two wind power projects totalling 260 turbines and a total capacity of 390 MW in the state of Washington. The regional input-output model IMPLAN was used. The analysis showed that a total of 95 direct jobs during the construction phase could result in about 90 additional jobs by the indirect effects that occurred as a result of increased demand in other sectors. The operational phase was estimated to create about 22 direct jobs, and also contributed to increased income in the form of rents to landlords. ECONorthwest estimated that the indirect impacts during the operational phase gave rise to about 31 additional jobs, with the largest effects in the trade and service sectors. The same model was used by the American consulting firm BBC Research and Consulting (2000), in an analysis of the employment effects of a 40 MW wind power project in New Mexico. They calculated that the 71 direct jobs in the construction phase would generate about 44 additional jobs in the region. The analysis indicated an employment multiplier of about 1.6 during the design phase. The operational phase calculated an estimated 10 jobs, including indirect effects. Since the State of New Mexico owns the land where the proposed wind power project was planned, the local economy did not benefit in direct payments of rents, etc yet the increased income of the state was calculated to give rise to two additional jobs in the region.

Another American consulting company, ESS Group Inc. (2006) presented an analysis of the possible impact on employment in connection with a planned wind power project in the state of New York. The project included 109 turbines with a combined capacity of 218 MW. ESS estimated that about 190 local direct jobs would be created during the construction phase. ESS enclose the results of an analysis conducted by the Bureau of Economic Analysis which estimated the total impact on employment at about 275 jobs, thus indicating a complex employment multiplier of about 1.5.

Ratliff et al. (2010) analysed the effects of two planned wind farms (50/100MW) in Utah. Ratliff et al. used the so-called JEDI model[1]. Unlike the above studies, this analysis of employment effects in the entire state of Utah. The larger geographic delimitation means in comparison to the studies that have so far been examined to a larger part of the supply chain is now included in the analysis, such as manufacturers of turbines. Ratliff et al. (2010) estimated that the 50 MW option would create 109 direct jobs (FTE, full-time) in connection with the establishment and some 230 further jobs. Of those, 162 jobs were estimated to arise in the supply chain, and about 68 jobs would arise as a spin-off effect generated by increased consumption. The operational phase was estimated to give rise to a modest two direct jobs, but a total output of around 17 jobs. The 100 MW alternative was estimated to give rise to 132 direct jobs during the construction phase and about 431 additional jobs, divided into 308 jobs in the supply chain and about 123 new jobs in other sectors, as a result of increased consumption. The operational phase was calculated to generate 6 direct jobs, with a total output (including indirect effects) of about 36 jobs. In both the 50 and 100 MW alternative, the majority of the indirect effects of the operational phase was so-called individual effects i.e., jobs created in other sectors of the economy as a result of increased consumption (Ratliff et al., 2010).

Pedden (2006) summarised 13 case studies that examined the economic impact of wind power projects in the United States. The author made no specific conclusions because of the large differences between the case studies, but some important general insights were presented:

- The indirect effects tended to be smaller in small communities with few industries, due to leakage of revenue to other, larger communities with a more diversified economy.
- The number of local jobs created in the context of a wind farm establishment depends on what expertise can be recruited locally.
- Some local governments offer incentives for wind power companies to recruit locally.
- Use of renewable energy can create greater positive impact on the local economy than continuing to rely on fossil fuels. A scenario study from Pennsylvania (Black & Veatch, 2004) indicated that increased income in a 'renewable" energy scenario more than compensated for the higher cost of investing in renewable energy, compared to fossil fuels.

European Wind Energy Association (EWEA) (2009) examined the distribution of employment in the wind energy industry in the EU. A summary of direct employment by country showed that a total of 108,600 people worked in

[1] Jobs and Economic Development Impact model developed by the U.S. Department of Energy – National Renewable Energy Laboratory (NREL). A number of reports using the JEDI model to analyze wind power's impact on the local economy can be downloaded from www.nrel.gov/analysis/jedi/publications.html.

the EU wind energy industry in 2007. When EWEA included indirect employment – defined as jobs in companies that to some extent (though sporadic) were suppliers to the wind industry – the total wind-related employment was more than 150,000 jobs. EWEA reported that a total of 151 jobs in the EU for every MW of installed capacity were created. EWEA's definition of indirect employment does not seem to clearly include jobs generated by increased consumption as a result of household income when working in the wind energy industry. Tables 3.1 and 3.2 provide an overview of employment in the EU wind energy industry. The numbers do not include offshore wind power which, according to EWEA, generates even more jobs per MW and is estimated to have amounted to a total of 2,800 jobs in 2007.

Table 3.1: Employment in EU´s wind energy industry (2007).

	Share of direct employment, per cent	Direct employment, numbers	Indirect employment, numbers	Total direct + indirect employment
Turbine manufacturing	37.0 %	40,182	42,716	
Component manufacturing	22.0 %	23,892		
Wind power development	16.0 %	17,376		
Installation, operation and maintenance	11.0 %	11,946		
Electricity producers	9.0 %	9,774		
Consults	3.0 %	3 ,258		
R & D	1.0 %	1,068		
Finance companies	0.3 %	325.8		
Other	0.7 %	760.2		
Total	100.0 %	108,600	42,716	151,316

Source: European Wind Energy Association (2009).

Table 3.2: Employment per MW in the EU (2007).

	Jobs	Jobs/Annual MW	Jobs/Cumulative MW	Assumption
Manufacturing – direct	64,074	7.5		Annual
Manufacturing – indirect	42,716	5.0		Annual
Installation	10,665	1.2		Annual
Operation and maintenance	18,657		0.33	Cumulative
Other direct employment	15,204	1.3	0.07	75 % annual, 25 % cumulative
Total employment	151,316	15.1	0.40	

Source: European Wind Energy Association (2009).

According to EWEA's baseline scenario for wind power expansion in the EU, 180 GW of installed capacity will be reached in 2020 which, according to their calculations, results in a doubling of the employment in the wind energy industry. In total, the EU wind energy industry is estimated to employ about 330,000 people in 2020, with a big employment increase in expanding offshore wind power.

Goldberg et al. (2004) used the so-called JEDI model to analyse the effects of three alternative scenarios for the establishment of wind power projects in a total of 11 areas in five different states in the U.S. The three scenarios analysed were: (I) a 150 MW wind farm owned and funded by non-local companies/organisations, (ii) a 40 MW wind farm, owned and funded by non-local companies/organisations, and (iii) 20×2 MW power plants owned by local stakeholders (landowners) and funded by local lenders. The local ownership is estimated to result in less 'leakage" and thus more indirect effects, at least per MW. Lantz and Tegen (2008) also used the so-called JEDI model to analyse which factors, related to wind energy, which drive economic development. The economy is strengthened even if local labour is used in the operation and maintenance of wind turbines. Local ownership strengthened the local economy; here it was shown, however, that the economic benefits, was the revenue of own capital that arose in profitable wind power projects.

Moreno & Lopez (2008) examined how many jobs could be created by the renewable energy sector in Asturias, Spain. They analysed three alternative scenarios of how renewable energy affected development: these are based on optimistic, pessimistic and 'rigid" expectations. When the scenarios were evaluated they also analysed which professionals and competence that were needed for the new jobs generated in the installation, operation and maintenance of various renewable energy systems. The results showed that most of the jobs were generated by solar energy and wind power. Projections showed that renewable energy has a significant impact on employment and therefore, according to the authors, compensates for the loss of jobs in the traditional mining industry. In addition, renewable energy was expected to create more jobs in the construction and installation phase than in the operation and maintenance phase. There was therefore a risk of shortfall of available professionals in the coming years. Finally, political and private actors should adopt strategies that meet the needs of the new sector, educate workers to improve local expertise so that the local competitiveness is maintained (Moreno & Lopez, 2008).

3.1.2 Concluding comments on employment effects

The studies summarised in Section 3.1.1 showed large differences in the estimated employment impacts of wind energy projects. For example, the ESS Group Inc. (2006) estimated that the employment multiplier for a 218 MW wind power project in New York State amounted to approximately 1.5 during the construction phase. That is, for every 100 direct jobs an additional 50 jobs were created. In contrast, a study by Ratliff et al. (2010) indicated that the construction phase of a 100 MW wind project in Utah created a local direct employment of approximately 132 people and 431 additional jobs, which gave a employment multiplier of about 4.3. It should be emphasised that the study by Ratliff et al. (2010) includes the entire state of Utah, and therefore included jobs at turbine manufacturers and other parts of the supply chain in the analysis. It should also be mentioned that Ratliff et al. (2010) estimated the induced employment effect. The review of the analyses of the employment effects shows that the size of the local multiplier depends on several factors, in addition to region size also the local business community's ability to meet the demand for goods and services.

During the labour-intensive construction phase the local availability of labour is an important variable. If local labour is lacking, competence can be recruited from outside. According to Northwest Economic Associates (2003), there were large differences in local employment effects depending on whether workers from outside can commute to and from work or if they, because of large driving distances, are temporarily living near the workplace. Workers who commute from and to their home do not spend their income on the work location, and thus create a kind of 'leakage" in the same way as if the goods or services cannot be procured locally by a wind power company. This applies mainly to smaller locations/communities, while medium-sized and larger communities do not have the same 'leak", but can use local labour. For local decision-makers and other stakeholders, such questions are of vital importance. For a general analysis of wind power's impact on employment, or interpretations of such studies, it is important to investigate the meaning of a narrowly geographically-defined study.

The same reasoning may also apply to the operation and maintenance phase, although one can assume that it is more likely that operational staff is recruited locally. Lantz and Tegen (2008) found that second to the local manufacturing of turbines and other components it was the operational phase that had the greatest potential to contribute to long-term local economic development. According to the authors, policy measures aimed at increasing the use of local resources during the operational phase should be prioritised over measures aimed to increase the proportion of local workers in the construction phase, if the funds for such measures were scarce.

Due to the above discussed factors there are also varying results during the operational phase, but generally, the estimated employment multipliers are in the range of 1.6–2.4. Many studies indicate that the induced effects are important at the local level and report significant impact on the trade and service sectors. It is also possible to indicate employment per installed MW during the operational phase. An average of eight such measurements indicate about 0.3 jobs per installed MW, including indirect and induced effects, during the operational phase. Goldberg et al. (2004) suggest instead that employment per MW could be significantly higher. The results of their scenario exercise indicated that about one job per installed MW can be created during the operational phase, if the wind farm is owned by local actors and financed by local lenders. This is because the income in such an option remains in the region and thus continues to benefit the local economy.

3.2 Effects of wind power establishments on other economy sectors

In this part of the chapter we consider industries that may be adversely affected by wind power projects in their local area. Two major industries that are often involved in discussions on Swedish wind power are discussed: (i) tourism and recreation, and (ii) reindeer herding. This chapter begins with an overview presentation of studies related to tourism and recreation (Section 3.2.1) and a concluding discussion (Section 3.2.2). This is followed by a summary of studies on reindeer herding (Section 3.2.3). Only a few studies of wind power's impact on reindeer herding have been possible to collect. Industries such as agriculture and forestry are discussed in Chapter 3.4 and 3.5 for instance in the form of land ownership (Chapter 3.4, 3.5).

3.2.1 Consequences for tourism

Wind power's economic impact on tourism concerns how the expansion affects the number of visitors to the area, their willingness to pay and the time they stay in the area. Access to scientific (evidence-based) knowledge is very limited, partly due to the fact that many studies have qualitative deficiencies and that very few systematic studies illustrate the development process both before and after the expansion (Scottish Government, 2008). Most studies consist of attitude surveys and how the expansion of wind power affect attractiveness of a place and to a lesser extent its effects (effect) on the number of visitors, willingness to pay and the time visitors stay on the site (Bodén, 2009). The difficulties in pricing non-monetary benefits (Kågebro Vredin & Johansson, 2008), such as a landscape's aesthetic and recreational values, contributes to a state of knowledge that today is unsatisfactory (see Section 3.3). Knowledge of wind power's impact on tourism is also complicated by its effects differing in the short and long term. There is also a problem related to different levels, i.e. that the effects on tourism may be different at the local, regional and national level (Bodén, 2009). Another shortcoming is that tourism studies are limited to visiting tourist. The category of 'second home owners" is inadequately investigated and will require more research.

Bodén (2009) studied how wind power relates to tourism in Jämtland. The study's purpose was, on the basis of wind power development, to identify policy issues for tourism to be considered during the planning process. Thestudy was based on scientific literature, interviews and discussions with local representatives of both tourism and wind power. The questions were linked to prospective wind power projects situated in different types of landscapes. The results showed that:

- from a visitor's point of view, focus should be directed towards different individual wind power projects and their impact on the landscape also in a wider geographical context, i.e. considering cumulative effects of the development. Visitors with a static landscape view, and for whom the journey is a goal in itself in the pursuit of 'pristine" nature and cultural experiences, is considered to be a group that is more likely to reject wind energy landscapes compared to tourists for whom the journey is a means to an end such as music or sports events. Even home owners can constitute such a group. That certain groups of tourists to a higher extent reject wind energy landscapes as a travel destination, however, be interpreted as a hypothesis due to lack of systematic scientific knowledge, as well as the positioning of wind farms, can be made in more or less challenging locations. Active marketing and an adaptation of the tourism product to new groups of visitors are expected to reduce the negative effects that the expansion of wind energy can have on the tourism industry.

- the *producer perspective* places wind energy development and tourism industry profitability in focus. The question is related to the development's short and long-term economic effects, the tourism industry's commercial weight, the tourism companies' activities, the distribution of wind energy income (added value) and companies with their activities located directly adjacent to the development site. A wind farm can induce improved infrastructure which can have positive effects on the local tourism.

In forest landscapes with a generally weak commercial tourism industry, representatives of the tourism industry believe that the positive short-term economic effects of large-scale wind farm projects is a necessary though not sufficient condition for the industry and the countryside to survive in the long term. In areas where tourism is more commercially viable, the acceptance of a wind power project is more influenced by whether or not the industry is compensated for the loss of natural values, reduced attractiveness and for costs to adapt the existing tourism product. In mountain areas where the industry is vital for society and commercially strong, the precautionary principle has a stronger impact and the expansion is more restrictive. In cases where land ownership and entrepreneurship go hand in hand, the acceptance of an expansion is strong, as well as believing that wind farms can serve as a touristic value and enhance an area's attractiveness. The degree of acceptability is thus positively correlated to the projects having a strong local anchorage.

- the local *societal perspective* places the importance of tourism for the prosperity of the town in focus and in what way it is affected by wind energy development. Given the short term (construction phase) and provided that the development is not incompatible with tourism interests, the results indicate that the expansion of wind power in a general level is compatible with tourism interests. In the longer term, the situation may change if the economic effects of the development gradually decrease and the risk of adverse cumulative effects increases (Bodén, 2009).

Riddington et al. (2008, 2010) presented in a report to the Scottish Government an attempt to quantify how wind farms affect tourism. The study consisted of a national and international literature review of some 40 studies, and three empirical substudies. The overall conclusion was that there is no support for the conception that wind farms are a threat to the tourism industry. There is no statistically significant result which confirms that this is the case *after* development. This should, however, according to the authors, not be interpreted as a development not having a negative effect at all. Instead, it should be interpreted as: authorisation of a development would not have been given in case contested nature and landscapes with high tourist potential and attractiveness were threatened, or that the effects studied, if they exist, are too small to be measured. The results of the literature review shows:

- studies which show that wind farms do not generate measureable effects either on visitors' preferences or the likelihood that they return to the destination. Other studies show that the percentage of visitors that are affected positively and negatively respectively largely offset each other. There were studies showing that up to 32 per cent of visitors would probably not return.
- that people show a strong desire to protect and preserve the cultural landscape (Moran, 2005). Moran's results, based on 42 landscape studies on how people value landscapes, are expected to be difficult to relate to tourism, because the scenic landscape in general is only a part of tourists' overall experience and thus has a limited impact on their travel motives and willingness to pay.

The results of three empirical studies (Riddington et al., 2008, 2010) show that:

- more than 80% of the tourists visiting Scotland could see wind farms, that between 10–32% of the total number of hotel beds were affected in the four regions included in the study and that the total number of professionals in the tourism industry in these regions were between 7–11%.[2]
- 39% of visitors were positive towards wind farms, 36% neutral and 25% negative or very negative (10%). The results showed that between 20–30% of all visitors in the four regions prefer landscapes without wind farms, and that wind farms produce fewer reactions among visitors compared to e.g. mobile towers and hydropower.
- the percentage of possible English and American visitors who said they did not intend to visit areas with wind farms is near 18 per cent. The result of this Internet-based substudy[3] showed that the percentage of visitors who could opt out of a region or Scotland as a destination is

---

[2] The four regions have different tourism impact, measured as employment within the tourism industry: Perth & Kinross & Stirling (10.7), Caithness & Sutherland (9.9 %) Scottish Broders (8.6), Dunfries & Galloway (8.4).

[3] The substudy is based on an Internet survey covering 600 prospective English visitors and 100 American.

significantly higher than what the interview survey shows (2.5%). Close to 63 percent of the potential foreign visitors are preferring rooms with views with no wind farms. The results also showed that younger users (16–25 years) draw less attention to the wind farms.

- The negative economic impact of visitors' attitudes towards wind power was calculated to contribute to a loss of a total of 211 jobs, equivalent to 0.1 percent of the number of people employed in the tourism industry in Scotland ('worst case" scenario) [4]. Job losses were greatest in the most distinctive touristic regions Stirling, Perth & Kinros. The calculation excludes, however, positive employment effects in other industries and that tourism in undeveloped areas may increase as a result of wind power establishment. The addition of jobs in the wind industry was assessed to more than offset the loss of employment in the tourism industry.

Negative total impacts should, according to the authors, be avoided by prioritising large developments over several small ones, especially if they occur in the same area. Exploitation of areas for wind energy is also expected to require measures so that 'repelled" tourists can be offered unexplored areas elsewhere. The ability to launch wind farms as tourist attractions and to market areas as 'green" should also be considered according to the study (Riddington et al., 2008).

The study was commissioned by the Scottish Government and has faced harsh criticism from organisations representing the tourism industry, like representatives of ecotourism, outdoor activities and smaller travel agencies[5]. To what extent the results of the study can be transferred to Swedish conditions is unclear. The literature review did not address distance between wind turbines and buildings.

Lilley et al. (2010) conducted a survey among 1,000 tourists who visited the beaches in Delaware, USA. The tourists were shown images manipulated to illustrate the visual impact of offshore wind farms in the vicinity of the beaches and were then asked to consider how this development would affect their willingness to travel to Delaware and visit the beaches again. Four different distances to an offshore wind farm was illustrated: 1.5 km, 10 km, 22 km from the coast, and too far out to see.

The results indicated that a wind farm 1.5 km from the coast would lead to a potentially huge loss for the tourism-related industries in Delaware, since 35% of respondents stated that this establishment alternative would make them visit another beach in Delaware, while nearly 10% of respondents would not return to Delaware at all. This loss diminished, however, the greater the distance to the proposed wind farm was, but still 7.2% of

[4] The study of the economic impact is based on official data and studies of tourists' expenses.
[5] These critical articles are found in Wilderness of Scotland dated 20-03-2008. The organisation states that 'the Government's survey is fundamentally flawed and should not be relied upon".

respondents reported that they would not return to a beach in Delaware if a wind farm was built 10 km from the coast. The establishment of alternative 22 km from the coast would mean that 2% of the respondents stopped visiting the beaches in Delaware, while 0.3% would stop visiting the beaches even if a wind farm was built out of sight. The authors found that wind farms could also attract some visitors.

NFO World Group (2003) investigated, on behalf of the Wales Tourist Board, potential impacts of wind farms on tourism in Wales. Among the 266 respondents in a survey 77% said that the beautiful landscape was an important reason why they visited Wales. 23% of the respondents felt that visible wind turbines would have worsened their experience of the visit, while 17% felt that visible wind turbines would have improved their experience. The majority of the tourists were in favour of wind power as an energy source and there was a strong preference for offshore wind power (83%). 43% of tourists disagreed with the claim that wind farms destroyed the visual impact of rural Wales, while 43% agreed that wind farms destroyed the visual impression of the coast of Wales. 68% said they would be interested in visiting a wind farm if there was a visitor centre, but only 21% felt that wind farms could be a tourist attraction if they were placed in 'tourism areas". 68% of respondents stated that it would not make any difference to their willingness to visit the Wales countryside if the number of wind farms increased, while 11% said they would not return again. NFO made the interpretations that new wind power projects can have negative consequences for the tourism industry in the future. They also noted that none of the respondents reported that more wind farms would increase the likelihood that they would visit Wales again.

3.2.2 Reindeer and wind power

Swedish Sami Association (SSR) describes reindeer herding as a form of nomadic grazing, where the reindeer roam, drift or are transported between different pastures depending on the season. One grazing area can often not replace another, which means that the development of land areas for e.g. wind power could mean interference to the reindeer. Such interferences are problematic in several ways, as the reindeer industry not only creates supply, but also social values and forms a basis for cultural identity (SSR, 2011). SSR (2011) argues that the availability of appropriate calving, effective migration routes with resting areas and central consecutive grazing areas for each season is of great importance for a functional reindeer herding. It also requires grazing peace, especially during calving and the growth period. Access to secured winter pastures are said to be vital for the survival of reindeer herding.

A study on quality of life in seven Sami villages in Sweden was conducted during 2003–2006 (Daerga et al., 2008). 147 Sami responded to a questionnaire on quality of life with questions including physical, psychosocial and socioeconomic conditions. The study showed that men had a positive attitude towards the future of reindeer herding. Women however, associated future earnings to their own ability to control income. The greatest threats to the quality of life among the Sami people is probably the reduced income of reindeer herding and the psychosocial stress of the constant competition for land, which may relate to mining as well as wind power. The authors believe that quality of life would be reduced among reindeer owners, especially if they do not get any opportunity to influence the development of the pastures (Daerga et al., 2008).

Only a few studies of how wind power affects reindeer have been found (see e.g. Larsen, 2002, Norwegian Water Resources and Energy Directorate – NVE, 2004). According to these studies, wind power has no significant negative effects on reindeer. For further research on the effects on reindeer see the synthesis report *Wind power's effects on terrestrial mammals – a synthesis* (Vindval 2012a). The most important factor to consider is the human activity associated with the construction phase, and it is mainly the use of roads that disturb the reindeer. Skarin & Hörnell Willebrand (2011) has developed a tool for the planning of wind power's effects on domesticated reindeer.

Sami village representatives believe that early dialogue and good planning can help prevent negative impacts by avoiding sensitive areas such as calving land and prioritise already exploited areas with existing roads and power lines (Larsen, 2002).

The interviews Larsen (2002) conducted also showed that there is some interest from the Sami villages to be a partner in wind power projects and thus secure a source of income. The villages that already had running turbines on their land had been asked to become partners, but declined because they saw no economic benefit in it and also lacked the ability for finance investment. Most of the villages with existing or planned turbines felt that they should be compensated financially for grazing losses, but only one of the villages reported that they had either received or will receive financial compensation for the land occupied by wind power projects and in that case it concerned a road construction. A research study on 'Planning for wind power's effects on reindeer" started in 2009 (EPA 2011b, www.naturvardsverket.se 24-08-2011).

The study is a complement to the above-mentioned Norwegian survey Wind Rein (NVE, 2004). The project aims to develop a GIS-based planning tool for reindeer that can be used in the planning and implementation of new wind farms (see more information in the Vindval synthesis report *The Effects of Wind Power on Terrestrial Mammals – A Synthesis*). Swedish Wind Energy and the Swedish Sami Association has, in the project 'VindRen" funded by the Swedish Energy Agency, developed guidelines and knowledge on wind power and reindeer (Swedish Wind Energy & Swedish Sami Association, 2011, www.sampi.se 01-09-2011, Swedish Wind Energy, 2011 www. vindkraftsbranschen.se 01-09-2011). The information is aimed primarily at wind power developers and the people in the Sami villages and describes consultations, agreements, EIA, construction, operation, wind power and reindeer, how reindeer can be affected, changes in the Sami village and the work on wind power.

Several appeals for wind power projects in the mountains have been made and the Environmental Court gave in 2011 judgment in a case regarding authorisation for wind farms in Västernorrland and Jämtland County (Case No. M 824-11, 825-11 and 847-11). One of the judgements is about reindeer herding in the Björkhöjden-Björkvattnet area. Wind turbines cannot be allowed placement closer than five kilometres from the gathering area for reindeer. This means that wind turbines are only allowed in a limited area (Environmental Court, 2011).

3.2.3 Concluding comments on tourism and reindeer herding

The compilation of studies on wind power's potential impact on the tourism industry gives no clear picture. Bodén (2009) studied how wind power relates to tourism in Jämtland and found among other things that in the forest, with generally weak commercial tourism, the representatives of the tourism industry assess that the positive short-term economic effects of large-scale wind farm projects is a necessary (though not sufficient) condition for the industry and the countryside to survive in the long term. In areas where tourism is more commercially viable, the acceptance of an expansion is more influenced by whether the industry is compensated for the loss of natural values, reduced attractiveness and costs to adapt the existing tourism product. From an international perspective, a comprehensive study from Scotland (Riddington et al., 2008), reaches the overall conclusion that there is no support for the view that wind farms are a threat to tourism, because there is no statistically significant result which confirms that this is the case *after* a development has taken place. They point out, however, that this should not be interpreted as an expansion having no negative effects. Instead, it should be construed as authorisation of an expansion not being granted in cases contested nature and landscapes with high tourist potential and attractiveness have been threatened, or that the effects studied, if they exist, are too small to be measured.

The Sami habitat and economic situation may be affected by a wind farm establishment. There is not much research on the situation of reindeer owners associated with wind power. A tool for planning of wind power's effects on domesticated reindeer has been developed (Skarin & Hörnell-Willebrand, 2011).

3.3 Economic valuation of non-marketable effects

In previous sections there are aspects of wind power projects that in many cases are possible to quantify. With the appropriate analytical method it is possible to estimate the number of jobs created by a wind power establishment which makes it possible to assess the economic value. This section summarises research where researchers have tried to put a 'price tag" on wind powers positive and negative external (non-priced) effects on society and the individual. Sections 3.3.1 and 3.3.2 are overviews of research and other analysis of non-marketable aspects of wind power investments. Concluding remarks are found in Section 3.3.3.

In markets where ‘normal” goods and services change hands, the individual buying decisions depend on how the characteristics of a product is perceived in relation to its price. The market price can therefore provide information about how valuable the consumption of the product is experienced.[6]

For ecological resources and services there are generally no established markets and the absence of a market means that there is considerable uncertainty about the size of the economic value which these resources and services generate. Some environmental services have a relatively clear market price. There are relatively clear price differences between properties that have sea views (can be classed as ‘environmental services”) compared with surrounding properties without a sea view. There is also uncertainty in terms of how much impact external environmental costs have on society and the economy. External costs are side effects of production or consumption that no one pays for. In the environmental economic field there are different valuation methods in order to highlight these values and costs. Research in this area has grown considerably in recent decades. Often, a rough division into *direct* and *indirect* methods of economic environmental evaluation is made[7]

Direct methods for economic environmental assessment is based on interviews and/or surveys where people's willingness to pay are examined. In *indirect* methods we use existing relationships between environmental quality and individual action on an already established market in order to quantify the value of environmental benefits and/or costs. Section 3.3.1 summarises the results of a number of environmental valuation studies based on direct methods, where positive and negative attributes of wind power are emphasised. The results from studies of willingness to pay (WTP) can contribute with knowledge of how much or how little a ‘typical” person is willing to pay to get electricity from wind power – or to minimise/avoid impacts from wind power that is perceived as negative. These values are estimates of the size of the value (in terms of economic entities) that people on average assign the environmental advantages or disadvantages that may be associated with wind power. The results of the so-called ‘choice experiments” also provide information on how various positive and negative characteristics of a resource are valued in relation to each other.[8]

---

[6] If a person is willing to pay a certain price, for example ten dollars, for a particular service, such as going to the cinema, that person voluntarily refrains consumption that he or she otherwise could have used that ten dollars for, and the economic value of the cinema visit can thus be said to be equal to at least ten dollars for that person.

[7] See for example Brännlund & Kriström (1998) for a more detailed review of the theoretical and empirical aspects of the economic environmental valuation, including the main advantages and disadvantages of different methods.

[8] There is an intense debate, both within and between disciplines, about the key advantages and disadvantages of various environmental economic valuation methods. There are several theoretical and methodological problems with these methods. One weakness of direct methods is that they are based on answers about how people would respond to a hypothetical situation, as opposed to indirect methods based on actual behavior in existing markets. One advantage of direct methods is that they are able to include the total economic value as opposed to indirect methods which are only able to include so-called user values. Meanwhile, the results of these studies give an opportunity to highlight the ‘invisible” values and costs, and they can thus, together with other research, form an important part of the overall information on how wind power affects people.

The research presented and summarised in Section 3.3.2 is based on the *property value method*, which is an example of an indirect method for economic environmental valuation. Using the property value method, one can examine how various characteristics of properties (both physical characteristics of the current property as well as characteristics in the environment) affect the price. This section summarises studies that empirically investigate whether real estate prices for properties with wind power in the vicinity are lower than prices for properties without wind power in the vicinity. Such a price effect may then be interpreted as an indication of the size of (some of) the socioeconomic environmental cost.

There are similarities between some of the studies presented in this section and the attitude studies in the introductory chapter. Studies within economic environmental valuation contribute, like the attitude studies, with knowledge of the properties of different resources or services (such as wind power) that people perceive as positive and negative. It is also possible in both attitude studies and economic environmental valuation studies to describe how a particular view, e.g. a positive attitude towards wind power, associates with different socio-economic, political or experiential factors. One difference between regular attitude surveys and economic environmental valuation studies is that in the latter case, the economic valuation translates to a common scale that is expressed in monetary units. This means that the results of economic environmental valuation provide information both about how a particular change is perceived and how high (or low) the change in question is valued.

3.3.1 Direct methods for the economic valuation of environmental effects

Some of the studies that estimate the public's willingness to pay for renewable electricity focus specifically on wind power. The result shows that people say they are willing to pay a higher price for electricity from renewable sources. Below are studies where mainly the choice experiment method has been used. The studies are divided, subject to certain studies that could fit under several headings due to several properties having been studied.

Choice experiments – willingness to pay for renewable energy

Navrud & Grönvik Bråten (2007) investigated how the Norwegian consumers rated different types of energy. The authors focused on domestically produced electricity from wind, water and natural gas – in relation to imported coal. The wind was perceived as the main option (WTP is higher) while additional hydropower and gas power was perceived as inferior to imported coal. An average Norwegian household claimed to be willing to pay 1,087 NOK more per year for electricity produced from wind, compared with imported coal. The results also indicate that the WTP for wind power is significantly higher in cities than in rural areas. Norwegian households prefer fewer large wind farms before several small ones.

Borchers et al. (2007) studied WTP for 'green" electricity in the United States. One of the characteristics analysed was how 'green" electricity from different sources was evaluated. Respondents were asked to choose from unspecified ‘green” electricity in relation to ‘green” electricity from wind, solar, biogas and biomass. Also included in the experiment was a quantity attribute in the form of various units of ‘green” electricity in total household consumption (varying between 0% and 25%), and a cost attribute (ranging from 5 euro and 30 euro per month). According to the results, there was a positive WTP for both ‘green” electricity in general and for each of the specific energy. The willingness to pay was highest for solar power (19–22 euro per month), but also wind (13–16 euro per month) and unspecified ‘green” electricity (15–17 euro per month) was valued relatively high, while the WTP was lowest for electricity from biomass (9–11 euro per month).

How different characteristics of renewable electricity were valued in 300 households in the UK was studied by Longo et al. (2008). The attributes studied were: different levels of reduction of greenhouse gas emissions, the number of outages, the number of new jobs and different size increases in household’s annual electricity costs. The results showed that a one per cent reduction in greenhouse gas emissions were valued higher than one per cent increase in the number of jobs in the energy sector.

Choice experiment – willingness to pay for landscape impact

Ek (2006) examined the Swedish public’s valuation of some properties associated with wind power. The focus was how consumers valued wind power in general. The results are based on a questionnaire which was sent to 1,200 homeowners with a response rate of 52 per cent. The experiment included location (coastal, mountain or sea), noise, height, grouping (individual, up to 10 and up to 50 turbines) and a higher electricity price. The results showed that impact on the landscape and the siting of wind farms was thought to be most significant for the perceived (un)usefulness of Swedish consumers. Electricity consumers prefer offshore wind power over coastal wind power and wind power in the mountains. Wind power in the mountains was seen as inferior to coastal wind power. Relatively small groups of wind power were preferred over individual turbines and large wind farms.

Meyerhoff et al. (2010) analysed how the public in two German regions (with hitherto limited wind power) valued environmental costs of wind power development. The authors examined how turbine sizes, height, impact on bird life, distance from the accommodation, and a higher monthly electricity cost was valued. The results showed a statistically significant willingness to pay (i.e. perceived environmental costs) to limit both wind power’s impact on birds (red kite) and to extend the distance to the residents. By contrast, the turbines’ height had no statistically significant impact on how the participants in the experiment chose between alternatives. This may be because it is difficult for respondents to assess and compare the heights of built objects that significantly exceed human scale.

In a study, Dimitropolous & Kontoleon (2009) analysed which factors affect the willingness to accept two planned wind power projects in Naxos and Skyros in Greece. The size of the environmental cost was estimated, and respondents were asked to choose between wind power with different characteristics and with different levels of compensation (i.e. the question related to the compensation required in order to accept wind power, unlike the majority of similar studies that asks for the willingness to pay in order to limit negative impact). The characteristics/attributes included in the experiment was wind farm size (in number of turbines), height, ecological status of the area (whether it was a Natura 2000 site or not), the existence of local influence in the planning process and the different levels of an annual economic compensation per household. The results showed that the ecological status of the area and local participation was more important, i.e. valued higher, than the number of turbines or turbine height.

Alvarez-Farizo & Hanley (2002) analysed and quantified environmental costs of a planned wind farm in (a unique area with its own micro-climate) in Zaragoza, Spain. The characteristics/attributes included in the experiment were as follows; impact on limestone rocks, the flora and fauna, on landscape and a cost attribute in the form of a tax increase. The authors found that the wind power establishment in question would have significant socio-economic costs in terms of negative environmental impacts. They also found that the impact on animal and plant life was perceived as more negative than the impact on the rocks and on the landscape.

Bergmann et al. (2006) analysed the positive and negative non-market priced effects (externalities) arising as a result of wind power on land and offshore, hydropower and biofuel power. The authors focused on differences in preferences between people in urban and rural areas. The study was conducted in Scotland. Results were based on 828 survey responses. The experiment included the following five characteristics/attributes: (a) impact on the landscape, (b) impact on wildlife, (c) impact on the amount of emissions (air pollution), (d) the number of new jobs, and (e) impact on electricity prices. Respondents reported the highest willingness to pay to reduce the amount of emissions (air pollution). Limited impact on wildlife was also perceived as important. There was a positive willingness to pay to reduce impact on the landscape (when impact was described as being high) but no significant willingness to pay for reducing the impact on the landscape when impact was described as limited. Another result of this study supported that preferences did differ among the population in rural areas compared to urban populations.

A detailed analysis of these results was made by Bergmann et al. (2008). The results were consistent with the study from 2006 i.e. urban people had a positive willingness to pay, mainly to protect the landscape, but also for wildlife and reducing the amount of emissions. However, there was no statistically significant willingness to pay for new jobs in the urban population. People in rural areas had a positive willingness to pay for new jobs, to protect wildlife and to reduce emissions to a greater extent than urban people. There was some support for rural people valuing landscape impact lower than what urban people did; they found no significant willingness to pay in the rural population for limiting landscape impact. Bergmann et al. (2008) also found that offshore wind power was valued highest. Small wind farms on land are preferred over large wind farms on land.

Choice experiments – willingness to pay for offshore wind power

Preferences for different alternatives of offshore wind power were investigated in Delaware in the U.S. (Krueger, 2007). The results showed that there was a positive willingness to pay for moving the wind farms further offshore. Accommodation near the coast had higher WTP than residents in the hinterland. In general, Krueger's results show that there was a positive attitude towards offshore wind power among the residents in Delaware, USA. Assuming that there would be no additional cost, an astonishing 95 percent of respondents said they would opt for offshore wind, while only 7 percent chose coal or gas-fired power. Even at a higher electricity costs, 91 percent of the respondents said that they would chose wind power.

Ladenburg & Dubgaard (2007) examined the environmental costs (negative externalities) of offshore (coastal) wind power in Denmark. The study had been included, the plants away from the coast (8, 12, 28 or 50 miles), number of wind farms (5, 7 or 14) with a varying number of turbines in each park (49, 100, or 144 per park) and a cost attribute (one annual surcharge on electricity bills). The results indicated that the socioeconomic environmental costs of wind power decreases if the plants move farther out to sea. The mean WTP for moving the future wind farm 12, 18, and 50 km offshore instead of 8 km was 46, 96, or 122 euro / household / year. The results also showed that respondents can see the wind from his home or his summer had a significantly higher willingness to pay to avoid the establishment than the average respondent.

Choice experiments – valuing positive effects of wind power

Koundouri et al. (2009) did a CBA (cost-benefit analysis, evaluating the socioeconomic benefits in relation to the economic cost) of a planned wind power project in Rhodes (Greece). In the calculation, the authors included an estimation of the size of environmental benefits (i.e. the size of the positive externalities) on the utility side. Respondents were asked to accept or reject different price premiums in the form of higher electricity costs in order to help finance a planned wind farm in Rhodes. The results showed that the average household was willing to pay via their electricity bill another 50 euro per year to help make the wind power project possible. Households that seemed to know much about renewable energy and were generally positive about renewable energy sources were more likely to support the project, as did respondents with higher education. However, there was no difference in willingness to pay depending on where on the island the respondents lived (near or far from the project), nor did age or income level affect the willingness to pay. Given the included investment costs, the authors concluded that the project was economically profitable. Note that no costs for potential negative environmental impacts from the wind power project were included in the analysis.

Compensation

Groothuis et al. (2008) studied what compensation in the form of reduced energy bills would be needed for residents in the southern Appalachians to accept wind power in the area. The probability that an average respondent would accept (vote for) a wind power project increased with the size of compensation. Also, the respondent's level of education, and a generally positive attitude towards wind power as an energy source increased the likelihood that the proposed project was accepted. The probability that a person would accept the project was, however, lower for individuals who have settled permanently, and for individuals whose ancestors came from the area. Those who stated to a higher extent that wind turbines harm the landscape in the area were also less likely to vote for the project.

3.3.2 Indirect methods – wind powers effect on property values

A concern that the value of property would decrease significantly if wind turbines are built in the vicinity, has in recent years been the cause of debate among the public. Concern is often found in the public's opinions on projects and local plans and in local press and media. Opponents of wind power often address this issue.

Sims et al. (2008) made an attempt to quantify how the wind farm Bears Down (with 16 turbines of 60 metres height) in Cornwall, had affected property values in the area since it was commissioned in 2001. The area around the wind farm stood out because it (at the time of the study) is the only area in the UK where there has been enough property transactions near wind turbines in order to conduct a quantitative analysis. Sims et al. (2008) used the property value method and analysed a total of 201 property transactions during the period 2000–2007. The results indicated that there was no correlation between the number of visible wind turbines and lower property values. The authors found no indication that the distance to the wind farm (about 800 m) impacted house prices. Their analysis also showed that even though it was not possible to draw any conclusions about wind power's impact, an attractive view contributed to a higher property value.

Hoen et al. (2009) studied the impact of wind farms on property values in the United States. They used a combination of the property value method and other methods to analyse data of 7,500 property transactions. The researchers found no strong evidence that wind farms affect property values. No statistically significant correlation was found between the sale price and the view of wind farms. The authors point out, however, that the analysis cannot exclude that individual properties may be adversely affected, but if it is so, the effects are either too small or they occur too infrequently to be measurable, at least in this type of analysis.

Joly et al. (2009) used a property value method in a report to quantify the value of the surroundings. Information from a total of 4,352 houses with known value, location, and landscape characteristics were used. The results confirm that the landscape characteristics affect house prices, but the landscape and visible features more than 100–200 metres away had a negligible effect on property prices. In this study, forest and agricultural land directly adjacent had a positive impact on the price while roads had a negative impact (Joly et al., 2009).

In Sweden, one is often referred to Lantmäteriet's property barometer statistics on house price trends. There are few follow-up studies and valuations before and after a wind farm establishment that are linked to specific properties. The Swedish Wind Energy Association conducted a study on the subject in 2010. The consultancy Ångpanneföreningen (ÅF) analysed 42,000 Swedish house sales within 5 km of 120 wind turbines. They compared these homes sales with reference areas of other affected municipalities, to thus examine whether neighbouring wind turbines affect property values negatively.
The study reported that the increase in house prices was very strong during the past decade, about 100% based on the average selling price. The survey also showed that the average price of single-family homes that were within 5 km of new wind turbines had increased at about the same rate as prices in the reference areas during the period 2000–2009 (about 133%) and thus also risen significantly more than the national average. As part of the investigation they made statistical calculations to explain the results, which showed a negative effect of 2–4% for properties within the distance range of 1–3 km from the wind, but the degree of explanation was low. The authors believe that the lack of possibly important qualities like the landscape character and wind turbine visibility may mean that the analysis systematically under or over-estimates the effect of closeness to the wind turbines (Swedish Wind Energy, 2010).

The above study was complemented with an analysis of sales three years before the turbines went into operation. This indicated that prices even then were lower in the range of 1–3 km from the forthcoming wind turbines. This could suggest that there are other factors specific to those areas, such as geography in general, that have the greatest impact on property values. The study also observed 98 single-family properties where the sale price fell after the wind turbine was put into operation. The study found that in no case was there any indication that wind power, by direct or visual impact, caused the fall in prices. The overall conclusion was that it was not possible to show any strong correlation between new wind power projects, and the development of prices of nearby properties. But the authors point out that the issue is important to study further, not least because the above investigation was made with a limited statistical basis (Swedish Wind Energy, 2010).

The U.S. consulting firm Appraisal Group One (AGO) (2009) analysed how wind farms affect land values in Wisconsin. The report presents a survey of brokers in the area, which indicated that proximity to wind turbines could reduce property values by as much as 24–43%, according to the brokers' view. AGO cites a number of sources, not the least personal communication with brokers, which meant that proximity to wind turbines could lower a property's market value by 20–30% because of perceived noise, lighting effects and negatively affected views. Some brokers ruled out certain land as 'unmarketable" because of the negative effects from wind turbines in the property's vicinity. Of the studies and reports that have shown to lower property values in the synthesis AGO presented, the average reduction is about 20%. AGO also presented its own analysis of transaction data. By comparing the 12 land transactions in two separate areas where wind turbines were visible from the site, the 96 second land transactions deemed comparable, but without visible wind turbines, AGO found that visible wind lowered the value of the land by an average of 30–40% in the two areas. It is important to note that in the U.S. limits for noise from wind turbines differ from those in Sweden. The benchmarks also differ between states. A comparison between the American and Swedish studies, in terms of property values is therefore difficult to make.

3.3.3 Concluding comments, environmental valuations and property values

Overall, the research we examined indicates a positive willingness to pay for electricity from renewable energy sources. The literature review also indicates that wind turbines cause some perceived environmental costs, such as impact on flora and fauna. A number of studies indicate that the impact on the landscape is of great significance for the perceived 'un-utility" of wind power projects (see for example Ek, 2006). This is reinforced by Ladenburg and Dubgaard (2007) and Krueger (2007), who found a positive willingness to pay for offshore wind farms sited further offshore.

Among the studies reviewed, which examined wind power's impact on property values, no overall statistically significant ones were found supporting that proximity to wind turbines has a negative effect on property values (Sims et al., 2008; Hoen et al., 2009; Swedish Wind Energy, 2010). As a contrast to this, a U.S. consultancy report by Appraisal Group One (2009) cites personal communication with brokers, who say that proximity to wind turbines can lower a property's market value by 20–30% due to noise, light effects and negatively influenced views. The lack of statistically significant support for a negative effect on property prices in the literature does not preclude that individual property may be adversely affected. Sims et al. (2008) also found that an attractive view was an important explanatory factor in a property's value. Such values may be affected by a wind farm nearby. One problem with the American studies is that they report other benchmarks than the Swedish studies. The American studies state that there is a correlation between a reduction in property prices and wind power while the Swedish do not. There is too little research on this, more longitudinal studies are needed.

The above analysis also raises the issue of wind power's total external costs compared to other forms of energy sources. This question is difficult to answer in general terms, not least because these costs are highly dependent on context. Figure 3.1 below summarises the estimated environmental costs of eight different power technologies based on the results from a total of 63 studies, and shows that the estimates of external environmental costs – including those for the same production – vary considerably (note the use of a logarithmic scale). The lowest values are basically zero, while the highest values in some cases are much higher than EUR 800 per MWh. The wide variation in results is partly because studies are analysing different types of wind power plants in diverse geographical contexts and because different valuation methods are used. Coal and oil had the highest external costs. It is also worth noting that wind power generally exhibits relatively low external costs, and is also together with solar energy the only technology for which no estimates of over 10 U.S. cents per kWh were reported. Wind power's external costs are dominated by aesthetic effects such as the landscape impact, but also noise and impact on flora and fauna adds to its environmental costs (Sundqvist & Söderholm, 2002).

3.4 Shared owning and cooperatives

Earlier parts of Chapter 3 have touched on local ownership, for example in Section 3.1 where it was found that locally-owned wind projects can potentially create more local jobs than projects owned by outside companies, as revenues 'stay" and benefit local business (Goldberg et al., 2004). This section is a brief overview of the literature on how economic impacts of wind power investments are affected by different forms of local ownership. The section begins with a brief introduction followed by an overview of studies in Section 3.4.1 and a summary in Section 3.4.2.

Various forms of local ownership, private or municipal, shares or companies, may be of importance in the acceptance of a project (see Warren & McFayden, 2010). The form of ownership is also important for the local economy. Wind power establishments are sometimes declared (mainly in local and regional news media) as a beneficial way to create jobs in rural communities and to make use of local resources. Not least are locally owned projects an important issue. The Federation of Swedish Farmers, LRF, has highlighted its members' opportunities to make money on wind power. Via its website, LRF provides a guide for members affected by wind power establishments (see The Federation of Swedish Farmers 2011 www.lrf.se 25-08-2011) where the Federation recommends that parts of a wind energy investment should be offered to residents in the area because it benefits the local economy. Another factor that can bring income is by remising land in the form of leases, and optional forms of compensation such as 'rural allowance". These are discussed further in Section 3.5.

3.4.1 Wind power and local ownership

Lantz and Tegen (2008, 2009) analysed which factors drive wind energy-related economic development. Their analysis indicated that local ownership is of great importance. Locally owned wind farms (51%–100% local ownership) can generate a total of 79% and 164% greater local economic benefit, compared with external ownership. This is driven by the incomes to a greater extent remaining in the region, but also by the local owner (with support in the literature) being more likely to buy goods and services locally. It should be noted that the analysis presented by Lantz and Tegen (2008) was performed on the U.S. state level, which may mean that the results are difficult to compare to smaller communities.

The United States Accountability Office (GAO) (2004) analysed the economic impact of wind power investments on agriculture and rural communities in the United States. Their study indicated that although farmers normally receive an annual fee of U.S. $ 2,000 to U.S. $ 5,000 per turbine in revenue from land use fees, income from owning wind turbines can be two to three times higher. GAO points out that the investment cost of about U.S. $ 1 million/MW means that a farmer may only be able to build one or two turbines. GAO believes, therefore, that a lower income per turbine may be outweighed by the overall effect of instead leasing land to a capital strong energy company that is able to build more turbines. The survey also showed that farmers and other potential small investors generally did not qualify for investment incentives in the form of tax credits for renewable energy projects, which made the investment more expensive for them.

Bolinger & Wiser (2006) and Wiser et al. (2006) examined how different forms of ownership affected the revenues of wind power investments in the United States. They presented a comparative financial analysis of four alternative forms of ownership for 'farm owned" wind projects. Their overview of existing economic instruments showed that even if there is no financial incentive, one of the mainstays of the federal so-called *production tax credit* (a tax credit covering mainly larger, company-owned wind power projects), is a limited instrument to encourage small-scale wind power investments. The so-called PTC system excludes cooperatives and non-profit organisations, and does not allow the produced electricity to supplement electricity use – you cannot connect the wind power on their side of the electricity meter, you must sell production to an independent company. Bolinger & Wiser (2006) focus on four hypothetical wind projects in Oregon and found that the forms of ownership that allow the project to take advantage of the PTC system's tax credits were most likely to be successful. Their results indicated that a wind power project with many small, local ownerships has the potential to be profitable, but if the project cannot fully take advantage of tax credits in the form of the PTC system, the good economic conditions soon disappears. Then the so-called *Minnesota-style flip*-option is seen as the winning option instead. This is the same system that was investigated by the GAO (2004) and means that the wind power project is 99% owned by a major investor in the first 10 years, while the remaining 1% is owned locally, and then reversed after 10 years so that local ownership is 99% and 1% is owned by the former main owner. The reason for why this seemingly complicated system becomes profitable is primarily fiscal, but is also due to the local partner, at least in Minnesota, qualifying the project for state financial support for renewable electricity for 10 years. Bolinger & Wiser (2006) also believes that passive investors value the opportunity to pull out after 10 years at minimal transaction costs.

Lantz (2009) presented an analysis of how the effects of locally-owned American wind power projects differ from the effects of non-local ownership. He compiled a synthesis of previous studies which indicated that locally-owned wind power projects generate about 1.5 to 3.4 times greater impact on the local economy than non-locally owned projects. Lantz summarised a series of analyses of existing wind power projects, which showed that the employment effects of locally-owned projects were 1.1 to 1.3 times greater than the effects of non-locally owned projects during the construction phase, and 1.1 to 2.8 times greater than non-local projects during the operational phase. Lantz concluded that policy measures which encourage more locally-owned wind power projects in the U.S. probably contributes to increased economic development (per MW).

In a study in south-west Scotland, attitudes to land-based wind turbines were examined (Warren & McFayden, 2010). The study compared two forms of ownership; wind turbines owned by the local community, and wind turbines owned by external companies. The researchers conducted interviews with 68 individuals from the local population as well as 38 tourists and found that communities that were directly involved in the development of wind energy through local ownership were more positive towards wind farms compared to areas where the local community had no ownership in the projects. They argued that wind farms owned by the local community can be an option which reduces opposition at the local level, but at the same time they saw difficulties associated with this since 80% of the interviewed tourists expressed some form of concern over wind farms.

In Sweden, a series of handbooks on owning wind, authored by Wizelius (2009, 2010a, 2010b) have been published. The books are aimed at individuals, small businesses, property owners and municipalities in Sweden.

In Wizelius (2009) Vindkraft på lantbruk, (Wind energy on farms) farmers on Gotland and Falbygden are interviewed. They invested in wind power in the mid-1990s, and stated that the return on invested capital was 0–12%. The book describes the different forms of ownership. A wind farm can be as part of a farming business, in a company or a cooperative. Different forms of land lease are addressed and examples are given of the design of commercial leases, land contracts, network contract, calculation of land compensation and calculation of wind catchment.

Wind power cooperatives are described as a growing popular movement (Wizelius, 2010a). In 2010, there were 70 such cooperatives in the country and they are listed in the book's appendix. Between 2009 and 2011, the number of members of cooperatives increased by 31 per cent from 20,000 to 25,000 members. Based on five examples of successful initiatives the author discusses what happens when older wind cooperatives are facing renewal, how cooperatives are growing and how newly established cooperatives work.

Wizelius (2010a) writes that a wind farm cooperative need not have any connection to the members' own consumption. There are many producers' cooperatives in agriculture and forestry, and it is possible for wind power as well.

In Wizelius (2010b) the author turns to municipalities and first provides an overview of what the Swedish municipalities and municipal companies have done in wind power. Wizelius indicates several reasons to own wind turbines locally: it contributes to an ecologically sustainable society. If a municipal property company buys its own wind turbine, electricity from the plant can be transported via the electric mains to buildings without being bought or sold. The company need not pay sales tax, or energy tax. A municipal company that has its own wind turbine is also resistant to fluctuations in the electricity exchange.

Figure 3.1. Example of a wind turbine close to a farm (Photo: Marianne Henningsson).

3.4.2 Concluding comments on shared ownership and cooperatives

The literature review shows that a number of potential benefits of locally-owned wind turbines can be highlighted (at least from the local community perspective). Not least, a wind turbine which is wholly or partly owned by the local community gains greater acceptance than one owned by external companies (Warren & McFayden, 2010). The literature review also indicates that local communities benefit from the revenues generated by locally-owned wind turbines. This includes not only the direct income from electricity sales, which remain local, but also the indirect effects that occur if part of this income is spent locally, thus favouring local industry (Lantz and Tegen, 2008; Goldberg et al., 2004). This can give rise to employment effects that are up to three times greater than those created by non-local projects.

But the literature also shows a threshold in terms of funding and that can make it difficult for individual farmers to invest in wind power. This is also pointed out by Larsen (2002), who conducted interviews with representatives of eight Sami villages in Jämtland. They pointed to some interest in becoming a partner in wind power projects, but also to difficulties in financing such investments. The United States Government Accountability Office (GAO) (2004) believes that it may instead be more advantageous to lease land to a capital-strong energy company that has the financial means to build more than one turbine.

3.5 Compensation mechanisms

Earlier sections of Chapter 3 have shown that the 'benefits" generated by wind power are not only the production of electricity from a renewable source, but also consist of income and employment. The literature review indicates also, however, that wind turbines potentially can create significant 'un-utility", usually depending on location. This un-utility can, as we discuss in Section 3.2 and 3.3, for example, consists of degraded recreational experiences and socio-economic costs in terms of negative environmental impacts. One question raised by the existence of such social costs, is whether these should be compensated, and if so, how? This section examines previous research on such compensation. Section 3.5.1 provides an overview of studies related to this issue and the section ends with some concluding remarks in Section 3.5.2.

Compensation is in the chapter assumed to provide some form of financial compensation, but in reality compensation may also be in the form of lost environmental services in an area being replaced elsewhere. Kuijken (2009) suggests that wind power related disturbances in natural areas in Norway are compensated by speeding up the establishment of other protected areas, in order to safeguard the landscape and biodiversity.

The section also deals with forms of land use fees, such as leases, which by their nature are different from the type of compensation we discuss briefly above. Fees that are paid to a landowner if he/she grants land for wind turbines is a business deal between developers and landowners where access rights have a market price, while e.g. deteriorating recreational experiences is a negative external (non-priced) effect which in some sense is a cost to society.

By common law, the Right of Public Access (EPA, 2011, www.naturvardsverket.se 12-08-2011), everyone in Sweden has free access to nature, subject to certain conditions and regulations. The Right of Public Access can be said to prevail by e.g. the shoreline legislation which prohibits exploitation and measures at beaches, including wind turbines that prevent outdoor activities.

There is a discussion on 'the value of the everyday landscape" and 'free sky over the treetops and buildings" and thus 'free starry sky" without flashing lights at night. Is the value 'free view" a national economic resource that can be utilised by everyone? The question has not been treated in research. Authorities sometimes require that visualisations and photomontages are made, showing impact of the wind turbine lights on the night sky.

The free views with a lot of sky appear mostly on the coasts, in the plains and in the mountain areas. In areas with forest they occur primarily by the lakes and in the agriculture regions and is particularly attractive when there is a combination of these. Views over marshes are part of the wilderness and its natural values where influence from urbanisation is minimal and 'free skies" therefore become important. According to Pettersson (2008), the wind is not owned by anyone: 'The wind does not fall under the definition of real property, it cannot be individualised and therefore it cannot be owned" (Pettersson, 2008, s 102). Pettersson writes that, according to prevailing legal principles of land ownership, the right to dispose the wind is dependable on the landowner during the period in which the resource is located within the boundaries of the owner's property.

Conflicts may arise when various forms of exploitation and conservation interests are competing for the same area. Through the Swedish planning and environmental legislation, 'affected stakeholders" are entitled to challenge decisions that they deem detrimental to their interests, and such issues should get a proper assessment regarding 'individual stakeholders" interests. The Environmental Court held in its judgment: 16-06-2009 Mod, D 7051-07 (Environmental Court, 2009) that the fact that the wind turbines can be seen, is not in itself grounds for denial of an establishment. The question of what happens when an entire district becomes affected by wind turbines in this way without the entire district being deemed as 'individual stakeholders", has given rise to a debate about compensation to entire districts. Nowadays it is relatively common for wind power developers and companies to voluntarily agree on some form of financial compensation to the district.

3.5.1 Compensation and lease

Scientists Lantz and Tegen (2008, 2009) analysed which factors drive wind power-related economic development. They reported that land use fees often amount to U.S. $ 2,700–2,900/MW and is an important positive effect. They also point out that such payments to landowners in rural areas generate a significantly higher return on the land than farming. They found that, if the multiplier effects are included in the analysis, land use fees for 1,000 MW of wind power could generate between U.S. $ 2.0 to U.S. $ 8.0 million in total utility.

An analysis of the economic impact of wind power projects on agricultural and rural communities was made by the United States Accountability Office, GAO (United States Accountability Office GAO, 2004). The results of the study showed that income from wind farms accounted for only 1% of farmers' total incomes in the ten states (in the U.S.) with the highest installed wind capacity, but for individual farms a wind farm could pose significant increases in income. A farmer who leases land to a wind farm may normally receive an annual fee of U.S. $ 2,000 to U.S. $ 5,000 per turbine. GAO also believes that the contracts are designed so that the landowner has a stable income for the entire wind power project lifetime, which can exceed 20 years. GAO also noted that wind power investments have been made in some of America's poorest rural areas, thus benefiting from the increased tax revenues and jobs. As an example the authors mentioned Pecos County, Texas, which benefited from U.S. $ 5 million in revenue from property tax for wind power projects, and that 30–35 jobs were generated by the projects.

Another American study was conducted by the Northwest Economic Associates (NEA) (2003). They analysed the regional economic impacts of wind power on behalf of the National Wind Coordinating Committee. NEA presented three case studies of existing wind farms built in the countryside during the late 1990s in the United States. They found that: (i) a 107 MW wind farm, which was established in Minnesota, generated a total of U.S. $ 621,000 in revenue from property taxes in 2001, and a total of U.S. $ 501,125 in annual revenue (net) for the landowners, (ii) a 25 MW wind farm, which was established in Oregon, generated U.S. $ 243,000 in direct tax revenue, and U.S. $ 64,300 in income (net) to landowners in 1999, and (iii) a 30 MW wind farm built in Texas, generated U.S. $ 387,000 in tax revenues for local governments in 2000, and U.S. $ 51,000 in income (net) for the landowners.

Today there is no legal practice in the EU that shows any rules for how compensation related to wind power should be given. In Germany, however, compensation to landowners is much more common than in Sweden. The issue of different forms of compensation related to wind power projects has been discussed extensively in the Swedish media. Below are some brief examples:

- Östersunds-Posten November 2009: Regarding district compensation: Common policy for compensation levels for wind power will be produced by the municipalities and the County Administration in Jämtland. (Östersundsposten 14-11-2009 www.ostersundsposten.se).
- Tidskrift Norrlandsförbundet, No. 1 2009, Theme Wind Power: 'Increased employment in the wind energy trail", example Bliekevare in Dorotea municipality: We apply a so-called rural allowance which means that three villages each year will share 0.3% of gross revenue from wind power (Tidskrift Norrlandsförbundet, 2009, www.norrland.info).
- Gotlands Tidningar 16-08-2010: 'Wind power has been important for the parish." Landowners receive 4.2% of the wind power companies' revenues, homeowners within 1 km from the turbine is compensated, the closer, the more and 0.2% goes to the community Näs (Gotlands tidning, 16-08-2010, www.helagotland.se/gt).

Wizelius (2010b) reports an example from Rättviks municipality's guidelines for rural allowance. Wizelius (2010b) argues that rural allowance should be calculated at least 0.5% of total gross compensation for the electricity turbines produce. The funds, which registered associations and organisations can apply for grants from (max 100,000), will be used for the promotion of joint projects or facilities for the area where the commercial wind power is established. As reported above, there is no legal practice for compensation in Sweden today.

Larsen (2002) conducted interviews with representatives of eight Sami villages in Jämtland, regarding the impact of wind power on reindeer herding (see further details in this Section 3.2.3). It emerged that only one village had received financial compensation for loss of grazing land, in connection with a road construction, while the villages with built wind power plants had not received such compensation. One of the respondents expressed the wish to have access to cheaper electricity for facilities, such as abattoirs, near wind turbines as an alternative to a direct financial compensation. The investigation indicated that compensation possibilities differ depending on the land in question.

As mentioned above, leases to landowners are not a 'compensation". The lease is a financial transaction between developers and landowners. In a Swedish context, leases represent a significant source of income for the landowner. According to the Federation of Swedish Farmers (LRF, 2011), an ordinary compensation for landowners who are leasing land for wind power investments is approximately 4% of the revenue from electricity sales.

3.5.2 Concluding comments on compensation and lease

It seems in general that there is a lack of comprehensive evaluations of compensatory forms of negative externalities (non-priced) effects of wind power investments. Initiatives such as the so-called rural allowance can help increase local acceptance, but such voluntary solutions generally require extensive negotiations. Perhaps they also open up the problem of how rural allowance shall be distributed equitably.

Fees for land use in the form of leases can be a significant source of income and is, according to the Federation of Swedish Farmers (LRF, 2011) typically about 4% of electricity sales. Such income is financial transactions between landowners and developers, and does not necessarily take into account recreational values and the impact on wildlife and nature. An example of this can be found in the northern counties where Sami villages have the right to use private land for reindeer herding (SSR, 2011), but if a wind farm is established in the area the lease of land only goes to the land owner. Economic compensation for such loss of pasture may in such a case the individual Sami villages themselves negotiate with the wind power company. When it comes to land above the cultivation zone, special rules apply.

4. Landscape

Box 4. Glossary for this chapter:
Expert: a professional who works regularly with the planning and/or projecting of landscapes.
Outdoor life: outdoor activities for well-being and the experience of nature.
Non-expert: a person who is not working on the planning and design of landscape in the same way as experts, but rather can be seen as users of or visitors to the landscape.
Identity: the feeling of interacting with a location, belonging to a place.
Landscape: a changing result of the interaction between natural conditions and society through its diverse cultural representations, expressions, and social actions. According to the European Landscape Convention "an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors".
Landscape analysis: a collective term for various ways to systematically analyse the landscape. Used as a basis for planning and illustrating state-linked changes in wind power development. Such analysis may include a factual study of landscape features, structures, scale, complexity, character and structural features.
Landscape Character Assessment LCA: Landscape Character Analysis is a tool that can be used in different planning contexts to describe and evaluate properties that are peculiar to a specific landscape.
Landscape character: a particular combination of elements (geology, soils, land use, settlement patterns) that give a landscape a distinctive character.
Landscape type: generic term for specific types of landscapes with common characteristics in terms of geology, topography, vegetation, land use, etc. Forest landscapes, maritime landscapes or agricultural landscapes are examples of landscape types that occur in different locations in Sweden. Every landscape has unique elements, but also belongs to a more general landscape type at the same time.
EIA: Environmental Impact Assessment, documentation of wind power´s environmental impacts.

This chapter has a slightly different story structure than previous sections of this report. The reason is that the concept of landscape hides a multitude of difficulties that arise in the planning of wind power. Four such difficulties seem to be central.

- The landscape is not only a physical place, but also something that exists in our cultural beliefs. The same physical landscape can be interpreted, construed and presented in several different ways by different actors in different social positions. Some interpretations have implications for the physical landscape's planning and development, while other interpretations might be sidelined. How the landscape is described, and the knowledge of the landscape that is considered to be relevant in planning, affects public opinion about wind power projects and the risk of conflicts.
- Landscape is a very complex area with a diversity of connected problems (planning, perception, psychology, sense of place, protests, ownership, commitment to the environment, housing, etc.). Unlike more defined areas, such as noise or the effects of wind power on sea eagles, the landscape tends to make more holistic claims. The landscape

includes not only what we hear, see, and experience, but virtually all flows and events that affect our environment. One could say that the landscape serves as a generic term that combines many of the elements that planners and researchers often treat as separate parts.

– There are several research traditions surrounding landscape, such as archeology, ethnology, landscape architecture, cultural geography, planning and environmental psychology. Various traditions give different answers to what is relevant, how the landscape should be investigated and which results are considered to be interesting. This chapter presents results from different research traditions to give as complete an overview as possible.
– A fundamental difficulty which partly is due to the complexity of the concept is that research on landscape rarely focuses on problem solving. Anyone looking for simple solutions have relatively little available. Furthermore, any practical solutions should always be considered in light of the circumstances, such as existing legislation and different planning traditions. A solution that works in Spain might be ineffective or impossible in Sweden.

The complexity outlined above may seem unmanageable for practical wind energy planning. But the chapter will show just how simplifications about the landscape and the inability to work with a complex reality have been an encumbrance in planning. A versatile approach to landscape is probably closer to citizens' everyday experiences.

In order to grasp the problems of the landscape concept, an understanding of the relationship between landscape and planning in the wind power context is required. First, in Section 4.1, we describe the Swedish planning framework. This is followed by Section 4.2 about the European Landscape Convention, which already has some implications for how the landscape is handled in Swedish planning. Landscape analysis has recently become an increasingly important tool for wind power planning, which is analysed in Section 4.3. Section 4.4 focuses on empirical research on the *perceptions* of wind power in the landscape, with special attention to *landscape character*, *visuality*, and *identity*. International research on landscape orientation shows that these three factors affect wind power in all environments and Section 4.4 can thus be said to provide a comprehensive understanding of landscape issues. Sections 4.5 and 4.6 provide slightly more specific insight into the wind power issue in *recreational, natural and cultural* environments. It should be noted here that the international literature is not easily divided into these categories. Natural scientific research on the impact on ecological systems, animal and plant species will not be discussed here, although this also (by extension) may have implications for humans. After each chapter we provide a number of summarising problem descriptions and issues that may be of interest to explore in the future.

It is now customary in theoretical literature on landscape that the “expert” view on landscape is not necessarily more neutral, rational, or better than “non-expert” interpretations of the landscape. Instead, differences in feelings, thoughts and interpretations are highlighted and the impact these differences have on power relations and how landscapes are managed in practice. Experts in this context refer to people who are working with planning and/or projecting of landscapes in his/her profession. Non-experts refer to people who are users of or visitors to the landscape. Many landscape specialists tend to emphasise visual techniques, scenarios, measurements, surveys, and other forms of expertise. A more humanistic perspective is needed that has its starting point in everyday life and the location’s unique conditions, social community and local forms of knowledge, and emphasises values that are not necessarily possible to quantify or generalise. A holistic view of the landscape, which takes into account a complex variety of tangible and intangible (“soft”, non-specific) flows, relationships and processes, which are difficult to translate into simple practical solutions (Cosgrove, 1998; Olwig, 2002; Sporrong, 1996). Just as the landscape has become significant beyond the visual image, it also becomes more difficult to see clear boundaries to the issues dealt with in other chapters in this report related to economy, health and anchorage.

In recent years, an important part of the theoretical literature on planning and landscape has shown a greater interest in participation as a key part of the planning process. This includes the development of:

- methods for dialogue (“participatory planning”, “collaborative planning”),
- studies of different forms of non-expert knowledge (“lay knowledge”),
- a stronger place and integrality orientation in landscape perspectives,
- a big interest in exercise of power and knowledge regimes (e.g. political ideologies or sciences), and
- a shift from quantitative measurable facts to intangible values in planning and landscapes.

The development outlined here has reached well beyond the purely academic debate. Today’s policy development on the landscape requires gathering knowledge and handling various forms of knowledge when it comes to wind power. The landscape has at the same time no univocal status in Swedish planning and its various policy areas.

4.1 Landscape, wind power and planning

To some extent, the tendency in Swedish planning is to see the landscape as an entirety. The Environmental Code (Chapter 6) refers directly to the landscape in the Environmental Impact Assessment (EIA). An EIA is a requirement to identify and describe the effects that a proposed activity may cause a landscape. The landscape concept is not defined in the legislation. An EIA, however, requires that when localizing wind power, one must take into account values that exist in the landscape (EIA procedures require a reasoned presentation of alternative designs and alternative locations). Several *environmental objectives* are affected by wind power development (SOU, 2000), although wind power is mainly seen as an indicator for monitoring Good Built Environment and a Reduced Climate Impact. Objectives like A Varied Agricultural Landscape, Balanced Marine Environment, Flourishing Coastal Areas and Archipelagos, and Magnificent Mountain Landscape, are also affected by the wind power expansion (also see Chapter 1 of this volume). Wind energy is in this context associated with complex environmental issues surrounding landscape image and commitment from the affected landowners and the public. The idea of protecting different values on the landscape can also be linked to the Planning and Building Act's (PBL) rules on consultation with the public, authorities and concerned (Swedish Board of Housing, Building and Planning, 2009a) (see Box 5). The comprehensive plan, additions and deepening, building regulation and detailed planning can be important tools when a municipality examines a landscape's suitability for wind turbine positioning. The legislation and the formal planning thus refer to the public perception of and everyday relation to the landscape.

Since 1st of August, 2009 larger wind farms are usually only trialed with the support of the Environmental Code. The former double trial for the establishment of wind farms under the PBL and the Environmental Code was in principle repealed. Building permission is needed for wind turbines higher than 20 metres above the ground, or when the wind turbine diameter is more than three metres. The building permit requirement for wind farms on public waters and in sparsely populated areas have disappeared, as well as when permission was granted under the Environmental Code. A detailed plan may in principle only be requested in areas of high competition for land for buildings and other facilities. The obligation to prepare an EIA for larger wind turbines remains, but the County Board or a regulatory authority in each case have to determine whether the wind turbine is likely to cause significant environmental impacts. At the same time, the regulatory authority can authorize a wind power project only if the municipality recommended it. In exceptional cases, when national interests exist, the government can still authorize a wind power project (Environmental Code, Chapters 16 and 17).

Municipal comprehensive planning is an important tool for raising the issue of wind power planning at an early stage. The comprehensive plan, with deepening, will be indicative for decision making, thus ultimately sets demands on municipal standpoints and guiding work with wind power expansion. The wind energy plan is often the basis for the comprehensive plan. The reason for shifting from the Planning and Building Act (PBL) to the Environmental Code was to facilitate the expansion of wind power in Sweden through simplified trials of wind farms. A more effective environmental trial would, at the same time, increase the possibility of reaching the environmental objectives and safeguard the public's right to transparency and participation (SOU, 2008).

In practice, trials under both laws essentially deal with the same issue in terms of location: distance to buildings, and the impact on the landscape (SOU, 2005: 767). This does not mean that several authorities trialed the same issue by laws with similar purposes, under equal conditions, or with exactly the same expertise or appeal procedures. Both laws include a trial of the consequences for the surroundings, but the Environmental Code starting point is environmental effects, while the trial of the Planning and Building Act (PBL) has broader and more area-specific starting points. Such starting points, that are specific to a particular area, must still be described in the application, according to current legislation. Environmental planners must, however, nowadays examine the technical details that were previously assessed by physical planners.

Two important questions arise in this policy development. Firstly, it is in the current situation difficult to say which consequences the new regime creates for wind farming landscape, planning and public opinion (cf. Ministry of Environment 2009). Secondly, one can discuss how the new rules relate to the European Landscape Convention, whose principles have received quite significant recognition in how Swedish authorities manage the landscape. This means the Environmental Code focuses on the environmental effects and not as much on the surroundings while the European Landscape Convention focuses on the whole i.e. environmental impacts and surroundings.

4.1.1 Concluding comments on landscape, wind power and planning

Landscapes are perceived, interpreted and represented in different ways by different actors in different social contexts. The expert's view of landscape is not necessarily more neutral or rational than the "non-expert" view. Many landscape specialists tend to emphasise visual techniques, while a more humanistic perspective includes everyday life and the place's different conditions, social community and local knowledge (Cosgrove, 1998; Olwig, 2002; Sporrong, 1996). In recent years, the interest in participating in the wind power planning process has increased and different techniques for dialogue with the public have been developed.

Large wind farms are today mainly trialed with support of the Environmental Code. An Environmental Impact Assessment (EIA) must be made for each power plant and the County Board or a regulatory authority may in each case determine whether the facility is likely to have significant environmental impacts. The regulatory authority may authorise a facility only if the municipality has approved it. In exceptional cases, when national interests do exist, the government can still allow a wind power facility (SOU, 2008).

The municipal comprehensive plan, with supplements and depressions, is an important tool for early raising the issue of wind power planning in the municipality.

Box 5. Comprehensive plan
Each municipality must have a valid comprehensive plan covering the entire municipal area. The comprehensive plan is intended to have a time horizon of 10 to 20 years, and should therefore only address the larger and structurally important features of land and water use in the municipality. General interests and national interests should be considered and the comprehensive plan should be displayed so that the public can comment on it. The comprehensive plan is the tool that the municipality uses to balance conflicting interests, but it is not legally binding and therefore has a completely different meaning than a detailed plan.
The comprehensive plan can be supplemented with depressions for certain areas/llocations or thematic supplement for wind power, water and wastewater, etc (Swedish Board on Housing Building and Planning, 2009a).

The contents of a supplement to the comprehensive plan for wind power can, for example, consist of:
Background/planning prerequisitions
Municipal goals, commitments or weigh-offs regarding wind power development
Regional goals for wind power development
Wind conditions
Landscape analysis
Restricted areas or areas with nature protections. And interests of the cultural environmental management.
Restrictions regarding shipping, telecommunications traffic and total defence.
Electric mains, road
Suggestions on wind power development:
Overall commitment/motivation
Overall guidelines regarding impact on surroundings and safety distances
Overall guidelines for placement and design
Subareas with guidelines and motivation (e.g. areas where additional studies or depression are needed)
Environmental assessment and EIA's
Other:
Guidelines for detailed plan design
Implemental issues(e.g. landowning, need for cooperation, need for inter-municipal cooperation in the implemental phase, expansion order, time plan
Follow up (Swedish Board of Housing Building and Planning, 2009a, s 97).

4.2 The European Landscape Convention (ELC)

The need of the local valuation was raised further by Sweden's ratification of the *European Landscape Convention*. It became law in Sweden in May 2011.

The landscape is defined by the European Landscape Convention as:
- "an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors" (Council of Europe, 2000 Art.1a).
- Sweden's affiliation to the ELC, results in a series of fundamental consequences for planning, protection and development.

This means that:

- legislation and administration will develop a concrete holistic view on landscape values,
- public, government and industry awareness of the landscape should be increased,
- a persistent local participation in decision-making on landscape is required.

As the Convention states, the landscape has an important role in creating identity. Changes in the landscape are often valued by citizens from a more "everyday" perception. The ELC doesn't, however, transform the landscape into a local concern, but rather raises sustainability issues, knowledge sharing and collaboration to a European level.

Based on the Council of Europe's definition, a landscape is a relatively elusive entirety, which includes valuations and values, experiences with all the senses, memories and emotions, identity, history and future, as well as the interaction between people and nature. This approach has been reflected in a number of central authorities; Swedish Board on Housing Building and Planning, National Heritage Board, the Environmental Protection Agency, the Energy Agency and Lantmäteriet, which the publication *Wind energy and the landscape* testifies (Swedish Board on Housing Building and Planning, 2009a, cf. ibid, 2009b). Practical implications of the ELC are shown for example by the County Board of Västernorrland working with landscape analysis for large-scale wind power development and also in the ongoing work of *regional landscape strategies* at county level (Appropriation, 2005). According to the Council of Europe (2011 www.coe.int 28-08-2011), the purpose of ELC is to define a method of placing wind turbines in the landscape, while the context is retained.

4.2.1 Expert and/or public perspective

In recent years, the tendency in planning on landscape is leaning towards a holistic approach (principle of ELC, the Environmental Code and PBL) and to develop processes and policies surrounding landscape through landscape strategies, landscape analysis, environmental objectives. An increased interest in developing new methods of policy on the landscape can also be seen. While this requires that different sectors work together, sector-specific definitions remain as well as other narrower approaches that are often justified on the basis of expert knowledge.

The European Landscape Convention is a good example of the conflict between expertise and people's everyday perceptions and local approaches to landscape. According to its introductory description, expertise will be at the forefront in terms of planning.

- Participation in planning and landscape management "should not be seen as a replacement for official decision-making, but as a complement to this. The goal is to add to the decision process perceptions of all stakeholders, whether defined as local communities, residents, visitors, landowners, particularly vulnerable groups or specialists together with representative, democratically elected councils/organisations" (Jones, 2009 s.234; cf. Olwig, 2009).

Despite this including formulation, Jones (2009 s. 237–238) notes that the Convention's own explanation report recommends "to evaluate [the landscape] in accordance with the objective criteria first" (as if some criteria can be objective), and then compare the results with the various assessments of the landscape made by the affected people and other stakeholders. The problem with this is that other research has shown that an expert's description of reality tends to dominate those who do not to the same extent have access to planning, or to the special language that characterises a planning situation (Aitken, 2002; Fainstein, 2010). Expert dominated planning processes can thus mask the basic problem since "conflicts of landscape values are often symptoms of deeper underlying social conflicts" (Jones, 2009 s 248).

What this means for the Swedish legislation regarding wind energy is not entirely clear, but after the Riksdag removal of double trials, it could mean that the aspect "human habitat" is given more weight in the admissibility trials under the Environmental Code. So far, the Environmental Code trials has focused more on natural values than on human habitat, probably as local people are taken into account by the Planning and Building Act (PBL).

4.2.2 Methods for measuring landscape perception

The European Landscape Convention (Council of Europe, 2000) clearly points out that there are many different descriptions of the landscape and that the perception of the landscape can vary. Therefore, it is understandable that in research there are also a variety of perspectives on, and approaches to, quantifying/measuring landscape values. Already in the 1980s Zube et al. (1982) could, using a literature review and an analysis of the main research directions, distinguish four approaches in research on landscape perception. These four approaches are: 1) expert approach 2) psychophysical approach, 3) cognitive approach and 4) experiential approach. In the 90s another direction came with Uzzell's (1991) research, namely the socio-cultural.

Within these five approaches are a number of different methods and tools used to identify the different landscape values and depending on which approach is used, the results vary. Within the *expert approach*, either ecological or formal aesthetic criteria are used when a landscape is valued. The ecological criteria can be assessed through field studies (inventories), GIS analysis or systematic evaluations of the biophysical landscape characters based on principles on ecology and biodiversity. These include methods/tools such as EIAs.

In the *psychophysical approach* (relation between measurable physical qualities and experiences) measurable relationships between people preferences and objective distinguishing features of the landscape are sought for. This is often done with the help of images which are rated in terms of attractiveness and beauty.

Within the *cognitive approach* (thoughts, knowledge), it is common to combine different methods to understand the underlying psychological processes that determines how people perceive landscapes. Surveys that are based on psychological models are commonly used, often in combination with the rating of images (as in the psycho-physical approach). Much research has been undertaken in this direction, including Kaplan and Kaplan (1985, 1989) who describe why certain environments are perceived as more attractive than others. This research forms the basis of many other relevant studies, including Berggren-Bärring and Grahn (1995).

The *socio-cultural approach* (the interaction and collaboration between people) was added by Uzzell (1991) to try to connect landscape perception with culture and politics. Much research in this approach assumes that landscape perception is socially and culturally conditioned. Qualitative methods (interviews, focus group interviews) are often used in combination with quantitative methods (surveys) where qualitative methods try to provide deeper understanding of the results.

Finally, we have the *experiential approach* which is based on individual interpretations and perceptions of landscape. This approach does not account for generalisation and uses only qualitative methods such as in-depth interviews.

Table 4.1 Spectrum of research approaches (based on Zube et al., 1982). The table shows how the different research approaches deal with the concepts of "landscape" and "human perspective".

	Approach				
	Expert	**Psychophysical**	**Cognitive**	**Socio-cultural**	**Experiential**
Human perspective	Passive	→	→	→	Active
Landscape	Dimensional	→	→	→	Holistic

In a research overview conducted by Swaffield & Foster (2000), the authors argue that it is important to combine qualitative and quantitative methods to get as good a picture as possible of how people perceive landscapes. It is not enough to only take into account general perceptions; there must also be an understanding of how individuals interpret their landscape. In a wind power context, methods from the so-called "expert approach" are often used when the landscape is valued, but in accordance with the European Landscape Convention's definition of landscape a direction towards the socio-cultural and experiential approach is needed.

4.3 Landscape analysis and planning

Research on the landscape analytic method in wind power planning is currently ongoing (2009–2012) at Gotland University (with funding from Vindval) and at the Swedish University of Agriculture, SLU Alnarp (financed by faculty funds). The starting point for the research project on Gotland is that current practice is often limited to an expert-dominated perspective on the landscape.

Landscape analysis is used as a basis for planning and shaping changes in wind power development. Such analysis usually contains a factual study of landscape features[9], structures, scale (regional, national, global), complexity (difficult to overview), character (typical features, touch) and structural features. A landscape's physical content is the basis for landscape analysis. With a starting point in academic perspectives from landscape architecture, engineering, cultural history, natural geography, we talk about the landscape's knowledge-based, documentary, or scientific values. Besides a formal landscape analysis, planners generally prefer to consider the qualities that are formally stated and mappable or measurable at a distance. The wind park's layout and design (colour, height, thickness and number of turbines) are considered as well, which not necessarily capture the qualitative aspects of landscape (Cowell, 2010; Daniel, 2001; Jobert, Laborgne & Mimler, 2007; Nadai & Labussiére, 2010). Nadai & Labussiére (2009) say that influential studies – with drawings, cross-sections and photo montages, showing the views before and after the establishment – have a tendency to highlight a landscape that prioritises vantage points and panoramic views. A landscape analysis should include both measurable ecological and social values, such as experience values, which also can be measured using a combination of quantitative and qualitative methods (National Board of Housing Building and Planning, 2007; Swaffield & Foster, 2000).

4.3.1 Landscape analysis

Landscape analysis has become part of a "rational" planning of wind power that is largely handled by designers, planners and authorities. Internationally, a trend towards top-down planning of large-scale projects is discerned, which seems to be a barrier to a successful implementation of wind power (Wolsink, 2007). This also means that studies on landscape impact is implemented in a "top-down" system where aspects such as size of the turbines, distance to the nearest settlement and landscape view are prioritised over perceived values. Perceived values, such as human connection to a place, have a tendency to fall outside the planning process (Wolsink, 2009). In the scientific community there is a growing consensus that an approach based on collaboration, is one of the strongest factors for successful wind power (Agterbosch et al., 2009; Cowell, 2007; Jay, 2008; Toke et al., 2008; Wolsink 2007, 2010).

According to Berglund et al. (2011), a landscape analysis implies:

The landscape's unique and general features are identified and mapped. Landscape features can, for example, consist of natural conditions such as soil types or area specific topography. They may also have their origins in social events, which have left traces in the landscape or in people's expectations and perceived landscape identities. They can apply to any unique characteristics of a place and are of great importance regionally or nationally. This can apply to many aspects simultaneously or just one (Berglund et al., 2011).

---

[9] Landscape elements can, according to the Swedish Board of Agriculture, be: avenues, roads, wells, springs, building background, cow paths, wooded fences, lopped trees in a row, lopped trees, small hard-cultivated fields, ponds, solitary trees, stone walls, open ditches and so on (Swedish Board of Agriculture, www.jordbruksverket.se, 26-01-2012)

In Wales in the UK, problems have arisen when social scientists and planners get the task of finding solutions to public acceptance of wind power. Cowell (2010) argues that this is done in a top-down-driven planning process where the government at the national level decides on energy technology and then leave it to local actors and authorities to solve landscape planning and siting issues, while "downstream" is about non-technical issues (human experiences and attitudes) which can be an obstacle in energy policy.

In Sweden, we need an institutional change that *from the start* creates participation and trust among the actors involved. Municipal comprehensive plans could be developed here. A top-down workflow where the public is invited after the location has already been selected causes resistance. Concepts such as "local identity" and "social identity" should be used to investigate the local support for wind power development in an area and consideration should be given to how individuals or concerned groups evaluate the landscape (Moore-Colyer & Scott, 2005; Scott & Shannon, 2007). In Sweden, this has to some extent begun to be discussed.

The Swedish Board of Housing Building and Planning argue for a holistic view of the landscape, which will include questions about:

- How concerned people perceive, use and value the landscape in order to start a process that can provide landscape analysis more legitimacy and credibility (Swedish Board of Housing Building and Planning, 2009a and b). Formally, these qualities are included the landscape's recreational value.
- People's feelings of familiarity, curiosity, admiration, domesticity, exoticism,
- Perceived values are individual – different people perceive the landscape differently due to different backgrounds, knowledge, interests and expectations of their environment. perceived values are central to the assessment of wind turbines (Swedish Board of Housing, Building and Planning, 2009a)
- Usage values, refers to the landscape as a resource for e.g. housing, industry and recreation, also impact how people interpret the landscape.

If such a landscape analysis will work, it would then require that the planning process as a whole focus on communication with the public.

A matrix for describing landscape characteristics have been developed in an ongoing project for landscape analysis in Uddevalla Municipality. The matrix below is developed to describe the landscape's different character types in a consistent manner. Its structure illuminates the landscape form and supporting ecological, social and economic processes. With the help of the matrix it is possible to communicate to stakeholders what distinguishes the different character types, and show what the analysis is based on. The matrix is a living document to which a range of different competences can help. To complement the matrix, GIS mapping of landscape characters should be done.

Table 4.2 Matrix for description of landscape characteristics. The matrix is now being tested in some municipalities in Sweden. It exemplifies how natural, cultural and social values can be described*.

Aspect	*Description (example)*
Landscape form	
Geology	Glacier delta, horst
Topography	Flat, hilly
Soil	Moraine, clay
Hydrology	Stream, river, lake, bog
Volumes	Forest, buildings
Rooms	Valley, lake
Surfaces	Field, lake
Lines	Roads, power lines
Landmarks	Church, wind turbines
Ecologial structure	
Patch	Older forest, bog
Corridor	Stream, tree rows
Matrix	Coherent structure
Main biotope	Flora/Fauna
Key biotope/species	Bog, bats
Social structure	
Everyday environment	Residential values, working places
Recreational environment	Feast places, cultural environment, outdoor life
Economical structure	
Land use	Commerce, agriculture, transport
Key economies	Forestry, industry
Time depth	Land with continuous cultivation that has given rise to culture historical and ecological values
Change: plans/tendencies	Municipal plans, climate changes, shifts in local economies
Possibilities and problems in establishment	Co-locations, conflicting interests

* matrix was made by Henrik Olsson, landscape architect, Karin Hammarlund, human geographer with contributions from Jenny Nord, archeologist, SLU Alnarp.

Example of mapped ecological values and perceived values

People perceive natural and cultural areas in different ways. A study in Kristianstad municipality on attitudes to biodiversity examined how mapped natural and cultural areas were considered by experts, farmers, business leaders, recreational organisations and the general public (Lindstrom et al., 2006, Johansson & Henningsson, 2011). Focus group interviews were conducted and a questionnaire was answered by 271 people. Five areas were mapped by the municipality in terms of biodiversity. A wetland (Lillö area and Isternäset) with open grazed meadows and abundant bird life was considered important by all groups when it came to protecting biodiversity. The area was also quite important for recreation. A forest area (Bockeboda-Uddarp) with spruce, beech and older trees was considered to have the greatest opportunity for recreation, but also importance for biodiversity. Experts in the study found the forest less important for biodiversity than the other groups did. The study also showed that the experts visited the forest Bockeboda-Uddarp more frequently than other groups. The wetland was, however, visited more often by experts and people from the recreational organisation than the other groups (Lindstrom et al., 2006).

Table 4.3 shows mapped ecological values within five areas in Kristianstad Municipality as well as perceptions of those values. The areas are ranked.

Areas with ecological values – mapped by the municipality	Experiences of areas with ecological values (ranking: 1=very important, 5=least important)	
	Important for protection of flora/fauna	Important for recreation
Lillö area and Isternäset (255 ha). Wetlands with open grazed meadows. Abundant birdlife	1	3
Bockeboda-Uddarp (522 ha). Spruce and beech forest with old trees that provides habitats for insects, mushrooms and lichens.	2*	1
Mosslunda (123 ha). Grazing land and small groves of trees and bushes. The area has a great diversity in plant species	3	4
Tivoli park. City park with hardwood trees, flower arrangements and birdlife.	4*	2**
Åsums avenue and marsh (10 ha). Swamp forest and calcareous soil with plenty of orchids	5	5

*less important for experts p=0.015 resp; 0.001;
**less important for farmers p=0.004.

The above studies on attitudes to areas of biodiversity and recreation showed that in some areas there was disagreement between experts and other groups. Experts affect decisions and therefore it is important that they have knowledge on attitudes of different groups in the local population. Such knowledge may facilitate future planning of local natural areas (Lindstrom et al., 2006; Johansson & Henningsson, 2011; van den Bergh et al., 2003).

4.3.2 Landscape analysis and public participation

By creating trust among people in the local community, we achieve greater success in planning (see detailed argument in Chapter 5). Early commitment provides greater opportunities to identify and address people's concerns, and to clearly communicate the potential risks and opportunities that come with a wind farm establishment. A planning process where the involved stakeholders work together should be a given initial step to meet people who are worried that the landscape is destroyed (Jones & Eiser, 2010). It is emphasised that it has to do with:

- taking advantage of the local population perspective, not only authorities' and planner's perspectives
- the process can only be successful if the perspectives are also taken into account in the decision-making

- the importance of allowing the public to be involved early in the process in order to influence the choice of location. This has proved to be a critical issue. Ideally, alternative locations should be available to discuss (Jones & Eiser, 2010) (see further discussion of public participation in Chapter 5).

In Sweden, there are many examples of discussion of wind power being mentioned already in the municipal comprehensive plan. But landscape analysis and wind power planning, for example, also need to include more dialogue with the public (see the example of the planning processes in Sweden in Chap. 5). Based on a study on ways to deal with the landscape perspective in the planning of French Aveyron, Nadai & Labussiére (2009) go one step further. According to them, it requires that you not only incorporate wind power into the existing landscape, but rather initiate processes where "new landscape representations" are generated with wind power as part of the landscape.

Experiences of working with acceptance of wind energy, development of policies, academic research, as well as legislation, are pointing to the need for a strengthening of the landscape analysis' ability to visualise, respond to and manage public perceptions of landscape. There is also a need to highlight people's relationships to the landscape where wind power might be established. The difference and the relationship between scientific values and perceived values were examined by Calvo-Iglesias et al., 2005; Lewis, 2008; Linden & Klintman, 2003 in terms of traditions and local experience, knowledge and identity. How the media handles scientific values and perceived values has been investigated by the Environmental Protection Agency (2010). A dialogue and dissemination of knowledge about the above values have been analysed by Holden in 2008, James & Gittins, 2007 and Hoppner et al., 2008. A certain theoretical understanding of the relationship between science and perceived values has been developed in the planning literature (Healey, 2006; Hillier & Healey, 2008), but there is great potential to clarify methods of landscape analysis further.

The research project at Gotland University will develop these issues further. Ongoing research at SLU in the project "Improving the landscape analysis for the transport sector: Based on EIA and design programmes" has the overall aim to generally improve and ensure the quality of the landscape analysis in road and rail planning. It addresses the European Landscape Convention's relationship to the landscape itself and to various aspects of the landscape. This work describes what a landscape analysis may be and also shows some examples from the wind power sector and discusses specific methods for public participation. In Chapter 5, we describe the implementation of a landscape analysis in practice. The whole process of working with landscape analysis and public participation in Åstorps municipality is described.

4.3.3 Concluding comments on ELC, landscape analysis, planning and public participation

The European Landscape Convention defines a landscape as "an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors" (Council of Europe, 2000: Art.1a). The Convention contributes to a *holistic* approach to landscape and requires local participation in decision-making on landscape. According to the Convention's description, expert knowledge is, however, prioritised when it comes to planning and participation should thus be seen as complementary. Landscaping for wind power should be done by different sectors work together in practice. Landscape planning requires cross-sectoral approaches (cf. the European Landscape Convention, the Environmental Code, the Planning and Building Act (PBL)), regional landscape strategies and environmental objectives). Sector-specific definitions and narrower specialist knowledge should be included in this entirety.

Landscape Analysis. The research points to a gap between an expert-dominated, quantitative landscape analysis and on the other a more communicative, qualitative approach to landscape. An expert perspective is often used by planners, designers and professionals, while a more everyday approach seems to be crucial for how public opinion against wind power appears. Landscape analysis has, as a method and a tool, been heavily dependent on expert knowledge. Two French researchers therefore believe that if the new energy landscape is to become sustainable, new representations of landscapes must be developed (Nadai & Labussière, 2009 s 753). One question that ultimately needs to be asked is: how can landscape analysis be developed further to promote dialogue and a balance between different forms of knowledge and interests? Landscape analysis is part of municipal planning, but a development of the landscape analysis' possibilities is important in order to include a greater emphasis on experiences, values and people's participation. A combination of quantitative and qualitative research methods can be used to illuminate both the ecological and social values (Swaffield & Foster, 2000).

The decision-making and planning. Within the planning and landscape theoretical literature an interest in power and public participation has evolved to become a key part of the planning process. In what form, scope and with which methods should and can this be translated to Swedish conditions? The development of policies in Sweden and in Europe leaves a contradictory picture; on the one hand, the authorities in the countries desire to develop the communication in wind power planning but, on the other hand, there is an expert dominance remaining, which in some cases is increasing. A faster trial and national objectives may conflict with the need for a more extensive participation. The European Landscape Convention requires strong influence of citizens in landscape planning but emphasises formal, technical landscape analyses. The picture is thus fragmented and contradictory. It becomes more complicated when issues relating to human identity (sense of belonging and place attachment) are discussed, as the concept of identity is used sweeping or is taken for granted in the literature.

4.4 Experimental values

"*It is mainly the perceived qualities of the site that determine the acceptability of wind turbines*." (Wolsink, 2010 p. 196).

The conclusion is drawn by one of the foremost researchers on acceptance for wind power projects. Many studies support the notion that *how* wind power is expected or perceived to influence different landscape values is a dominant explanation for attitudes towards wind power projects. This applies in both international as well as in the Swedish context (Wolsink, 2007; Nadai & van der Horst, 2010; Johansson & Laike 2007; Ek 2005). Research has shown that experiences are highly subjective and depends on the values that people ascribe different landscapes, but also on how the size, sound and other visual impressions from wind turbines are experienced (Johansson & Laike, 2007; Jallouli & Moreau, 2009). To what extent, and how the landscape perspective is addressed, in both the planning and trial process and decision-making, has been raised as a critical issue (Cowell, 2010; Nadai & Labussiére, 2009). Extensive research has shown that the ability to participate and influence the process is fundamental for the development of attitudes on a general level. This is not least when it comes to the opportunity to discuss the issues that affect people and where the recreational values of the landscape is an important factor (Wolsink, 2010). Research on wind energy that deals with the landscape has its starting point in the overall issue of attitudes towards wind power and how they can be explained. Research on wind power and landscapes resides mainly around three themes. In a number of studies, landscape impact is seen as one of the main *underlying* causes of different attitudes to wind power, without addressing the landscape impact in detail. Another category of studies makes more profound analysis regarding the *basis* for landscape-related argument against wind power, such as:

- human identity (sense of place) – humans interact with the place and describe themselves as belonging to a specific place (Gee, 2010; Hernandez et al., 2007; van der Horst, 2007)
- place attachment – a place to which humans have a special emotional bond and where they feel safe and well-being (Devine-Wright, 2009; Devine-Wright & Howes, 2010; Hernandez et al., 2007),
- different values, e.g. aesthetical, economical and ecological values (Gee, 2010; Wolsink, 2010), or
- different perspectives on visual impact, e.g. the significance of distance to wind turbulance and how densely they are placed (Möller, 2010; Jones & Eiser, 2010; van der Horst, 2007).

Other studies highlight:

- how the landscape perspective (including identity, place attachment) is included in the planning and decision-making process (cf. Cowell, 2010; Wolsink, 2007, 2009 & 2010; Jones & Eiser, 2010).

Generally, when it comes to perceptions, values and attitudes to different landscapes, people prefer landscapes with sporadically spaced trees on a flat or level ground with elements of water (see Figure 4.1). Low priority landscapes are vast with few elements to focus on and environments with dense vegetation that gives the viewer a sense of confusion and of getting lost (Kaplan & Kaplan, 1998).

- A landscape's *context* and *complexity* such as number of trees or buildings, and their placement and/or grouping is relevant to how people experience elements (e.g. wind turbines) in the landscape. The more trees, groupings and placements, the higher the complexity. High complexity can create anxiety and insecurity.
- *Clarity* and *mystery* are other terms that have to do with orientation in an environment and opportunity to explore things that are not already showing. A landscape which, for example, consists of a sparse forest with small paths and larger boulders, can be considered both high in clarity and mystery because sparseness and boulders contribute to the orientation while the small paths provide a sense of further exploration (Kaplan & Kaplan, 1989; Kaplan and Kaplan, 1998).

Wind turbines are perceived differently depending on how they are grouped (see below paragraph 3 of Design). A wind farm may also be a way to navigate the terrain. Factors that greatly affect people's perceptions of wind power are: Landscape character, Visual appearance, Design and Identity (see below).

Figure 4.1 Highly preferred landscape type; sporadically placed trees on flat ground with elements of water (Photo: Marianne Henningsson).

Landscape character (what a landscape looks like and what qualities such as natural, cultural, recreational the landscape contains). In studies on resistance to wind power, the general attitude towards wind energy plays a certain role, but the experience of the landscape's aesthetical and recreational values are thought to be of great importance. Several researchers concluded that the most critical factor to avoid opposition to a wind power project is that the proposed project visually fits into the landscape and thus blends into the surroundings, for example in industrial landscapes (Johansson & Laike, 2007). Wolsink (2007) has done a comprehensive analysis of studies made during 1986–2002. These studies show that landscape type (forest landscape, sea landscape, agricultural landscape) is the most important factor when people value landscape qualities. This in turn affects the attitude towards wind power. According to Wolsink (2010), landscapes often mean "nature", which in turn affect people's perceptions and acceptance. Ecologically high valued landscapes with great scenic, aesthetic and recreational values, often gives rise to conflicts, while a significantly higher acceptance for wind power is achieved in industrial areas and military areas (Devine-Wright & Howes, 2010; Gee, 2010; Jallouli & Moreau 2009). A telling example is reported in a study by Cowell (2010), which states that people have a desire to protect the unspoiled, pastoral countryside from the city like elements. Cowell describes it as an attempt to "protect the countryside from the city."

Figure 4.2. Wind power in an industrial landscape (Photo: Annika Andersson)

Devine-Wright and Howes (2010) write that there is no univocal research that supports the premise that offshore wind power projects are less controversial than onshore projects. Values that are found on land are also associated with "maritime landscape" (openness, recreation, spiritual needs) and is similarly a source of opposition to offshore wind power (Kempton et al., 2005).

In Denmark, they have for this reason started to establish wind power in the sea out of sight of land. Ladenburg (2009) argue that people who have experiences of offshore wind power located far from the coast are more positive towards the visual impact than people with experience of wind power closer to the coast.

2. *Visual impressions*. Landscape character, the location and the experiences there, is a crucial landscape question. A number of studies suggest that the visual impact of wind power is an important factor in people's attitudes towards wind energy. There are exceptions, however. A quantitative study has been conducted on Crete in Chania (Tsoutsos et al., 2009). In that area the visual impact of wind power in the landscape was low. A follow-up study showed the same results. Möller (2006) notes, however, that it is difficult to assess the visual impact with quantitative methods because the perceived impact varies between different contexts and different individuals (cf. Toke, 2005). Such problems lead back to the contrast between, on the one hand, the expert-dominated landscape analysis and, on the other hand, landscape analysis based on perceptions (Swaffield & Foster, 2000). Overall, researchers believe that the visual impact is causing great concern in the decision-making processes regarding wind power. Questions about how such concerns are treated need to get more space in the planning (Ellis et al., 2009a, 2009b, 2010).

3. *Design*. Landscape type seems to overshadow the visual factors such as *design, number* and *size*. Although these issues also come up in the discussions, they are not as crucial for attitudes. In addition, research indicates that the visual impact can be seen as a primarily qualitative, subjective or socially constructed issue. Visual appearance is only quantitatively measurable to a small extent. Qualitative methods such as interviews must also be used. Despite this, visibility of and distance to wind turbines plays a role in how they are perceived (van der Horst, 2007). Regarding design, research shows that there is a general tendency that people prefer collective wind farms over scattered wind farms, while smaller farms are more appreciated than very large farms. Möller (2010) have studied the effects on visibility and densities of larger (but fewer) wind power plants in the Danish landscape. He notes that since the introduction of much larger turbines has led to a higher visibility in the surroundings there has been no improvement visually.

Jones and Eiser (2010) conducted a study of how attitudes to an establishment may be affected depending on the *distance* to the wind turbines. Although a more positive attitude could be correlated with increasing distance to the wind turbines, this increase is not linear. It was visibility of a wind farm, together with fear that it would ruin the landscape, which had a great impact on the support for a particular location. People generally preferred the offshore establishments or out of sight from land. Bishop & Miller (2007) investigated the visibility and visual impacts of offshore wind power at three different distances (4, 8 and 12 km). The study showed that the stagnant turbines were perceived more negatively than rotating turbines.

4. *Identity* (the term refers to an interaction with a place and a sense of belonging to a place). A strong explanation of opposition to wind power projects is rooted in people's relationship to the landscape, not only as a visual experience, but also as a part of an individual or collective identity (Devine-Wright & Howes, 2010; Gee, 2010). Devine-Wright (2009) argues that local resistance should be understood as a way to protect established emotional connections to the place from activities that are perceived as threatening. Thus, one can speak of place attachment, place identity and place disruption in a wind power context. Planning must learn to consider such perspectives in the process, rather than dismiss them as irrational and irrelevant. Dan van der Horst (2007) addresses the issue of identity, noting that people who experience their landscape as a positive element in identity more are more strongly opposed to the development of wind power in the area. An important aspect is that *continuity* (context) in the landscape is often highly valued and that many expect it to remain unchanged. This, says Pasqualetti (2002), explains why people are reluctant to accept a change in the local environment for the benefit of renewable energy. Again a planning problem is raised. Warren et al. (2005, 2007) argue that some of the opposition to wind farms may be a reaction to the speed, scale, and an incoherent design of wind farms contribute to the rapid industrialisation of large parts of the natural landscape. A process is needed to develop clear strategic planning for decision-making on the location of a wind farm.

Finally, it should be noted that identity is a social phenomenon which is formed by different power positions (Aitken, 2010). What kind of identity is actually highlighted, by whom and why? Are there identities that fall outside the debate? Occupation and social class has by some researchers, for example, been identified as important dimensions of the establishment of wind power. A discussion of projectors, politicians and public roles in a wind farm establishment is engaged by Gray et al. (2005) and Toke (2005), amongst others.

4.4.1 Concluding comments on experimental values

How wind power is expected to affect different landscape values is the dominant explanation for different attitudes toward wind power (Wolsink, 2007; Nadai & Labussiére, 2010; Johansson & Laike, 2007; Ek, 2005). The experience is also dependent on the specific context, turbine size, sound and visual impression (Johansson & Laike, 2007; Jallouli & Moreau, 2009). The opportunity to participate and influence the wind power process is fundamental to how an attitude is developed (Wolsink, 2010).

Landscape Character: Landscape type is the most prominent factor for how people value landscape qualities (Wolsink, 2010). Ecologically high valued landscapes, with great scenic, aesthetic and recreational values, often give rise to conflicts associated with a wind project. People accept wind power in industrial areas or military areas far more (Devine-Wright & Howes, 2010; Gee, 2010; Jallouli & Moreau, 2009).

Visual impression, i.e. the visual impact of wind power, is also an important factor for the attitude. Overall, researchers argue that the visual impact is causing great concern in the decision-making surrounding wind power, which needs to be better treated in planning (Ellis et al., 2010). The *design* of wind turbines does not play an equally important role in attitudes toward wind power as landscape character and visual impressions do (Ellis et al., 2010). *Identity* is a vague concept in the landscape context. The way in which people identify with and feel connected to a place should be more clearly defined by research. Literature on wind power has to pay more attention to how landscape identities are associated with issues of power, class, ethnicity and gender. The research to date is sparse when it comes to such matters.

4.5 Natural and cultural environment

Research and method development on wind power and other intrusions in the landscape have been partly an applied focus that is under development by authorities such as the National Heritage Board and the Swedish Transport Administration. Academic research tends to be less sectoral and generally treats the landscape based on people's perceptions. As explained in Section 4.4 we speak in more general terms of landscape character, which can include all kinds of values and environments. Based on the research, the division between cultural and natural environments and its values is therefore somewhat artificial. Clarke (2009) suggests that the problem of the division of cultural and natural environment can be summarised as "the best locations for generations also often contain quite important vulnerable cultural resources that the society wants to protect" (Clarke, 2009 p 177).

A project on the experiences of the natural and cultural environments was conducted by the Swedish Board of Housing Building and Planning (2007). The aim was to clarify and specify perceived values. The goal was to be better able to take into account perceived values in planning. Several authorities worked together in a national survey, in which about 1,300 people responded. Among other things, the relationship between proximity to eleven mapped area types (compared with landscape types) in seven Swedish municipalities and perceived values (see Table 4.4). The study resulted in four perception levels (analysis was based on the 15 qualities that were seen as most important):

- Undisturbed diverse environment (undisturbed, vast and free, free from noise, varied environment, beautiful);
- Natural embossed environment (many trees, flora and fauna in a natural environment, nature-like area, quiet and peaceful in character);
- Possibility of restoration (ability to feel refreshed and more comfortable, able to be soothed and relaxed, able to keep in shape and being healthy);
- Security in a tidy environment (park with lawns, that it is a clean, safe and secure environment)

There was a strong connection between the four perception values. Indicators for measuring perceived values were: Proximity (how close to a natural/cultural area the person lived), Visits (how often the person visited the area) and Well-being (access to areas with recreational values).

Table 4.4 shows significant connections between proximity to eleven mapped area types and perceived values. The table is from the report "Perceived values of the landscape" (Landskapets upplevelsevärden) (Swedish Board of Housing Building and Planning, 2007 s.19).

Mapped area types *(landscape types)*	**Perceived values**
Smaller park or green area	Undisturbed+Nature embossed environment
Larger park or garden	no connection
City block with culture historical values	Security
Residential area with much vegetation	no connection
Natural area with facilities for outdoor activities e.g. parking space, trails and fire place	Undisturbed+Restoration+Security
Natural area without facilities for outdoor activities	Undisturbed+Nature embossed environment
Culture historical attractions/places, ancient monuments or similar	Undisturbed+Nature embossed environment
Swimming place by a lake or the sea	Undisturbed+Nature embossed environment
Open water (accessible by boat)	Undisturbed+Nature embossed environment+Restoration
Beach or archipelago	no connection
Mountains	Undisturbed

The closer the person lived to the area type, the stronger the connection to perceived values, which in its turn affected well-being positively. Undisturbed nature was important in almost every area type (Swedish Board on Housing Building and Planning, 2007).

Cultural environments and wind power has attracted the attention of both the research programme Vindval and of the National Heritage Board. Vindval is financing an ongoing multi-disciplinary project (2009–2010) under the name "Wind power & Cultural environments – land based wind power impact on the cultural environment" (*Vindkraft & Kulturmiljö – landbaserade vindkraftetableringars inverkan på kulturmiljön*).The project assumes that the landscape is undergoing major changes and that wind power is creating an entirely new landscape. The question is whether the impact of wind turbines is exclusively negative, or if there are positive aspects. The aim is to assess the impact on the cultural environment and cultural heritage during the projecting of wind turbines. The method is mainly to compare the assessments made with the actual outcome of the cultural environment adjacent to wind farms. The project will result in a final report in 2012 in the form of a handbook for administrators and planners. National Heritage Board has naturally a greater focus on how wind power can affect the cultural landscape and cultural environments and a smaller interest in the landscape that is not perceived as being shaped by man. National Heritage Board has recently published a paper on sustainable landscape development, aimed at people who assess applications or are working on projects and have in-depth knowledge about how different cultural values can be treated in different areas that are vulnerable to development pressure. The project aims to develop methods to achieve such knowledge and in-depth national interest descriptions were developed as a basis for planning. A number of sub-projects have been carried out by representatives of the cultural heritage in dialogue and cooperation with the municipalities and stakeholders. Wind power is addressed in planning for wind power in the form of descriptions of the cultural environment values in culturally valuable areas focusing on Tanum's World Heritage and Falbygden (National Heritage Board, 2010).

Figure 4.3 Example of wind power in a cultural environment (Photo: Marianne Henningsson).

Wind power plants are dependent on the infrastructure, including roads that influence a larger area. Through careful examination of sites to be exploited, and the adaptation of design and planning, direct damage to cultural heritage can to some extent avoided. However, you cannot overlook the fact that roads cross and change the impression of linear elements like prehistoric fields or boundaries in the landscape.

4.5.1 Callanish in Scotland – an example of a cultural environment

The overall impression of a landscape can be of vital importance for the experience of a cultural environment. The problem is illustrated in a study from the island of Lewis, one of the UK's heritage dense and biologically valuable landscapes. It noted that the most serious threat to archeology is not its physical survival but the surroundings of the monument, i.e. the ability to appreciate these as a part of the landscape. Wind turbines may seem gigantic compared to archaeological monuments. As Clarke (2009) points out, wind turbines usually need to be spread out over large areas to avoid wind shadow. This means that wind power establishments can affect landscape character in larger regions. An example where the wider landscape influence came to play an important role is the controversy surrounding a proposed wind farm near the world-famous stone circle of Callanish, Scotland.

The case of Callanish clarifies that wind power impacts are not primarily a matter of the physical monument, but rather the monument's location and importance in the landscape. Without the experienced landscape, the monument's interpretation contexts and pedagogical expressiveness decreases and thus diminish its culture historical value considerably. In UK planning and in many other countries, considerations of this type of placement in a wider environment are not very developed, despite the fact that an international context has been working with concepts such as visual impact zones around cultural relics. The above example can also be relevant to different cultural environments in Sweden, which also should be considered in planning for wind power, for example when it comes to cultural environments like churches and other historic sites.

Like the open landscapes of Scotland's islands, coastal and offshore wind power has also received particular attention in a number of studies. A report by the National Heritage Board in Sweden (2008) mentioned wind power as a threat to underwater cultural heritage, such as shipwrecks. It is particularly important that archaeological investigations are carried out when exploiting water areas (RAÄ, 2008). Reports on culture historical features (Nordström, 2003) and case studies from coastal locations in southern Sweden under the monitoring of the National Heritage Board (Nordström, 2000) discuss sensitivity to wind power in coastal and archipelago landscapes. Areas susceptible to large-scale wind power development are highlighted and the country's coastal and archipelago environments are presented, as well as approaches to and assessment of the cultural environment and wind power.

4.5.2 Seascapes

Offshore wind power raises issues about the ocean as a meaningful natural environment. In contrast to previous conceptions, research has shown that offshore wind power does not eliminate all the problems associated with the landscape issue (Haggett, 2010). Gee (2010) has made a study in Germany on offshore wind power in relation to people's perceptions of so-called "seascapes", by which he refers to the interface between sea and land. He found that there is a deeply rooted idea of the sea as a natural and wild room, something different from land which to a higher extent is perceived as something that humans have tamed and created. The sea represents both power and unpredictability with openness and an infinite horizon. Land on the other hand is perceived more as a cultural landscape, a place of tradition and familiarity, defined by words like "harmonious", "wonderful" and "beautiful" (Gee, 2010). This is part of the Swedish comprehensive planning for coastal municipalities, but a discussion on the above issues is rarely given (EPA, 2010).

Seascape, which is the area that connects land and sea, forms a "bridge" between people's different attitude to nature. Views on nature and the environment in the form of landscape or seascape, and whether the landscape needs to be free of cultural elements can thus be relevant to how a wind turbine is perceived. But such views are rarely cemented forever. First, it can again be noted that the landscape character varies, and wind power for example seems to be perceived as more disturbing in the coastal landscape with great scenic qualities, such as outlook, etc (Lothian 2008). Sea, as well as other seemingly "natural" environments like desert or mountain is extremely complex and are related to social and cultural aspects which are dependent on the location where they are (Cosgrove & Della Dora, 2009; Lambert, Martin & Ogborn, 2006; Peters, 2010). Research on wind power and marine life is addressed in a different synthesis project within Vindval (see EPA, 2012).

4.5.3 From global issues to local wind power ventures

If the landscape is seen globally, nationally, regionally or locally, with reference to nature and the environment, the very same wind turbine will have completely different meanings in the global climate crisis (Kahn, 200, Wood, 2003). Research on wind power in the natural environment, according to Warren et al. (2005), suggests that the conflict between development and conservation usually involves the balance between e.g. employment/investment and environmental costs.

When it comes to wind power, according to Warren et al. (2005), there are strong environmental arguments on both sides of the debate. Some advocate wind power because it provides clean energy while others oppose its impact on the local environment. Other advocates renewable energy in general, but opposes specific wind power projects (Warren et al., 2005). Examples of different attitudes to specific wind power projects are given in Chapters 3 and 5.

Research on landscape blends environmental and cultural arguments with socio-economic aspects and also varies over time and space, such as when wind power establishments are increasing in number. Questions related to the emotional connection the individual has to the place take place in the debate about the natural and cultural environments. In England, according to Toke et al (2008), the countryside is part of the national identity and long battles have been fought against an industrialisation of the countryside. The tradition dates back to the early 1800s. There are strong groups in England and Scotland who want to protect the landscape. The Campaign to Protect Rural England (CPRE), are sceptical about wind power, and the Campaign to Protect Rural Wales (CPRW), opposes wind power plans as part of their strategy. There are groups working against wind power development at a local as well as national level (Toke et al., 2008).

Spain has relatively little involvement in landscape protection, but it is beginning to increase. "Preference studies (studies of what people prefer) state that the impact of wind power on flora and fauna, especially local impact on geographically rare cliffs are valued higher than the landscape values of rural areas. Rural areas in Spain are poor and are subject to depopulation. It seems to be undervalued to live in rural areas in Spain, in contrast to the situation in England" (ibid.). The ability to create a strong public opinion or protest movement is about class and power positions, not only about identity. Toke's research illustrates this well, arguing that although many would say that there is nothing that can be called beautiful landscape in a harbour area, there may still be a number of residents who complain that their views will be ruined. On the other hand, in 2003, a very large wind power project near the Corus steel factory in Teesside was welcomed by the locals, even if it was relatively close to a densely populated area and even though the project went against the objectives of the English countryside (Toke, 2005 Page 1,538).

The local nature can also be seen in a broader environmental context, as a contributing part of an overall commitment to achieve sustainable development and to achieve global climate objectives. Both time and geography are crucial issues for the energy supply aspects. It places a seemingly local natural environment in a much wider context. In the wind power debate, environmental commitment based on long-term climate impacts, future generations, and change on a global scale level is often set against an environmental commitment that highlights local infrastructure, bat and bird populations, or visual impacts:

> "The impacts of climate change are large scale, long term, diffuse and seemingly abstract, whereas the impacts of wind farms are localised, immediate, highly visible and very real. Asking people to accept that their cherished views should be transformed today in order to counter a predicted threat which will most seriously affect future generations in faraway countries is a tall order. But if the current scientific consensus is accurate, then this is precisely the trade-off that is required."
>
> (Warren & Birnie, 2009 p 119 jfr. Mercer 2003; Nadaï & van der Horst, 2009; Warren et al., 2005).

A scale problem (from global to local) that corresponds to this dilemma is also valid for cultural environments whose importance can range from the local to the regional and global. Many cultural organisations insist that climate change is a major threat to both natural and cultural heritage. The cultural environment is dependent on sustainable energy options, including wind power, as shown in the above case from Scotland. Climate change is ranked as the greatest threat to cultural and natural heritage by organisations like Historic Scotland and SNH [Scottish Natural Heritage] (Clarke, 2009 s 183).

4.5.4 Concluding comments on natural and cultural environments

Natural and cultural environments may be perceived differently by different people but they have in common that the experience value "undisturbed" is highly prioritised in all landscape types (National Board of Housing Building and Planning, 2007). Since the value "undisturbed" also contained the qualities "free from noise and beautiful", it can be transferred to wind power. The National Heritage Board discusses the cultural environment in terms of wind power in several reports. Researchers within Vindval conducted the project "Wind power and cultural environment – land based wind power establishment's impact on the culture historical environment." It will result in a handbook for planners and administrators, which may contribute to raising the importance of cultural environments in the planning.

According to Clarke (2009), the most serious threat to archeology is the surrounding environment of the monument. Wind turbines are dependent on roads which affect a natural or cultural area. If roads are adapted through design and planning, the direct damage to cultural heritage will to some extent be avoided. It is not possible, however, to avoid roads crossing and changing the appearance of, for example, prehistoric fields or boundaries in the landscape. An improved infrastructure can also bring positive effects, for example on the local tourism (see Chapter 3 on local entrepreneurs' perceptions of tourism in Jämtland).

At the same time, climate change is a major threat to both natural and cultural heritage:

> "The question is how the benefits of decreased global warming should be weighed against the value of cherished landscapes or local quality of place. The latter inherently includes value judgements that are nevertheless the most salient arguments in wind power siting (Wolsink, 2007), whereas the former is hard to quantify (e.g. CO_2 reduction) using figures that are meaningful locally." (Breukers & Wolsink, 2007 p 2748).

4.6 Outdoor activities and recreation

Wind power's impact on outdoor recreation has been partially described in Chapter 3, Section 3.2.1. Bodén (2009) writes that people who are in search of "untouched" natural or cultural experiences opt out of wind power landscapes to a greater extent compared to people where the journey is a means to an end, such as music or sporting events (Bodén, 2009).

4.6.1 Outdoor activities – hunting, fishing, leisure homes, etc

Most of the huntable birds belong to groups of species of geese, ducks, waders and grouse. Some of these species belong simultaneously to those who exhibit the strongest response to wind power projects (Widemo, 2007; Environmental Protection Agency, 2011). The negative effects of huntable mammals are probably relatively small (Helldin et al., During processing). The potential to affect wildlife assets positively is addressed in a different synthesis report within Vindval; "The effects of wind power on terrestrial mammals – a synthesis report" (Helldin et al., 2012). According to the synthesis report, there are good opportunities to exploit areas around wind farms for example, to create food for wildlife. Some of the potential negative effects can probably be reduced, and grazing on production forests should also reduce.

Fishing is a hobby that can also be an industry. A study on attitudes to a wind farm in Massachusetts, the “Cape Cod” project, showed that more than half of the participants thought that the wind farm would have a negative impact on the aesthetic value of the landscape, the societal harmony, the local fishing industry and on recreational values for anglers. Factors that would influence participants’ decision to take a position for or against the wind farm was primarily that the impact on the marine life would be as small as possible, followed by the impact on aesthetic values, recreational fishing and energy prices. The authors write that it is important to understand the factors that people believe to be affected by wind power and on which issues they consider it important to prevent impacts from wind power. This does not always match (Firestone and Kempton, 2006). Research on wind power’s impact on marine life is addressed in the Vindval synthesis report: Wind power’s impact on marine life (EPA, 2012).

There is not much research on wind power related to second homes. Most people are out in nature to, for example, walking or enjoying the natural environment, or to rest and relax (Swedish Board on Housing Building and Planning, 2007). The Swedish Board on Housing Building and Planning (2007) notes that it is important that, when planning for new exploitations, taking into account the possibilities of improving walking paths and preserving natural green spaces, particularly close to housing, schools and workplaces (Swedish Board on Housing Building and Planning, 2007). Walking paths in forests and natural environments can be just as important for public health as jogging trails. The Public Right of Access enables people to move almost freely in the forest (see also Section 3.5 on compensatory mechanisms).

Research on how people, who are walking in the forest, perceive wind power is also sparse. The Forest Agency has described the social values of forests in a number of reports (Rydberg, 2001; Forest Agency, 2001). A discussion on these values is also ongoing in several forestry companies. The Ministry of the Environment and the Environmental Protection Agency’s report “People and Nature 2010” describes what the future of outdoor recreation might look like; examples are given from different municipalities and organisations (EPA, 2010). Even the National Public Health Institute addresses the question of the effects of nature and outdoor life on health (Public Health Institute, 2008). National interest in outdoor recreation and shoreline protection are aspects that should be part of a wind power plan. In a wind power investigation in Falkenberg Municipality (input for the comprehensive plan), social values of the forest were identified and marked on a map (Falkenberg Municipality: Vindbruksutredning, underlag till översiktsplan, www.falkenberg.se 03-02-2012).

4.6.2 Outdoor activities – recreation and relaxation

Recreation experiences are often linked with people’s attitudes towards wind power in general, with the relation to the wind turbine that is affecting them, and the need for relaxation (see also Chapter 5). Also urban people are demanding rural recreational effects. Recreation needs of rural residents and visitors are studied in research in environmental psychology. Grahn and Stigsdotter (2003) have shown that many people are bothered by stress-related ailments, and that the distance from home to the nearest green space is important for the number of days per year that people feel stressed, tired and irritable. Activities such as office work, driving in city traffic, answering e-mail, SMS or other so-called "aggressive" incoming information requires very energy-demanding attention. Nature's information, however, is taken in subconsciously and is therefore called "soft" incoming information (Kaplan & Kaplan, 1989; Kaplan, 1990; Kaplan, Kaplan and Ryan, 1998).

Restorative outdoor environments should ideally not be more than 300 m from the house, but even at longer distances than 50 m the frequency of visits reduces, which can lead to increased stress levels (Birch et al., 2008; Grahn & Stigsdotter, 2003). After just a few minutes' walk in a natural environment, blood pressure decreases (Hartig, 1993; Parsons et al., 1998; van den Berg & Hartig, 2007). Ulrich (1991) has shown that people who visit parks recover faster from stress-related ailments. Stays in green environments have been shown to reduce stress and also improve concentration. Bright natural environments such as grasslands and open parks, especially with elements of water and other "undemanding" natural elements, have been shown to produce immediate positive emotions (Coss, 1991; Ottosson & Grahn, 1998; Searls, 1960; Ulrich 1993). environmental psychological research, at among others, SLU Alnarp, concludes that there are eight characters in the outdoor environment that speak of basic needs (Grahn, Stigsdotter, Berggren-Bärring, 2005). These eight characters are: 1) tranquility, 2) wildness, 3) diversity, 4) space, 5) the common, 6) the garden 7) centre/festive, 8) history/culture. The Swedish Board of Housing Building and Planning report Landskapets upplevelsevärden ("Perceived landscape values") (2007) presented earlier, is partly based on the following characteristics (see Table 4.4). The characters were mainly developed for park environments, but can also be applied to the landscape.

Box 6
The eight landscape characters (Grahn, Stigsdotter & Berggren-Bärring, 2005).

1. **Tranquility** (you can hear nature's own sounds)
2. **Wildness** (as if it is untouched by humans)
3. **Diversity** (a variation of species and meteorological phenomena)
4. **Space** (a feeling of openness without boundaries)
5. **The common** (places for common activities, for everyone)
6. **The garden** (fun, creative elements to be fascinated by)
7. **Centre/Festive** (squares or other places where you meet other people)
8. **History/Culture** (where you can experience traces of earlier generations)

The experience of tranquility, of wildness, space and the garden is dependent on low ambience. These four characters are among the most important for stress reduction. The feeling of security in the environment is, according to some researchers, greatly dependent on noise (Berggren-Bärring & Grahn, 1995; Grahn & Larsson, 1997; Douglas & Douglas, 2005). A wind turbine in an open landscape cannot be said to convey soft information for all people. The actual movement in the landscape may be clamouring for attention and the sound from the turbine blades are not usually associated with natural sounds (see also Chapter 2).

4.6.3 Recreational environments and wind power

A survey in southern Sweden on attitudes towards wind power showed that participants felt that wind power's effects were quite positive for the community, while the attitude toward the effects on the local environment, to "the wild" (untouched) nature and the landscape aesthetic and recreational values, on average were negative (Johansson & Laike, 2007). Participants who thought that wind turbines had a negative impact on the aesthetics of the landscape, and that the wind turbines would diminish recreational values, also had intentions to oppose the wind power project. Concerns about effects on birds and other animals, as well as on the participants' own environment, had no relationship with the intention to oppose the wind power project (Johansson & Laike, 2007). Noise problems are often site-specific, subjective, dependent on technology, and thereby also changing over time.

In the early days, wind turbines were criticised for being noisy, and this reputation has stuck. Modern designs are, however, remarkably quiet, allowing normal conversation underneath a working turbine. At a distance of 350 m, wind farms generate a noise level of 35–45 decibels (dB) (cf. a busy office: 60 dB; a quiet bedroom: 35 dB), and this is often difficult to detect above normal background sounds such as the noise of the wind (SDC, 2005). Turbine noise affects very few people (Krohn & Damborg, 1999), although for those few the impact can be significant. Intriguingly, it seems that noise annoyance is related less strongly to absolute sound levels than to perceptions of visual impact; people who dislike turbines find their noise more disturbing (Wolsink, 2007b; Pedersen & Persson-Waye, 2008). (Warren & Birnie, 2009, p 112).

Noise should be understood in a wider context that also takes into account environmental issues, landscape and electricity production. Analyses of the arguments that affect public attitudes show that visual impact and intrusions in the landscape are the key factors. Other factors related to the environment, such as noise or impact on flora and fauna, may be relevant depending on the site. But upon closer examination, factors like noise annoyance from wind turbines are related stronger to the visual impact than the actual sound effects (Toke et al., 2008 s 1,136 cf. Pedersen & Persson Waye, 2005; Thayer & Freeman, 1987).

Research shows that the visual landscape impact plays a very important role in the wind energy context. In some cases, the results indicate a positive attitude: An Irish survey with 1,200 participants found that only one per cent of the public was directly against wind farms. 84 per cent perceived wind farms as something positive and most of those who were directly affected by wind farms did not think they had any significant impact on the area's beauty, the flora and fauna on tourism or on property values. Study results also showed that people's views were heavily influenced by the planning and development process, the sooner they are involved and the greater involvement they have in the process, the greater the likelihood that the public supports the establishment (Warren et al., 2005 s 858).

According to a Danish researcher, wind power has become an "integral part of the Danish cultural landscape" and he believes that "there would be a general complaint" if the turbines were removed (Nielsen, 2002 s 130). Research indicates therefore that wind power can provide positive cultural landscape elements that can actually be associated with more natural lifestyles and can be experienced as relaxing (Nielsen, 2002; Warren, 2005), although the size, spacing and design reasonably affect such an experience. In addition, wind turbines have become tourist attractions in several places, which suggests that technology in the landscape can be part of a wider recreational experience (Dalton et al., 2007; Krohn & Damborg, 1999; Jobert et al., 2007).

Greater pressure on the landscape and larger turbines has had negative consequences in Scotland. Warren & Birnie (2009) writes that the latest generation of mega-turbines is completely unthinkable in the Scottish landscape. The rapid expansion of wind power means that, from the top of some Scottish monuments, it is now possible to see several wind farms, and this affects the sense of wild and untouched nature that many people who are visiting the heights/hills experience (Warren & Birnie, 2009).

For the tourism industry wind power can be of some importance (see Section 3.2), but there is too little research and experiences available to make clear conclusions: Some tourists may choose to avoid areas with wind power, but recent research shows that wind power appears to only have a minor impact on tourism (see also Chapter 3). This may of course change as more and more wind turbines are built (Warren & Birnie, 2009 s 111).

What has been said above about planning and communication, and about people's perceptions which are culturally and socially complex, changing and varied, is also applicable for recreational environments. The research constantly points out that the sound and the visual experiences remain strong subjective variables that can only be understood in their specific context. Large variations in the specific landscape character, turbine design, ownership and decision-making processes makes it impossible to give simple answers to wind power's impact on recreation.

Figure 4.4. Wind power in a golfing environment (Photo: Marianne Henningsson).

Figure 4.5 Fishing (Photo: Marianne Henningsson).

4.6.4 Concluding comments on outdoor activities and recreation

Huntable birds belong to groups of species of geese, ducks, waders and grouse. These species belong simultaneously to those whose responses are strongest to wind power projects (Widemo, 2007; EPA, 2011). Fishing is another hobby that may be affected by a wind farm. People in a coastal landscape thought the establishment of a wind farm would have a negative impact on the aesthetic values and on the society's harmony, the local fishing industry and the recreational value of anglers. When the same people were asked about what would influence their decision to take a position for or against a wind farm, they felt that it was important that the impact on the marine life was as small as possible. This was followed by impacts on aesthetic values and angling (Firestone and Kempton, 2006). Attitude and planned behavior did not correlate; this is an important aspect to include in the planning process for wind power.

Second home residents' attitudes to wind power should be explored as second homes often are built in coastal areas, which are considered attractive (Swedish Board on Housing Building and Planning, 2007). A survey on attitudes towards wind power in southern Sweden showed that participants felt that wind power's effects were quite positive for the community, while the attitude toward the effects on the local environment, the "wild, untouched nature" as well as the landscape aesthetic values and recreational opportunities, on average were negative (Johansson & Laike, 2007). Another study showed that a wind farm would not have a negative impact on the aesthetic values (Warren et al., 2005). Tranquil environments that give rise to low levels of stress are important from a recreational and thus public health point of view. Wind turbines with its sound and rotational movements can be disturbing elements from this perspective, but a wide range of other factors preclude simple conclusions. The literature shows how different specific context determines the influence and subjective evaluations play a crucial role.

5. Acceptance and support

Box 7. Glossary for this chapter:
Attitude: an attitude is divided into an intellectual part, an emotional part and a behavioural part. According to Eagly and Chaiken (1993), an attitude is a psychological condition which evaluates a particular event either positively or negatively.
Dialogue: a meaningful and enriching conversation in which important aspects of how individuals experience their world emerge.
NIMBY: Not in My Back Yard means that people are in favour of a phenomenon, such as wind power, at a general level but are negative towards having it near their own living space.

This chapter initially discusses the concept of attitude as a psychological condition in which people evaluate a particular event as positive or negative (Eagly & Chaiken, 1993). Knowledge of attitudes is fundamental to understanding which documentation is needed to stimulate a constructive dialogue about wind power's impact on our landscapes. The concept of NIMBY (Not In My Back Yard) is often raised in the wind power debate and in other planning situations. The concept is explained and problematised here (Section 5.1). This chapter also addresses the importance of an open, understandable planning process that is enriched by the public's local knowledge. Finally, we summarise societal and institutional conditions to improve possibilities to comply the European Landscape Convention (ELC, ratified by Sweden). Here we present a concrete example of a planning process that is an attempt to live up to the Landscape Convention's intentions. The section also discusses how to better understand people's reactions to a wind farm. In the Council of Europe's recommendations on the implementation of the ELC, the importance of the landscape concept now to guide wind energy planning in Sweden is clarified (Council Of Europe, COE 2008:3).

> The senses (sight, hearing, touch, smell, taste) and the emotional experience that a population has of their environment and the recognition of environmental variation and special historical and cultural characteristics are necessary for the respect of and for ensuring a population's identity as well as enriching for the individual and for society as a whole. This means to recognize the rights and responsibilities populations have to play an active role in the process of acquiring knowledge, making decisions and taking care of the places where they live. Public participation in the decision to act and in the implementation and enforcement of such decisions over time should not be seen as a formal act but as an integral part of the implementation, preservation and planning procedures (Council of Europe 2000).

Why here and why? And to whose benefit? Also how and when these questions are answered is crucial to the possibilities and limitations of people's experiences of wind power establishment in their landscapes. The meeting between planners and the people affected by a wind power project places great demands on the projector's ability to explain legal requirements. There is also a need for technical material that answers the everyday questions asked. Many Swedes are in favour of wind energy development, but that knowledge is not enough to handle a single establishment. The aim to expand wind power in Sweden is dependent on an effective dialogue between the various stakeholders in planning at local and regional levels, which is clearly emphasised in the ELC (Oles & Hammarlund, 2011).

5.1 Public responding – attitudes and participation

Attitudes can be studied and understood as a combination of thoughts, feelings, and behaviour. Attitudes can be directed at persons, to events or material things. People daily evaluate occurrences or events and determine if these are good or bad. The individual has then formed an attitude, which can last for a short or a long time and eventually it may also affect behaviour (Eagly & Chaiken, 1993). Knowledge of wind power connected to the way people look at the landscape is crucial to understand how attitudes to wind power development are formed. People need to talk about their values and often use different networks for this. Such networks are becoming increasingly important the more abstract and contradictory the information provided is, or becomes. Hammarlund (2005, 2010) argues that information about wind power often focuses on the regional and national perspectives and on attributes like: reduced CO_2 emissions, renewability, low environmental impact, etc. Wind turbines at the local level are often linked to attributes like; visual impact, noise, shadows, concerns about deteriorating property values, negative impact on the cultural and natural landscape (Hammarlund, 2005).

Decisions and attitudes of groups are often more extreme than those of the individual, this phenomenon is called group polarization (Stoner, 1961). Decisions are influenced by knowledge and understanding, an understanding that people develop in collaboration with others. The possibilities for a successful communication are improved if the views that exist within the social network are illuminated (Hallgren, 2003). Anyone who recognises the network's opinions can have confidence, which is based on recognition and expectation (Ramirez, 1997). For the person to feel safe in collaboration with others, it is necessary to understand what participation in a wind power process means and may result in. If that understanding is missing, and if an individual perceives that his or her views are not taken seriously, a crisis of confidence may emerge. In order to feel motivated to participate in the consultation and planning processes, the individual must feel ready to participate. This requires an understanding of what the dialogue or consultation concerns and what the conditions of affecting the planning or decision-making are (cf. Hallgren, 2003). There needs to be a common ground where you want and are able to share different perspectives. The landscape can provide this common ground that enables in situ discussions of everyday life, leisure life, changing processes and aesthetic values (Hammarlund, 2005).

For the participants in a group to feel trust, the information within the group needs to be reliable so that it creates credibility. A "ladder of trust" is often used in research on risk analysis (Hedqvist, 2002):

- *Reliability*: Participants must feel that the information or the informant (projector or planner) is reliable.
- *Credibility*: is an important prerequisite for – and at the same time the result of – successful communication. Credibility depends on the knowledge that the speaker is attributed by the listener.
- *Trustworthiness*: Trustworthiness is a prerequisite for creating trust. A non-trustworthy spokesman of an organisation can damage the trustworthiness of the entire organisation.
- *Trust*: If a person relies on the informant, then he/she also trusts all information he/she receives.

Model: A ladder of trust (based on Hedquist 2002)

Trust

↑

Trustworthiness

↑

Credibility

↑

Reliability

Figure 5.1. A ladder of Trust (based on Hedquist 2002).

A significant amount of research on the establishment and acceptance of wind energy has focused on explaining and finding the causes of public opposition. In the early research the concept of NIMBY (Not In My Back Yard) could explain the resistance. The meaning of NIMBY is that people are in favour of wind power in general, are at the same time critical of the establishment in the proximity of their own living space. The definition, which emphasises the individual's approach, is based on the motives of self-interest. Recent research shows that NIMBY has limited explanatory value, and only describes one of several factors that affect people's attitudes to wind energy. The research has therefore been focused on alternative explanations for what drives the local opposition. A review of what research has shown and how it can be developed is given by van der Horst (2007) and Devine-Wright (2005). Several studies are made which show NIMBYs limited explanatory value: Wolsink (2005); Bell, Gray & Haggett (2005); Jones and Eiser (2009, 2010); Klintman & Waldo (2008); Mel & Aronsson (2010); Swofford & Slattery (2010), and

Waldo & Klintman (2010). Examples of research that sought to investigate what affected the acceptance or resistance are: Jorbert, Laborgne & Mimler (2007); Devine-Wright (2009) and Warren & McFadyen (2010). In summary, these studies point to the significance of:

- choosing the right location, from a visual point of view and with respect to the locations landscape character and values, and to the significance of public participation in the planning and decision-making process, also in terms of economic participation.

It is important that the link between fear of how the landscape may change and people's memories, identity and quality of life is taken seriously in the context of wind power (see further deepening in Chap. 4). Pasqualetti et al. (2002) argue that a simplification of the background to resistance can result in various interests in the landscape not being addressed.

- There are no studies on the underlying values, experiences and beliefs that form the basis of the individual perception. It requires knowledge of the social context in the landscape in which wind turbines are planned and for collaboration processes to be formed in which disagreements can be aired and help to improve the quality of decision making as well as contribute to a more constructive conflict management (Ellis et al., 2007).

Descriptions of the visual effects of wind power have in many contexts been presented as objective facts (Devine-Wright, 2004) and discussions on living environment have not emerged. Wind turbines' visibility has been reduced to visualisations using visibility analysis and photo montages. A landscape is a coherent entirety of meaning that requires a collaboration of all the senses to be experienced (Olwig, 1996; Hammarlund, 2005). Descriptions of the impact on the landscape should not only address the fragmented but describe entities that may be related to people's perspective on the landscape (Hammarlund, 2005).

Figure 5.2. Dialogue groups. Source: unknown.

By inviting local people to participate in the planning process, conflicts can be avoided. Research is studying the impact of participation in the acceptance of specific wind power projects. This has given rise to a number of new research questions related to the planning process for wind power. For example, how the opportunities for participation can be created and what the planning process should look like in order to manage different interests. Research has largely come to view planning as a problem that hinders, rather than helps, wind power development. It's about shortcomings in the planning system and the difficulty in managing the different interests and stakeholders in planning. Current research on public participation in the planning process is partly reflected in articles about studies that examine the significance of participating in the acceptance of a wind power project. Several research articles refers to participation as a suggestion to how acceptance can be achieved (McLaren Loring, 2007; Wolsink, 2007, 2010; Aitken, 2010a,; Aitken, 2010b; Wolsink, 2005; Jorbert, Laborgne & Mimler, 2007 and Warren & McFadyen, 2010).

5.2 Understanding reactions to landscape changes

Certain changes can cause stress for and be positive for others (see also Chapter 4). People react differently, depending on the relationship they have to a landscape or a place. A landscape is constantly changing, but some changes are more noticeable than others. The following model shows how different people react when exposed to a stressful situation (see Figure 5.3). A wind farm establishment can by some people be perceived as stressful. It can be a place that the individual does not want to see change through, for example, a wind farm establishment. This has not only to do with attitudes toward wind power, there may be deeper factors behind it, such as identity, culture, tradition and philosophy of life (see Chapter 4), (Ajzen,, 1988; Bell et al., 2001; Eagly & Chaiken, 1993).

Different strategies for adapting to changes in the landscape (cf. Bell et al 2001):
Strategy 1:
The person experiences changes in the landscape or in a place as very positive. The person feels good and he/she finds a balance between his/her own interests and the occurring change.

Strategy 2:
A person experiences the situation or change as stressful and does not really know how he or she should react. There could be a lot going on in the place and he/she feels that he/she does not have sufficient information or knowledge about what will happen. Then a feeling of stress, uncertainty and agitation may occur. How do you handle this person? In the successful stress management one can see solutions, the person tries to adapt or adjust themselves so

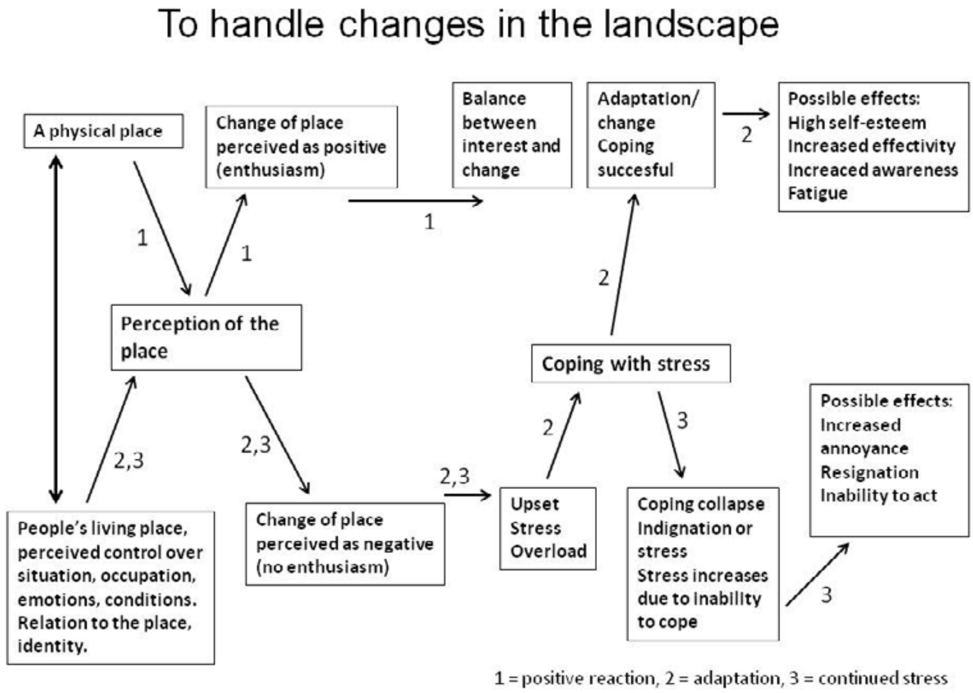

Figure 5.3. Model for how different people may handle a change in the landscape, which could be perceived as stressing. Three different strategies are shown: 1=positive reaction, 2=adaptation, 3=continued stress (based on Bell et al. 2001).

that the stress is relieved. The person feels they have something to say and is perhaps searching information about the change single-handedly. The increased awareness and knowledge can lead to higher self-esteem and increased efficiency or skill. He/she sees new opportunities and has adapted to the situation. Sometimes adaptation results in fatigue which may be the effect of an individual adapting to something he or she does not really want to (Bell et al., 2001).

Strategy 3:
The individual fails completely to manage stress and continues to be upset and angry (Ogden, 2007). Inability to manage stress can cause it to increase. It can become a vicious circle, where individuals do not see any options to express their opinion. Possible effects of this can be increased agitation and or resignation, the person experiencing it as a futile act because the situation cannot be influenced. The conflict can deepen both within the individual and between the individual and society (Bell et al., 2001). To make it easier for people to deal with stress, it is important that administrators and planners take people seriously and develop a good dialogue. Dialogue with concerned citizens must be established at the beginning of the process and continue throughout the planning period. Here, methods like landscape analysis, supplemented by "walking interviews" (see Section 5.3) are valuable. The methods can also be supplemented with qualitative methods such as interviews and stories.

5.2.1 Concluding comments on attitudes, participation and reactions

The expansion of wind power in Sweden is dependent on an effective dialogue between stakeholders in planning at local and regional level. This is clearly underlined in the ELC. People's attitudes are a complex matter. It is not enough to explain wind power resistance with the NIMBY effect. There are so many other factors involved, such as people's memories, identity and habitat, whether you live on the site and if so, for how long, whether he/she is farmer or forester, on holidays, walking, exercising, picking berries or mushrooms, hunting, exercising, motorsports and so on. The time spent on the site also affects the individual's sensitivity in relation to the change that wind power causes (Hammarlund, 2005). The above values are necessary to take into account in order to create a good dialogue with the locals. The importance of local networks is emphasised as well as dialogue groups where credibility, reliability and trust can be created.

In summary, the research points to the importance of choosing the right place, from a visual point of view and taking into account the place's landscape character and values, and the importance of public participation in planning and decision making.

To understand people's reactions to changes in the landscape it is important to create a dialogue with the public. Changes in the landscape may seem stressful. Anyone who is in favour of wind power and the specific establishment, thinks that the project is good. People who, on the other hand, are not sure about the suitability of the placement and of how their own interests will be affected, the situation may be perceived as stressful. People who are negative to wind power and have a very negative attitude to wind power being established in a specific location can experience stress to a greater extent than the above-mentioned persons and even feelings of anger and despair.

5.3 Institutional relations – planning

There is a link between people's attitudes to new technologies and the social and societal processes that contribute to how technology is used. Cowell (2010) writes that if the technology cannot be understood, it has no impact in the community. In the dialogue between the various stakeholders on environmental conflicts and risk perceptions, the language's technical difficulty of the projectors increases as they are required to provide more explanation and clarification. This often leads to conflicts escalating. It may also be that the conflict is caused by the large gap between expert knowledge and everyday knowledge (see further explanation in Chapter 4). Information campaigns based on a "top down approach" rely mostly only on expert knowledge (Boholm et al., 2000; Boholm & Löfstedt, 2004; Boholm, 2005; Boholm, 2008). We need more studies of how various wind farms are planned and how people in different ways are confronted with and being able to understand and relate to wind power in their local environment (Devine-Wright, 2004).

A crucial factor in how people perceive the planned wind farms, is the *number of wind turbines* that will affect their environment, rather than the *size of the wind turbines*. This suggests that, for example, administrators and planners need information for planning, describing and managing the cumulative effects of the various establishments connected in the landscape (Hammarlund, 2005). It is important that social context, landscape features for different actors and social networks are taken seriously and are integrated into the planning process for individual establishments at municipal as well as at regional levels. To only ward off protests by financial compensation or other remedies do not work (Devine-Wright, 2004; Hammarlund, 2005; Khan, 2004; Oles & Hammarlund, 2011). The Swedish Board of Housing Building and Planning has in a report described how a number of municipalities have included wind in their comprehensive plans. 215 municipalities and 15 county boards had until 2010 sought funds for planning to include wind power in their comprehensive plan (Swedish Board of Housing Building and Planning, 2010). Already in the comprehensive plan work, the public can be involved in more clearly (see Chapter 4).

The planning process includes three parallel processes (Khan, 2004): The *project-specific* process focuses on technical, economical and environmental aspects, and the distribution of roles and resources between stakeholders. The *political* process that deals with general discussions for and against the development and the *approval* process that addresses environmental impacts and weighing of different interests (see explanation below).

The planning process often focuses on the technical possibilities that are based on the availability of wind resources and areas with as few competing national interests as possible. Particularly valuable areas are protected. Documentation showing how different landscape qualities are utilised in wind power planning should be developed. Cowell (2010) writes that sometimes a technical rationality is applied which assumes that all people are economically rational and accept impacts in their living environments if they are compensated financially. Wind energy is already displaced to marginalised areas, to the everyday landscape, in order to avoid impacts on particularly valuable natural and cultural environments. Wind power's technical capabilities should be linked to social context, only then can a discussion of the location and planning of wind power take place (Cowell, 2010). Opportunities for better planning can then be given.

5.4 Landscape analysis in practice

Project-specific process

There are several ways of conducting a good landscape analysis. Some of the few good examples that exist in Sweden today follow the aspects emphasised by the ELC.

- **Strategic:** The work should be a planning tool to anticipate and understand the impact of planned or ongoing change processes. The maps or information should serve as an important basis for planning.

- **Holistic/Intersectoral:** The entire landscape should be described and its history connected to nature and land use values should be highlighted in a way that shows the connection between these values.
- **Landscape as a resource:** The functions, values and processes that exist in a landscape and which factors affect and change the landscape should be highlighted. Rate of change in different areas is also important to highlight.
- **Dialogue based:** The ELC emphasises that landscape analyses/assessments should build on a dialogue with the people concerned, NGOs (non-governmental organisations) and authorities and not on pure expert statements. This demands an active dialogue process during the entire work (Berglund et al, 2011).

Political processes
A landscape analysis[10]*, in accordance with the ELC definition of landscape*_ (Council of Europe, 2000: Art. 1), emphasises the importance of local collaboration on how different values are perceived and how they are being used by people living in or visiting the local area. This means:

- To describe the entire landscape and its history in connection to nature and land use values in a way that shows how these values are connected.
- To anticipate and understand the effect of the planned or ongoing changes.

A guide has been developed by the Swedish Board of Housing Building and Planning (2009, 2011).

A more macro-oriented part of the research focuses on other explanations for why the expansion of wind power in some countries is slowed. It compares different countries in terms of economic support policies and planning systems. The research points to the need for alternative policy approaches to more effectively expand wind power. Above all, it is about an open political engagement in issues where wind power will be established and a planning system that is capable of managing conflicts of interest surrounding land use (Toke, Breukers & Wolsink, 2008; Breukers & Wolsink, 2007; Agterbosch & Breukers, 2008; Agterbosch, Glass Mountains & Vermeulen, 2007).

Approval processes
In the wind power processes, Henecker & Khan (2002) see a clear gap between rhetoric, legislation and practice with regard to citizens' influence over land use planning (Henecke & Kahn, 2002; Kahn, 2003). The democratic tools of urban planning consist largely of the statutory consultation. The Planning and Building Act (PBL) and the Environmental Code require a consultation that permeates the planning and approval process (see Vindlov.se). There is according to many scientists a need for method development prac-

[10] Landscape analysis is not one method but several, like LCA, HCL, Lynch, etc.

tices. A prerequisite for the development of methods of consultation is that all the actors have a basic understanding that the landscape cannot be handled objectively. Authorities, planners, researchers and the general public need to be open to the fact that there is not just one truth, but several, each individual has his/her values, needs and activities in focus (Hammarlund, 2005). Knowledge affects perceptions of a change. This means that:

- if knowledge and experiences are lacking, emotional factors will, to a higher extent, affect the attitude towards a change (ibid).

The ELC's emphasis on the right to participate is also expressed in the Ålborg Declaration and the Agenda 21 Objectives (UNCED, 1992: Agenda 21 http://ec.europa.eu) as well as in the Århus Convention from 1998 (European Parliament and Directive 2003/4/EG and European Parliament and Directive 2003/35/EG, http://www.unece.org/env/pp/ 05-05-2011).

EIAs mean that knowledge on environment and landscape impact should be basis on decisions that are made in an open decision-making process. There is a conflict between two seemingly opposite ideals for improving the knowledge base in order to obtain scientific clarity and security and, at the same time, allow public participation to improve the knowledge base.

- *Approval processes* which today include public participation do not create a dialogue where different opinions and perspectives meet or where viewing points can change through convincing arguments by other parties (Soneryd, 2002; Leazun & Soneryd, 2007).

Landscape analysis – Example 1 Siljan.

Below is an overview description of two landscape analysis methods that include many of the above qualities. This report describes some processes a bit more in detail. The Swedish Board of Housing Building and Planning has presented the work of seven municipalities on wind power dialogues in the report "Citizen dialogue on wind power" (Medborgardialog om vindkraft) (Swedish Board of Housing Building and Planning, 2011).

The County Administrative Board of Dalarna has, in collaboration with Leksand, Mora, Orsa, Rättvik and Älvdalen municipalities, developed a planning document in the form of a landscape assessment of the area of wind power (Dalarna County Administrative Board, 2010). In the Siljan region, historical contexts interact with high conservation values where a long tradition and continuity in land use has given rise to a high visibility of cultural history. These unique connections between natural and cultural values are the basis for the important tourism industry and human historical and social contexts and identities. The landscape around Lake Siljan is of great importance for Dalarna's attractiveness. Dalarna and especially the Siljan region holds unique historical traces of land use, both from a national, regional and an international perspective. Thus, it is a delicate balancing act to plan for changes that do not follow the usual scale of the area's cultural landscape and its historical complexity. An expansion of wind power should be in harmony with the preservation of important cultural and natural values that form the basis for tourism and recreation in the Siljan region. The County Administrative Board of Dalarna has therefore, in collaboration with the municipalities and Siljan Tourism, conducted a landscape assessment of the Siljan area. In the spirit of the European Landscape Convention, active work has been done on:

- Consultation meetings: eight consultation meetings were conducted, which began with the information from the county board about the background; a consultant presented the state of progress. Lots of time was devoted to asking questions. In the last four consultation meetings, group discussions about the character and attractiveness of the Silja landscape were held.
- A blog and web survey informed and creates a dialogue with residents and others around Siljan. The blog had 8,266 visitors in three months. During that same period, the consultant made seven thematic posts which received 109 comments in total (County Administrative Board of Dalarna, 2010 www.lansstyrelsen.se/dalarna 11-04-2011).

Landscape analysis – Example 2 Åstorp

In Åstorp municipality a landscape analysis was conducted (Åstorp municipality, 2011, www.astorp.se 11-04-2011). The analysis was based on the method Landscape Character Assessment, LCA.

The work presents landscapes characters as fragments of the landscape that share specific characteristics and values. Each landscape character has been described systematically with regards to topography, land use, population structure, natural and cultural values, touristic values, visual values, identity and change processes (see Table 4.2, Chapter 4). The landscape has been inventoried and information has been compiled into a living document, in order for this to be developable by the municipality as new issues arise. Based on the compilation of information and field studies, a basis for "touring interviews" with the public in each landscape character has been developed. With the help of comments and discussions from the touring interviews, values that may conflict with wind power projects have been verified and supplemented, and the ability to coordinate the different values of wind power have been discussed. Landscape analysis is in this work an important basis for environmental assessment of each landscape and how it would be affected by wind power.

The first part of the LCA was made independent of wind power. Character types were described as a basis for the comprehensive plan. Thereafter, descriptions were deepened with the help of "touring interviews" where specific character areas and their suitability/sensitivity were discussed in relation to changes (such as a wind power establishment).

The character analysis was then compiled and appropriate areas were described along with the demands of adaptations and visualisations that are asked for in applications. Landscape analysis/character analysis could thus both be used generally for the comprehensive plan and be subsequently updated with facts about new issues that arise. One such issue is wind power and there was a wind energy plan developed based on the LCA (Berglund et al., 2011).

The implementation of the LCA in Åstorp municipality has assumed that landscape analysis will be used:

- as a basis for discussion in the citizen dialogue about their landscape, but also in the dialogue with those working with different aspects of planning and development of a landscape,
- to predict and prepare for changes in the landscape,
- form basis for the establishment of guidelines and objectives for landscape development, e.g. building permits, shoreline protection, wind power localisation,
- to assess and follow up both planned and unplanned changes in the landscape. How sensitive is a certain area for additional buildings? How has the described features of the character been affected by the change,
- to promote a holistic view of the landscape in all planning and development.

The "touring interview" is an evaluation method that was developed by Ivor Ambrose in connection to his work of evaluating Blanstegård in Odense, Denmark. In the U.S., the UK and New Zealand, similar techniques are used to evaluate buildings, here called the Walk-through Evaluation and the Touring Interview. The tour is used both in order to formulate programmes and propose actions in existing environments (de Laval, 1998). So there are a variety of tour methods that have been formed and named according to their specific purposes.

The touring method "touring interview" is a collective walk in the current environment with a concluding discussion:

- The tour starts with the project leader describing the purpose and approach of the meeting.
- The group moves along a predetermined route with a few stops.
- At each stop, participants note their opinions on specific issues.
- After the tour, there is a collective briefing of experiences and observations.
- These opinions and experiences are collected and compiled.

The goal is to get different opinions and impressions. It is important to write a report from the tour, so that what is discussed is preserved as a basis for future projects (de Laval, 1998; Swedish Board of Housing Building and Planning, 2011).

Below we present the process of how the wind energy plan in Åstorp municipality was developed, see Figures 5.4 to 5.13 below. For more information go to www.astorp.se.

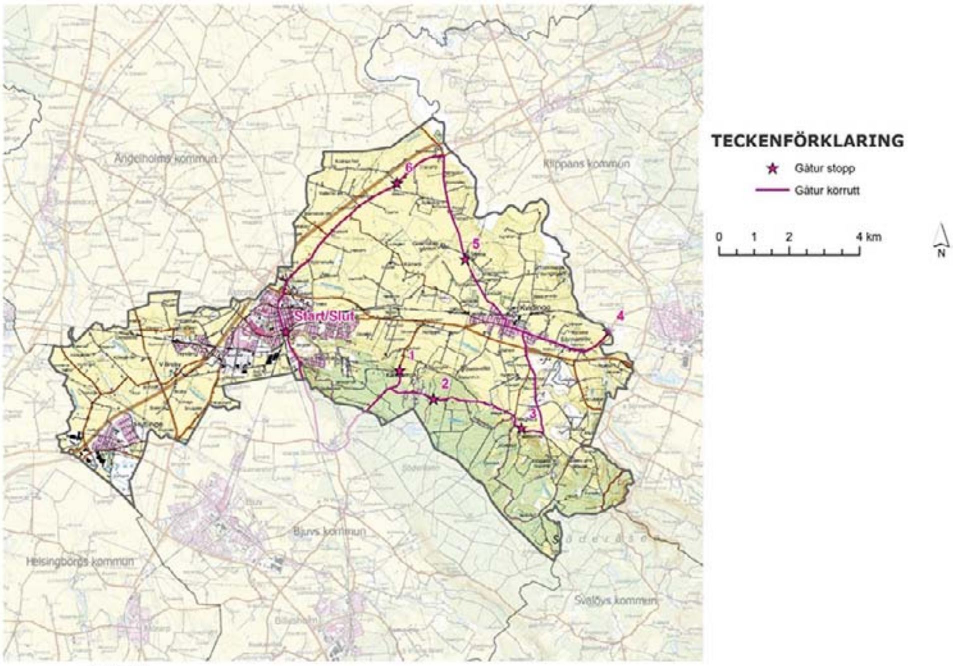

BILD 2: Källa: Mellanrum AB

Bildetext:
Karta för genomförande av gåtur i Åstorps kommun

Figure 5.4. Map for the touring interview in Åstorp municipality. Source: Åstorp Municipality.

BILD 3: Källa: Mellanrum AB

Bildetext:
Ute på gåtur i Åstorps kommun

Medverkande från Mellanrum AB:
Jenny Åkesson landskapsarkitekt
Jenny Nord Fil Dr. arkeologi
Carina Daubner landskapsarkitekt
Karin Hammarlund projektledare

Figure 5.5. Touring interview in Åstorp municipality. Source: Åstorp municipality.

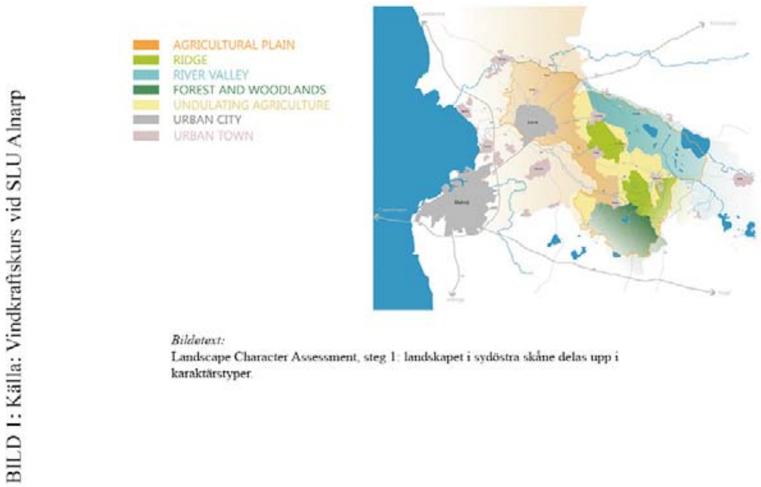

Figure 5.6. Landscape Character Assessment, step 1 the landscape of southeastern Scania is divided into character types. Source: Wind power course at SLU, Alnarp Källa: Vindkraftskurs vid SLU, Alnarp.

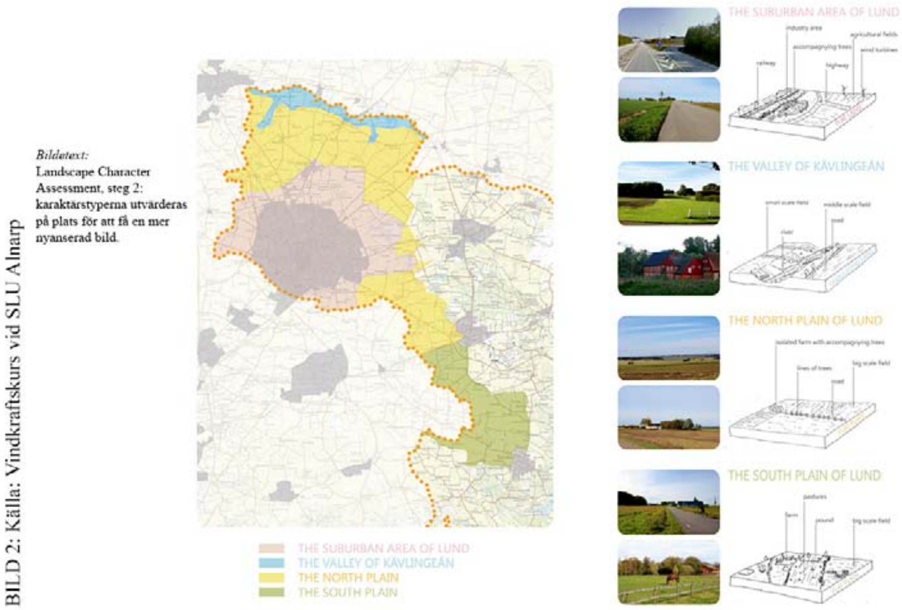

Figure 5.7. Landscape Character Assessment, step 2 Character types are evaluated in situ to get a more nuanced view. Source: Wind power course at SLU, Alnarp.

Figure 5.8. Analysis according to Kevin Lynch´s (1960 method for mapping important spaces, land marks, movement patterns and nodes. Source: Wind power course at SLU, Alnarp.

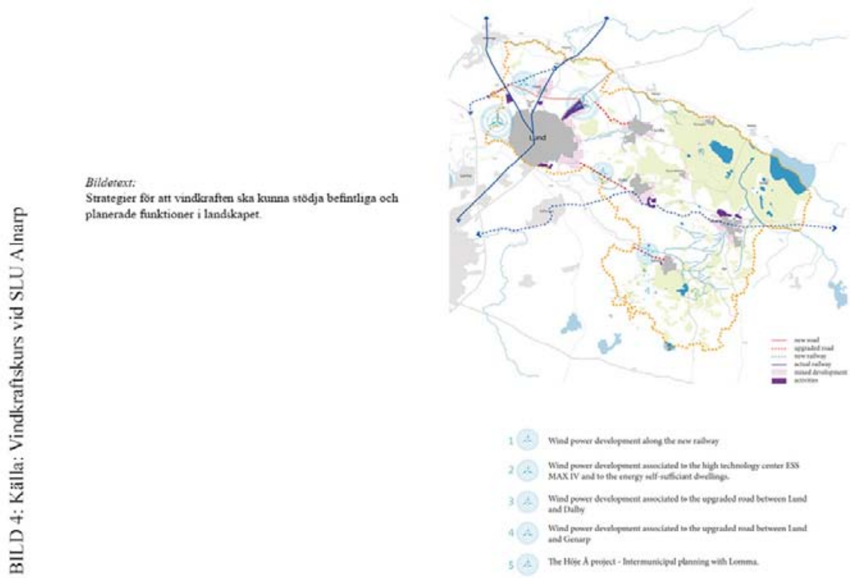

Figure 5.9. Strategies for wind power to support existing and planned functions in the landscape. Source: Wind power course at SLU, Alnarp.

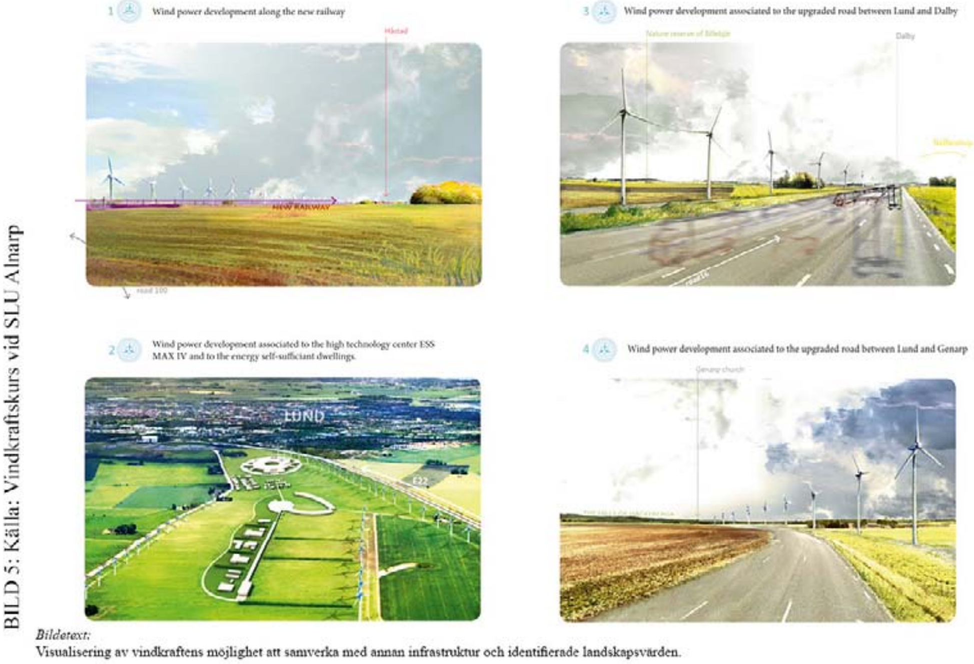

Figure 5.10. Visualisation of wind power's opportunity to co-work with other infrastructure and identified landscape values. Source: Wind power course at SLU. Alnarp. Note that the photo montage above is an illustration and no basis for approval

Figure 5.11. The landscape determines wind power's possibility to support local functions. Source: Wind power course at SLU, Alnarp.

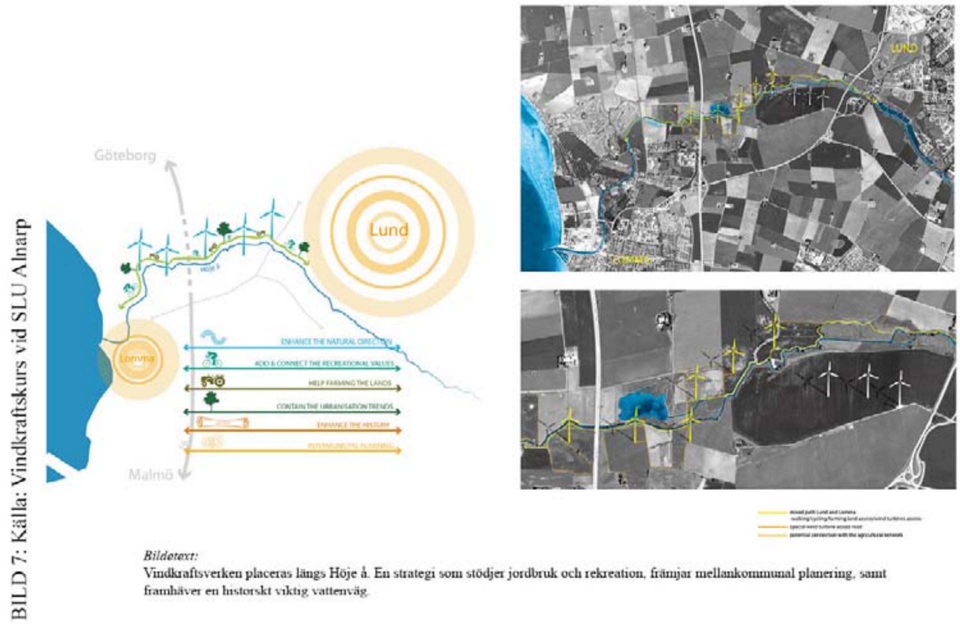

Figure 5.12. Wind turbines placed along Höje river. A strategy that supports agriculture and recreation, promotes inter-municipal planning and highlights a historically important water way. Source: Wind power course at SLU, Alnarp.

Figure 5.13. Before and after: Wind power creates accessibility to recreation in the agricultural landscape, protects the nourishing soils and highlights Höje river as a historically important water way. Source: Wind power course at SLU, Alnarp. Note that the photo montage above is ann illustration and no basis for approval".

5.4.1 Concluding comments on landscape analysis in practice and planning

Participation and the opportunity to influence planning and decision-making have positive effects on acceptance. The question which then arises is whether the planning process serves as a means of creating opportunities for participation. Explanations as to why the implementation of wind power is weak may be due to a lack of clarity in the planning system. The strongest criticism against the so-called top-down approach to planning is that it strongly reduces the ability of the public local knowledge to be integrated into planning and decision making. For the most part, projects are currently planned on the principle of decide-inform-defencing model (Ellis, Cowell, Warren, Strachan & Szarka, 2010; Wolsink, 2010; Khan, 2003; Aitken, 2010).

The findings from studies on conflicts surrounding the railway expansion in Sweden have revealed a strong link between social reinforcement of risk perceptions and conflicts surrounding specific locations. An important conclusion from the research is that the more the personal and emotional arguments from the opposing side get the more impersonal and technological are the arguments of the projector. The most powerful arguments of the opponents in this context are those that contain an element of risk. Trade-offs must be made between what is justifiable in relation to the benefits of the project and the risks which humans and environments are exposed to (Boholm, 2000). By already in the municipal comprehensive planning more clearly including public experiences, this could reduce subsequent conflicts (National Board of Housing, 2010).

Consultations should be carried out with the public; it is an obligation for the authorities. Consultations can be developed so they work better. It is important to clarify the roles and at an early stage involve citizens in the planning process. A prerequisite for this is:

- that all involved stakeholders have knowledge that the landscape cannot be handled objectively,
- that authorities, projectors, researchers and the public are open to there being not just one truth but several,
- that each individual has his/her values, needs and activities.

Yet another method is presented: “touring interviews”. People meet and walk together in the landscape. This can lead to a shared understanding of the landscape. Attitudes differ in terms of landscape and visual assessments but by moving together along the landscape, different opinions are discussed. Through touring interviews, people can find out where particular problems that difficult to solve are localised (Büscher, 2006 s 10). The walking interview has proven to work well in the wind power context.

5.5 Communication and dialogue

Bringing forward a message while getting the participants to feel involved in, for example, a wind power process, requires strategies (Nilsson & Waldemarsson, 2007). Communication takes place in a physical, psychological, social and cultural context, and there is a tendency to neglect the social perspective. P*hysical* contexts mean (according to Nilsson & Waldemarsson, 2007) location, time and external events. The psychological context is about thoughts, feelings, experiences, expectations, needs, stress and prejudices.

The *social* context is about identity, relationships, power, roles and potential conflicts and the *cultural* context consists of the values, attitudes and the world image and language that is shared by a group of people (Nilsson & Waldemarsson, 2007).

Soneryd highlights in her thesis *Environmental conflicts and deliberative solutions* (2002) local environmental conflicts and conditions for public participation. This is done within the framework of an environmental impact assessment process (EIA), which is in accordance with the legal standards on activities with significant environmental impacts. Soneryd provides both an empirical and theoretical background to the problems of creating a representative dialogue with the public. A dialogue is a meaningful development and enriching conversations in which important aspects of how individuals experience their world will emerge. A dialogue process means that those involved are ready to change their judgments, preferences and perceptions during the interaction (Dryzek, 2000).

Hajer & Versteeg (2005) point to five important factors in a dialogue process:

- Openness. Anyone should be able to participate.
- Clarity. It should be clear who is responsible for a decision.
- “Favours and returning favours” means that a dialogue is conducted
- Respectfulness means that participators talk one on one so that everyone is listened to.
- Involve teaching by repeating the dialogue (Lezaun & Soneryd, 2006).

Mels (2001) emphasises the importance of the difference between providing someone with information and having a dialogue. To provide some information may be treated as presenting already made decisions rather than developing decisions through consultation (Mels, 2001). According to the author, the purpose of a dialogue is that it empowers citizens and nourishes the collective life (ibid.). One problem, that according Soneryd (2002) severely impedes dialogue with the public, is that the environmental conversation has become scientific since the 1980s and therefore is dominated by professional experts. This can lead to an absence of a profound social, political and economic analysis of environmental problems (Soneryd, 2002). The participatory democratic theory argues for an active public participation and stresses that all citizens or groups should have equal opportunities to participate in the political process. The participation model focuses on the discussion of central democratic elements but does not see debates as a means to reach agreement. The theory is based on the theories of Habermas (Habermas, 1989) on communicative action and the ideal conversation situation, which means that joint decisions are made by a process (Henecke & Khan, 2002; Khan, 2004). A checklist for quality of dialogue and consultation work can look like this:

- Participation: have all relevant stakeholders and their questions been identified?
- Suitability: was participation good and was there enough time?

- Focus: have there been clear distinct objectives for the participation?
- Openness: has the process been conducted in a friendly and understandable manner?
- Resources: has the process been well staffed?
- Reconnection: has the process generated answers?
- Effectiveness: have the methods earned their purpose and served the participants in a good way and created a legitimate process? (Hammarlund, K, in progress: EU-project)

A successful method for dialogue in small groups is between people who know each other (through an association, a group of land owners). Information and training is then included in the group's strategy work. Cooperation in groups is a long-term strategy that can help solve social dilemmas. Prerequisites for the dialogue in a group to be successful are in particular that:

- it is a stable group,
- few members,
- a common interest,
- common values,
- members who trust each other,
- members who make use of enthusiasts (Gardner & Stern, 2002).

Dialogue in such a group can lead to a sense of belonging and that they work for the best of the group. Within the group, participants can share each other's knowledge and experiences of a place. Participants can get past self-interest because they share a common concern for a resource (e.g. a specific place) which can lead to the possibility that they also take greater collective responsibility for the place or the common resource (Ostrom, 1990; Gardner & Stern, 2002). This is a way to address social dilemmas mentioned in Chapter 4.

5.6 Experiences from the wind power industry – Codes of Conduct

There is a Code of Conduct and a checklist that describes how projectors should work with information in the establishment of wind power. The Code of Conduct contains common recommendations for the entire wind power industry based on acquired knowledge already held by projectors, and by others affected by the establishment of wind power. The idea is that the Code of Conduct should set a certain level to communication in wind power projects, and those who have committed to do it, do the same work. By following the Code of Conduct, wind project planners take responsible for their part of a wind farm establishment. The Code of Conduct and landscape analysis have many common interacting factors. These should be linked together.

Projectors who comply with the Code of Conduct shall:

1. Be an ambassador for wind power and take responsibility for the industry's reputation by offering general information about wind energy and work for long-term and well established solutions.
2. Behave honestly and openly and provide essential information as much as can be expected of a player in a competitive market.
3. See those affected by the project as a resource and work with them to find solutions.
4. Finding information about and identifying other interests in the area, and evaluating the project's interests against these and doing this in consultation with stakeholders.
5. Informing about the project as soon as there is something of value to say, and as early as possible.
6. Provide stakeholder dialogue.
7. Answering questions about wind energy and the project to the extent that it is reasonable
8. Take responsibility for ensuring that information is clear, objective, accurate, balanced in time and performed in a way that the receiver can understand.
9. Throughout the project, creating good conditions for new projects.

All wind power developers are recommended to follow this Code of Conduct (Swedish Wind Power Association, 2010). The above-described conduct is now under development. It is important to develop and follow each step in this code so that dialogue takes place early in the process and developers learn about the issues that are of importance to the public. Then the various interests are identified and analysed. Dialogue should take place in smaller groups because meetings in large groups contribute to only a few people being heard, and that the dialogue takes place on the location for the planned wind farm establishment.

5.6.1 Concluding comments on communication and dialogue

Research shows that early dialogue with concerned stakeholders in a wind power area can help avoid conflicts of interests. It is important to have a participatory process in which five factors are crucial:

- openness, clarity, dialogue, respectfulness and to involve teaching by repeating the dialogue (Lezaun & Soneryd, 2006).

There is a difference between information and dialogue. The dialogue aims mainly to empower citizens and nourish the collective life (Mel, 2011). There is also a checklist of how (or if) a dialogue works (Hammarlund, ongoing EU project). Additional important factors for a dialogue to be successful are that the group is not too big and that the members trust each other (Gardner & Stern, 2002). The Code of Conduct that the wind power industry is developing contains some of the above factors, but it should be followed up at each wind power establishment.

6. Discussion, conclusions and recommendations

The purpose of the synthesis report "The Effects of Wind Power on Human Interests" is to describe, analyse and evaluate existing knowledge about wind power's impact on different interests in society. This chapter discusses the results obtained from the literature review. It then summarises the *conclusions* (Section. 6.1) as well as gives *recommendations* for planning and trial (Section 6.2). *Knowledge gaps* identified during the project are presented in Section 6.3.

Wind energy is a renewable energy source that should be seen in a global context. Wind establishments are increasing in many countries of the world, Sweden included. A number of agreements have been adopted on the need to reduce global warming by e.g. increasing the share of renewable energy in the world (UNCED, 1992; WSSD, 2002; the Millennium Declaration, 2000); regionally by the European Parliament and Council Directive 2009/28EG, IPCC (2007), and at a national level by the Environmental Objectives Council (2010). A development of renewable energy is part of the efforts to promote sustainable development. According to Harper (2011), it is important that interdisciplinary and cross-sector collaborations and every perspective of sustainable development should take into account the ecological, economic and social perspectives. In this project, researchers from different disciplines are working together to try to provide a holistic approach to the effects of wind power on human interests.

Climate change may seem vague and difficult to view holistically. Climate change occurs slowly and is therefore not present in everyday life (Ajzen, 1988; Eagly & Chaiken, 1993; IPCC, 2007; Lindstrom & Küller, 2008; Uzzell, 2000). One issue that is important at the global level may lead to adverse reactions locally. Wind power establishments in the landscape can affect many interests and give rise to both positive and negative reactions. Although people prioritise "clean air" and the development of renewable energy to a great extent, their own responsibility for the issues is perceived low (Lindstrom & Küller, 2008).

The landscape will be adversely affected by climate change, for example by shifting climate zones, droughts and floods. Therefore, no landscape will remain as it once was. Today the focus is on wind turbines' visual impact on the landscape. The landscape impacts caused by climate change are rarely discussed, however. To demand that our generation should abstain beautiful views of the landscape in order to prevent a threat to future generations is a big request, but according to science, it is required (Warren & Birnie, 2009; Mercer, 2003; Nadai & van den Horst, 2009; Warren et al., 2005).

Navrud & Grönvik Bråten (2007) found that people were willing to pay more for electricity from wind power than from fossil energy sources. They had to choose from wind power, hydro power, natural gas and coal. People said that they were willing to pay higher electricity costs to purchase electricity produced from wind turbines compared with imported coal. The willingness to pay was higher in cities than in rural areas. This is an example of people's positive attitudes towards wind power. Ek (2006) showed that people were more positive towards offshore wind power than onshore or in the mountains. Most respondents preferred smaller wind farms over larger. Kreuger's (2007) study showed that people, particularly those living on the coast, would be willing to pay a higher price for wind power electricity if the wind turbines were placed further out to sea. There are currently no laws specifying the appropriate distance from wind turbines to housing facilities, it is dependent on e.g. the topography and the noise level (Swedish Board of Housing Building and Planning, 2009).

Many studies show that people have a positive attitude towards renewable energy in general (European Commission, 2008; Lindstrom & Küller, 2008; Damsgaard & Byman, 2009) and the vast majority believe that wind power is environmentally friendly (87%) (Hedberg, 2011). The SOM survey (Society Opinion Media) in Sweden showed that many were positive (31% very positive, 25% fairly positive) to wind power in their own municipality, but less positive to wind power close to their homes (13% very positive, 27% fairly positive, or close to their holiday home (14% very positive, 26% fairly positive) (Hedberg, 2011). People's attitudes may be due to fundamental values, the experience of wind power, knowledge, the relationship to the landscape where wind power is to be established and other factors such as culture, identity, interests, and expectations. People's different interests play a major role in the attitude towards a wind farm (Bolinger & Wiser, 2006; Lantz and Tegen, 2009; Warren & McFayden, 2009; Bodén, 2009; Riddington et al., 2008).

Health and Illness

When people react to wind power, it generally relates to the concern about noise pollution and negative landscape impact. As for noise, it is the swishing and thumping sounds from the turbines is most annoying. Pedersen, Hallberg & Waye (2007) found that swishing and hissing sounds were associated with self-reported noise disturbance. Perceived noise can be bothersome and there is a concern among humans that noise, especially low frequency sound and infrasound, can affect the health. Several studies have been conducted in this research area and the research shows that the noise levels in the low-frequency and infrasonic range is no higher than for many other common noise sources in the environment (Levent Hall, 2006; van den Berg, 2004; Nilsson et al., 2011). Currently, there is no evidence that infrasound (1–20 Hz) contributes to noise pollution or have other health effects (Nilsson et al., 2011). The benchmark for wind power noise is 40 dBA (Swedish Board of Housing Building and Planning, 2009) and in a comparison with other sounds in the environment, 40 dBA is similar to low radio music (Hygge, in Johansson and Küller, 2005). People who see wind turbines are disturbed by noise to a greater extent than those who do not see the turbines (Pedersen et al., 2007).

Studies on perceived noise in Sweden and in the Netherlands show that among the residents (within the range 35–40 dBA), the proportion of disturbed (disturbed or fairly disturbed) in the Swedish studies was about 10% and about 20% in the Dutch study. The proportion of very disturbed was about 6%. These results indicate that 80–90% of the residents stated that they did not feel disturbed. When it comes to sleep disorders, research cannot reliably state the effects of sleep by wind turbines (Pedersen, 2011; WHO, 2009). An Australian study found an association between noise from wind turbines and sleep disturbance (Shepherd, 2011). This must be researched further. Why some people feel disturbed, even though sound levels are below the recommended level of noise, should also be researched further. There is also a lack of studies on the possible cardiovascular effects due to noise from wind turbines. Claims that wind power noise would cause vibroacoustic diseases and "wind power syndrome" have no scientific evidence.

Shadows from wind turbines can sometimes be disturbing. However, there are rules for this. The maximum *possible* shadow time for sensitive buildings shall not exceed 30 hours per year and no more than 8 hours of *actual* shadow time per year and 30 minutes a day (Swedish Board of Housing Building and Planning, 2009). Shadows occur when the rotor blades obscure the sun whilst rotating.

Economy and businesses

In a number of studies, the social benefits of wind power are discussed, such as a wind power project generating employment. New jobs are added or "taken" from other sectors in the community. Wind energy can create jobs in a community in the construction phase as well as in the operation phase. Both direct and indirect employment can be created. Several studies show that various peripheral effects may contribute to the development of the entire district. Studies in Jämtland County municipalities (2010) show positive employment effects. They have proved most successful in the large municipalities, as labour from the municipality can be utilised. Workers who live in the proximity buy goods and services in the municipality (NEA 2003). Local labour results in less "leakage", i.e. workers spend their income at the place of employment, according to Goldberg et al. (2004). It is also shown in research that local ownership stimulates the local economy and contributes to a positive attitude towards wind power (Bolinger & Wiser, 2006; Goldberg et al., 2004; Lantz and Tegen, 2008; Lantz and Tegen, 2009; Warren & McFayden, 2010).

Tourism can be considered from the visitor's, producer's and societal perspective. Tourism can be affected positively or negatively by wind power. People searching "untouched" places and plan their trip to just visit a particular natural or cultural area feel more disturbed by wind turbines than those visiting music or sporting events. In these cases, the journey is a means to an end, according to Bodén, (2009). Even when it comes to tourism, the local acceptance is of great importance. International studies show that there is no support for the belief that wind farms would threaten tourism. There are no results that confirm this is the case after an expansion has occurred.

Nor are there any studies that can show whether property prices decrease due to wind farm establishments. Several studies have been made but no significant differences have been demonstrated in real estate prices of properties in areas with wind power and properties in areas without wind power (Sims et al., 2008; Hoen et al., 2009; Swedish Wind Energy, 2010).

Landscape

Landscape is a complex concept because there are different interests and different relationships to places and landscapes. The landscape is perceived and used in different ways and for different purposes by landowners, property owners, permanent residents, summer residents and tourists. Anyone looking for peace and quiet may feel disturbed by wind power, while landowners may see wind turbines as a source of income (Swedish Board of Housing Building and Planning, 2009a). Concrete natural and cultural values are measured with mapping or GIS analysis. To measure the recreational values, other complementary methods are needed such as focus group interviews, in-depth interviews, stories or surveys. Studies show the importance of experts being familiar with public attitudes and develop forms for dialogue (Lindstrom et al., 2006).

The European Landscape Convention has been ratified by the Swedish government. This means that the definition of landscape as "an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors" (Council of Europe, 2000 Part 1a) should be followed. A concrete holistic approach to landscape values should be developed. According to the research, values can be divided into four different categories:

1. *Landscape character*, which type of landscape establishment it should occur in. Wind turbines should fit into the landscape and industrial landscapes are preferred for wind power (Johansson & Laike, 2007; Wolsink, 2005, 2010a, b). People are in general inclined to protect wilderness, pastures and rural areas from city like elements. According to Cowell (2010), this can be described as "protecting the countryside from the city".

2. *Visual impression*, the experience of seeing the wind turbines in the landscape. According to Möller (2006), it is difficult to assess the visual impact with quantitative methods, because the experience of the effect varies between individuals (Toke, 2005). Ellis et al. (2010) argue that the visual impact is causing great concern in the design of the wind farm and therefore these issues need to be highlighted.

3. *Design*, how wind farms are designed, such as placement, number and size is important for the experience. But this does not affect attitudes as much as landscape character. According to Möller (2010), people prefer smaller wind farms over larger ones (Moller, 2010) and stagnant turbines are perceived more negatively than rotating turbines (Bishop & Miller, 2007).

4. *Identity*, deals with the individual's relationship to the landscape, place attachment and place identity. There may be conflicts about which values are most important (Aitken, 2010; Gray et al.; Toke 2005).

Areas for outdoor recreation may be affected in different ways by a wind farm. People often use the forest and/or the sea for recreation and a drastic change in a frequently visited landscape can affect well-being negatively. People who live close to natural and cultural areas visit them often. Sequestered and natural embossed environments are perceived as important for recreation (National Board of Housing Building and Planning, 2007). Areas with qualities of tranquility, wilderness and space are often highly appreciated for recreation (Grahn, Stigsdotter & Berggren-Bärring, 2005). Johansson & Laike (2007) found that people who thought that wind turbines had a negative impact on the aesthetics of the landscape and that the wind turbines would reduce recreational values, also intended to oppose wind power (Johansson & Laike, 2007).

There are great advantages in involving the public early in the wind power planning process. This can create trustworthiness among experts, including officials and planners (Hedquist, 2002). It is important to build trust and respond early to any concerns that may exist and take into account the local population's perspective. The important issues need to be given room in discussions. When all perspectives emerge, these can be utilised in the planning process (Jones & Eiser, 2009 & 2010). Landscape analysis is an example of a strategy of early involvement of people in the wind power planning process.

Acceptance and support

Changes in the landscape may cause concern mainly due to uncertainty about what to expect and how wind power can influence people's own situation (Hammarlund, 2005). It is very important *how* and *when* in the process designers and planners answer questions like "why should the wind be built right here, why and to whose benefit?" The expansion of wind power in Sweden depends on dialogue between stakeholders in the planning process at the local and regional level, which the ELC clearly emphasises. Support for this is also found in the Planning and Building Act (PBL) and the Environmental Code (Code).

Concerns that a place is to be changed by, for example, a wind farm can create stress (Bell et al., 2001). If the individual cannot adapt to the situation, it can lead to increased agitation and/or resignation (Ogden, 2007; Bell et al., 2001). The conflict can get deeper and deeper and then it is important that administrators and planners take people seriously and develop a model for a good dialogue. More knowledge is needed about how people's stress should be countered in wind power processes.

Knowledge about people's attitudes and how attitudes are formed is important when talking about changes that wind power projects create in the landscape. By understanding the factors that create an attitude and a behaviour, one can also understand how people's attitudes can be addressed (Eagly & Chaiken, 1993; Johansson & Laike, 2007).

The concept of NIMBY (Not In My Back Yard) does not provide sufficient explanation for wind power opposition. As mentioned above, there are many other factors that can contribute to people's positive or negative attitudes towards wind power. They include choosing the right location from a visual point of view with regards to the identity of the place and the importance of public participation in the planning process and the possibility for local ownership (Jorbert et al., 2007; Devine-Wright, 2004 & 2009; Warren & McFadyen, 2010).

Social context, landscape features for different actors and social networks should be protected and integrated into the planning process for wind power. Landscape analysis is currently used by some municipalities, examples are given from Dalarna (Siljan) and Åstorp. There, aspects like "strategic, holistic/intersectoral; landscape resource; dialogue-based" are taken into account, in full compliance with the European Landscape Convention. In Åstorp municipality, they used Gåturer ("touring interviews") (deLaval, 1998). Methods that involve and engage people in the early stages can help to prevent conflicts. It is an advantage if landscape analysis can be integrated in the municipal comprehensive planning.

Building trust and a good dialogue is fundamental for a successful wind power process. Henecke & Kahn (2002) and Kahn (2004) have developed a checklist for quality control that can be useful for dialogue and consultation meetings. If good dialogue meetings are to be developed, it is necessary to "be open, clear, that dialogue takes place, has mutual respect and to learn from each other" (Lezaun and Soneryd, 2006). According to Gardner & Stern (2002), the dialogue should take place in stable, smaller groups where people share common interest and common values. It is also important to involve the enthusiasts. It is possible to use existing social networks, e.g. a group of land owners, an outdoor activity organisation or other interest group. To have a dialogue with each group individually contributes to including all opinions in the early stages.

The method for working on this report has been the studies of literature. The synthesis panel consists of expertise within the areas of Health and Illness, Economy and businesses, Landscape and Acceptance and support. The synthesis panel has mainly examined, analysed and valued internationally published research in order to make collective conclusions. In areas where research is underdeveloped (or not existing), reports from national/regional authorities and consultants were also used. Consultant reports have been used to describe specific cases, how a wind power process has progressed and/or how a particular method has been used. The knowledge base has been discussed, analysed and evaluated in the synthesis panel meetings. The synthesis report is the overall assessment and evaluation of the available knowledge on the effects of wind power on human interests. It has sometimes been difficult to compare results from other countries with Swedish conditions, as methods to measuring e.g. noise pollution, employment and property values differ between countries. These methodological considerations are described in the introductory section of this report.

6.1 Conclusions

6.1.1 Wind power – globally, regionally and locally

The synthesis panel makes the following conclusions, based on existing research on wind power in a global context:

- Wind power is a renewable energy source that should be seen in a global context. Global issues are often perceived as vague on a local level. Climate change is comprehensive and occurs over a long time, whilst wind power impact is local and immediate and very visible and real.
- It can be difficult to demand that this generation need to accept changes in the landscape in order to prevent threats (like climate change) for future generation. But this is, however, a necessity according to research. (Warren & Birnie, 2009; Mercer, 2003; Nadai & van der Horst, 2010; Warren et al., 2005).
- Global environmental and development problems can be perceived as very important and worrying but the responsibility for fixing the problems are often put on global organisations and not on the individual (Auhagen, 2001; Lindström & Küller, 2008). Consequences of climate change should therefore always be discussed in wind power establishments.

6.1.2 Wind power – health and illness

The synthesis panel can, based on existing knowledge, make the following conclusions regarding health and illness:

- Noise from wind turbines is sometimes perceived as disturbing. People who see wind turbines are more disturbed by the sound than those who do not see the turbines (Pedersen et al., 2007). What causes this difference is not yet clear, but most likely it has to do with wind turbines often being built in areas with low background noise, and that the turbines sometimes are perceived to have a negative impact on the visual landscape. There may be other explanations, such as wind power being a relatively new phenomenon in the landscape whereas, for example, highways often represent a given component in the landscape (Pedersen et al., 2009).
- Ten per cent of residents (on average) were annoyed by wind power noise (at 40 dBA) and 6 % were very annoyed (Pedersen and Waye, 2004; Pedersen et al., 2007; Pedersen, van den Berg, Bakker & Bouma, 2009).
- Subjective experiences of noise can be difficult to measure and methods are at the moment underdeveloped. Qualitative methods, such as interviews with residents and stories, could be a complement.
- How much a wind turbine sounds depends on e.g. vegetation in the landscape, how sound is transported and how much wind there is (Swedish Board of Housing Building and Planning, 2009a).

- Infrasound from wind power has shown no negative health effects (Lewenthall, 2006).
- Sound levels in the low frequency and infrasound spectra are not higher than other common noise sources in the environment (Leventhall, 2006; van den Berg, 2004a).
- Some research shows a weak correlation between the calculated noise levels from wind turbines and self-reported sleep disturbance (Pedersen et al., 2007; Shepherd, 2011) while other studies show no such correlation (E. Pedersen, 2011). Therefore, it can not be excluded that wind noise can affect sleep negatively, but no conclusions can be made as more studies must be performed.
- Moving shadows that occur at certain times when it is sunny can be perceived as disturbing. There is today technology that can reduce such effects. This can be entered as a condition in trials or in control programmes.
- Studies of traffic noise have lately found evidence for a correlation between noise exposure and cardiovascular disease. Similar studies on wind power noise are lacking.
- Claims that wind power would cause "wind power syndrome" or "vibroacoustic disease" lacks evidence.

6.1.3 Wind power – economy and businesses

The synthesis panel can, based on existing knowledge, make the following conclusions regarding effects on economy and businesses:

- Wind power's impact on employment varies depending on whether the turbines are owned by local actors or not. Usually there are positive employment effects during the construction phase. During the operation and maintenance phase, the local development benefit if local contractors are hired and operational staff are locally resident (Lantz and Tegen, 2008).
- Wind power's impact on tourism is associated with the visual impact of the landscape and what visitors to the area expect of the area/location (Bodén, 2009). Visitors have different motives for their destination. Tourists seeking untouched nature are to a greater extent considered to opt out wind power landscapes, compared to tourists for whom the journey is a means to an end, such as a sporting or music event (Bodén, 2009).
- Research provides no univocal picture of the effects on tourism and therefore no general conclusion can be made. It can be said, however, that 20% to 30 % of tourists prefer landscapes without wind power.
- Wind parks are sometimes used as a tourist destination and research shows that different local businesses can benefit economically from this.
- there is a positive willingness to pay for renewable energy sources such as wind power (Ek, 2005 & 2006).

- Limited research on the effects on property prices show no significant price differences between properties close to wind power and other properties (Sims et al., 2008; Hoen et al., 2009; Swedish Wind Energy, 2010).
- There are different forms of local ownership of wind power projects. Existing social and economic networks, attitudes, willingness to enter into a cooperative and empowerment are often critical to the degree of success and commitment in a wind power process.
- Wind power's environmental costs have been handled differently in different projects. However, no research has analysed whether or how a wind farm can cause external costs in the form of, for example, impacts on flora and fauna. Wind power's external costs are dominated by aesthetic effects such as landscape impact, but noise and impact on flora and fauna also adds to its environmental costs. The synthesis panel cannot make any conclusions in this matter.

6.1.4 Wind power – landscapes

The synthesis panel can, based on existing knowledge, make the following conclusions regarding effects on the landscape:

- Landscape analysis must be further developed in planning in a way that it contributes to dialogue and a balancing act between different interests. A combination of quantitative and qualitative methods is preferred and an integration with the municipal comprehensive plan is important.
- Landscape analysis as a method should be developed and be used more frequently in wind power establishments (Cosgrove, 1998; Cosgrove & Della Dora, 2009; Olwig, 2002; Sporrong, 1996) and to increase awareness in different interests in the landscape. The ELC's criteria makes out a very good basis for landscape analysis: "An area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors" (Council of Europe, 2000: Part 1). If the understanding of different interests in the landscape is to increase, the convention's definition should be followed.
- The research reveals a gap between an expert-driven, often quantitative, analysis of the landscape and a more communicative, qualitative approach. Better communication and a more collaborative approach are the strongest factors for successful wind power development (Agterbosch et al., 2009; Cowell, 2007; Jay, 2008; Toke et al., 2008; Wolsink, 2007 & 2010a, b).
- the expert perspective is today dominating decision-making and planning processes. Opposition is characterised by a more everyday and emotional approach (Cowell, 2010).
- People's perceptions of the landscape can be divided into four factors: Landscape Character, Visual impression, Design and Identity. The proposed wind power project must fit into the landscape

(Johansson & Laike, 2007). Landscape type is the most prominent factor in how people value the landscape's qualities, which in turn affects the attitude towards wind power (Wolsink, 2007). The visual impact of wind power is also important for attitudes. The perceived visual impact can create anxiety (Ellis et al., 2010). Visualisation of wind turbines connected to the concern that the turbine will destroy the landscape has a greater impact on support for the placement of a wind farm than the distance to the wind farm (Jones & Eiser, 2010).

- Wind power opposition should be understood as a way of protecting established emotional attachments to a place against new elements that can be perceived as threatening (Devine-Wright, 2009).
- Green areas are used for recreation and relaxation, which can reduce stress. Undemanding natural elements such as open land, especially with elements of water, create immediate positive feelings (Coss, 1991; Grahn & Stigsdotter, 2003; Ottosson & Grahn, 1998; Searls, 1960; Ulrich, 1993). A discussion of green environment's importance for recreation should be completed and included in the Landscape Analysis.
- Cumulative effects of wind power establishments in the landscape are so far an uninvestigated area, but this should also be discussed in the concept of landscape analysis.
- Environmental effects on different levels (global, regional, local) are a dilemma that also transfers to cultural environments. Climate change can threaten both natural and cultural heritages (Clarke, 2009).

6.1.5 Wind power – acceptance and support

The synthesis panel can, based on existing knowledge, make the following conclusions regarding acceptance and support of wind power:

- Social contexts, landscape features for different stakeholders and social networks should be integrated in the municipal and regional planning process (Devine-Wright, 2004; Hammarlund, 2005; Kahn, 2004).
- Knowledge on attitudes and reactions to changes in the landscape should increase among administrators and projectors in order to understand different opinions and to reduce conflicts.
- NIMBY (Not In My Back Yard) has a limited explanatory value. Alternative explanations as to why wind power opposition arises is discussed in research (Bell et al., 2005; Jones & Eiser, 2009; Swofford & Slattery, 2010; Wolsink, 2005 & 2010a, b). The significance of choosing the right location for the turbines, from a visual point of view and with respect to the place's identity and values, should be highlighted as well as the importance of public participation in the planning process.

- Dialogue at an early state in the planning process is essential in order to establish a good working climate. Openness, clarity and respectfulness are key factors for a successful result (Lzaun & Soneryd, 2007). Trust is created in the dialogue with the general public (Hedquist, 2002). Common decisions should be made by a process in which the best arguments are determents (Henecke & Khan, 2002; Khan, 2004).
- Landscape analysis should be concretised so entrepreneurs, administrators and the public understand (and can work with) the European Landscape Convention's directives, i.e.: Strategic, Holistic/intersectional, Landscape as a resource, Dialogue based. Quantitative analyses should be combined with qualitative studies on landscape perceptions.
- Activities and communication with citizens, as for example by "touring interviews" (gåturer) can increase participation and dialogue in a wind power process. The method "touring interview" can be included in landscape analysis. This is an example of a participatory process. According to Gardner & Stern (2000), dialogue in smaller groups is a successful method for achieving common solutions.

6.2 Recommendations

The synthesis panel can, based on the above conclusions, recommend the following in order to increase the understanding and knowledge on the effects of wind power on human interests (the recommendations are aimed at regional and municipal administrators and projectors):

- Discuss sustainable development in every planning situation by placing the wind power project in a global context. Pro's and con's of wind power should be defined and discussed with respect to global, regional and local levels.
- Inform the public about the different roles in a planning application for wind power. For example, the projectors are responsible for dialogue with local people, the community, concerned neighbors, citizens, associations, businesses, authorities and the military. The County Administrative Board is responsible for consultation and dialogue being sufficient and for making sure that different opinions have been treated and considered.
- Create dialogue forums with the locals, already in the process of developing the comprehensive plan, so that different interests are highlighted and considered. Dialogue with concerned citizens should take place at the beginning of the wind power process and throughout the project period.
- Exert a interdisciplinary and intersectional work
- Consider cumulative effects in the planning and trial process. Landscapes should be treated as an entirety according to the ELC.

- Increase understanding of people's attitudes towards and experiences of, noise, negative health effects and landscape impact. This can be done by dialogue with different stakeholders. Qualitative methods are preferable.
- Landscape analysis as a method should be developed and used more frequently in wind power establishments as well as in municipal and regional planning. Within the method of landscape analysis, the social values can be identified and methods for measuring these values can be developed. Concepts such as perception of wind power depending on landscape character, visual impressions, design and identity should be considered. These values should be included in the work the Landscape Analysis method. Successful Landscape Analyses have followed the aspects that the European Landscape Convention emphasizes: strategic; holistic/intersectional; landscape resource; dialogue based: An integration with the comprehensive plan is important.

1. Landscape analysis should be a planning tool that anticipates and understands the impact of planned or ongoing change processes. The maps or information should serve as an important basis for planning (*strategic*)
2. The whole landscape should be described and its history linked to natural and user values should be highlighted in a way that illustrates how these values interact (*holistic/intersectional*)
3. The functions, values and processes that exist in the landscape and the forces that affect and change the landscape should be highlighted. The rate of change in different areas is also important to highlight (*the landscape as a resource*).
4. According to the ELC, landscape analysis and evaluation should be based on a dialogue with concerned people, interest groups and authorities, and not as pure expert testimonies. This requires an active process of dialogue throughout the process (*Dialogue-based*) (Berglund et al., 2011; SLU example compilation, 2011).
   - Expanding the dialogue with the public by adding qualitative interviews. Transparency, clarity, and a respectful dialogue are essential to build confidence and trust. The current structure of consultation can be enhanced and this may increase the understanding of human reactions and prevent conflicts.
   - In a Landscape analysis method, "touring interviews" (Gåturer) can be included as a way to increase people's participation. Touring interviews are made on the planned site where small groups of people from different areas of interest are invited on different occasions. Local experiences of different places and different qualities of the landscape can thus be utilized. Both wind power developers and municipal representatives should participate and the results should be documented. A checklist can be used to follow up results from the Touring Interview.

Recommendations on wind power and socio-economy:

- Clarify strategies for how the local community can create additional economical values from wind power establishments.
- Describe cumulative effects on tourism. The means and goals of a tourist's journey are significant for the attitude toward wind power.
- Develop a general model for rapid follow ups to make sure that conditions for the establishment are complied with.
- Develop up-to-date templates to minimize the need for completions in applications.

6.3 Knowledge gaps

- In the case of wind power's impact on human health and disease, most research is on noise and annoyance. However, there is a need for more research in sleep disorders and diseases (cardiovascular diseases). Since good sleep is essential for physical and mental health, it is important to further evaluate the effects of wind turbine noise on sleep. It is also important to investigate why some people are disturbed by noise even though the benchmark for wind turbine noise is less than the benchmark at their home. Some research on the above has been initiated by the Environmental Protection Agency.
- Research is needed in the relationship between perceived stress, well-being and noise or other disturbances from wind turbines, especially when it comes to holiday homes.
- Research on positive and negative cumulative effects of a wind farm as a whole should increase.
- Examine how distance between home and wind turbines, as well as landscape type, influence the experience of sound, health and well-being.
- Examine people's attitudes to changes in the landscape, such as, a wind farm is the background to the positive and negative reactions and how identity and place attachment affect attitudes. Research on landscape characteristics associated with wind energy should also increase by doing a survey of people's perceptions of landscapes.
- There are no comprehensive evaluations of compensatory forms of negative external (non-priced) effects of wind power. In the current research, there is no scientific evidence that proximity to wind turbines would have a negative impact on property prices. The lack of statistically significant support in the literature of a negative effect on property prices does not preclude that individual properties may be affected. Longitudinal studies are needed.
- A more collected knowledge on how the local community can create additional economical values is needed.
- Knowledge and experiences from municipalities that have succeeded in creating good dialogues with the public need to be spread.

7. References/literature

Chap 1. Introduction

Abrahamsson, J. 2010. Sveriges energi i framtiden, före och efter 2010 (Swedish energy in future, before and after 2010). Presentation at VIND 2010, in Gothenburg 2010-09-15.

Ajzen, I. 1988. Attitudes, personality and behavior. The Dorsey Press, Chicago, USA.

Ajzen, I. 1991. The theory of planned behavior. Organizational Behav. Hum. Decision Processes 50, 179–211.

Arent, D.J., Wise, A., & R. Gelman. 2011. The status and prospect of renewable energy for combating global warming. Energy Economics 33, 584-593.

Auhagen, A. E., & H. W. Bierhoff 2001. Responsibility. The many faces of a social phenomenon. Taylor & Francis, United Kingdom.

Birk Nielsen, F. 2002. The Nature of Wind Power. Landart, Århus, Danmark.

Council of Europe 2000. European Landscape Convention Article 1. European Treaty Series, No 176. http://www.conventions.coe.int, 2011-05-15.

Damsgaard N. & K. Byman 2009. Svenska folkets kunskap och attityd kring energifrågor – en Vägval energi-undersökning (Swedish people´s knowledge and attitudes towards energy issues – a Vindval energy survey). IVA, Stockholm www.iva.se/energi, 2010-10-06. (In Swedish)

Eagly, A.H., & S. Chaiken 1993. The Psychology of Attitudes. Harcourt Brace & Company, Orlando, USA.

European Parlament and Council Directive 2009/28EG. 2009. Om främjande av användningen av energi från förnybara energikällor och om ändring och ett senare upphävande av direktiven 2001/77/EG och 2003/30/EG. (On favouring the use of renewable energy sources and on change and a later annulment of the directives 2001/77/EG and 2003/30/EG). European Union official news 5.6, 2009. http://eur-lex.europa.eu, 2010-02-01.

European Commission 2008. Eurobarometer. Attitudes of European Citizens towards the Environment. Special Eurobarometer 295. Wave 68.2 – TNS Opinion and Social. http://ec.europa.eu/public_opinion/archives/ebs/ebs_295_en.pdf, 2010-02-01

EWEA The European Wind Energy Associationn 2011. Wind in Power 2010 European Statistics. http://www.ewea.org/fileadmin/ewea_documents/documents/statistics/EWEA_Annual_Statistics_2010.pdf, 2011-08-28.

Harper, C. 2011. Environment and Society. Human Perspectives on Environmental Issues. Fourth Edition. Pearson Prentice Hal, New Jersey.

Hedberg, P. 2011. Inställningen till olika energikällor i Sveriges län 1999–2004, resp 2005–2010. (Attitudes towards different energy sources in Swedish counties). SOM Report 2011:25. Gothenburg University: SOM-institutet (Society Opinion Media). http://www.som.gu.se/digitalAssets/1339/1339612_2011-inst--llningen-till-olika-energik--llor.pdf

IPCC (International Panel of Climate Change) 2007. Climate Change 2007. The IPSS fourth assessment report. Synthesis report. IPCC, New York.

Johansson, M., & M. Henningsson 2011. Social-Psychological Factors in Public Support for Local Biodiversity Conservation. Society and Natural Resources, 24, 717-733 http://pdfserve.informaworld.com/856069_775702109_934930038.pdf.

Johansson, M. & T. Laike 2007. Intention to Respond to Local Wind Turbines: The Role of Attitudes and Visual Perception. Wind Energy 10, 435–451.

Kaiser, F. G. 2006. A moral extension of the theory of planned behavior: Norms and anticipated feelings of regret in conservationism. Personality and Individual Differences 41, 71-81.

Kaiser, F. G., & H. Scheuthle 2003. Two challenges to a moral extension of the theory of planned behavior: moral norms and just world beliefs in conservationism. Personality and Individual Differences 35, 1033-1048.

Klintman, M., & Å. Waldo 2008. Erfarenheter av vindkraftsetablering: Förankring, acceptans och motstånd. (Experiences of wind power constructions: Support, acceptance and opposition). Report Nr 5866. Swedish Environmental Protection Agency, Stockholm. (Summary in English).

Lindström M., & R. Küller 2008. Sustainable Development Priorities in four Swedish Communities; Priorities, Responsibility and Empowerment. Environment, Development, Sustainability 10, 311-336.

Mels, S., & L. Aronsson 2010. Planering och kommunikation kring vindkraft i havet. En studie av lokala förankringsprocesser. (Planning and communication on wind power at the sea. A study on local anchoring processes). Report Nr 6350. Swedish Environmental Protection Agency, Stockholm. (Summary in English).

Miljö- og energiministeriet 1996. Opstilliong av store vindmöller i det åbne land – en undersögelse av de visuelle forhold. Miljø- og Energiministeriet, 12/1996, Danmark.

Miljö- og energiministeriet 1994. Vindmöller i danske farvande – en undersögelse av de visuelle forhold ved opstilling av vindmöller på havet. Miljø- og Energiministeriet, Danmark.

Miljömålsrådet 2010. Miljömålen. Svensk konsumtion och global miljöpåverkan. (Environmental Objectives. Swedish consumption and global environmental effects). Swedish Environmental Protection Agency, Stockholm.

Millennium Declaration 2000. Millenniedeklarationen och millenniemålen. (Millennium Declation and the Environmental Goals) http://www.sweden.gov, 2010-11-05.

Pedersen, E., & K. P. Waye 2004. Perception and annoyance due to wind turbine noise – a dose-response relationship. Journal of the Acoustical Society of America, 116(6) 3460-3470, doi: 10.1121/1.1815091.

REN21 Renewable Energy Policy Network for the 21st century 2011. Renewables. Global Status Report. http://www.ren21.net, 2011-09-13.

Skärbäck E. & G. Fagerström 2004. Landsbygdsbebyggelsen hinder för vindkraftsutvecklingen (opublicerad utredning sept 2004) Länsstyrelsen i Skåne, SLU Alnarp. (In Swedish)

Skärbäck, E. 2010. Vindkraftslokalisering i jordbruksbygder – potentialer och konsekvenser. I: Kungliga Skogs och Lantbruksakademins (KSLA) tidskrift Nr 3. Vindkraft javisst, men inte alltid och inte överallt. KSLA, Stockholm. (In Swedish)

Skärbäck, E. 2011. Hur mycket vindkraft tål det svenska landskapet? I: G. Bluhm, S. Larsson, C. Sejer Pedersen, E. Pedersen, E. Skärbäck & B. Persson. Buller i blåsväder. Texter om ljud från vindkraftverk. Ljudmiljöcentrum, Lunds Universitet. (In Swedish)

SOU (Statens Offentliga Utredningar) 2003:113. El- och naturgasmarknaderna – europeisk harmonisering (SOU 2003:113). Betänkande av El- och gasmarknadsutredningen. Stockholm, http://www.regeringen.se (In Swedish)

Swedish Board of Agriculture 2011. Vindkraft i slättlandskapet. Så gynnar anläggning av vindkraft den biologiska mångfalden. Swedish Board of Agriculture, Jönköping. (In Swedish).

Swedish Board of Housing Building and Planning 2009. Vindkraftshandboken. Planering och prövning av vindkraftverk på land och i kustnära vattenområden. National Board of Housing Building and Planning, Publication Service. Karlskrona. (In Swedish)
Swedish Board of Housing Building and Planning 2011a. Personal communication. Ted Kransby, Karlskrona.

Swedish Board of Housing Building and Planning 2011b. Medborgardialog om vindkraft. (Dialogue with the inhabitants). National Board of Housing Building and Planning, Karlskrona. (In Swedish)

Swedish Energy 2011a. Kraftläget i Sverige. Statistik Kraftläget. http://www.svenskenergi.se/upload/Statistik/Tidigare%20statistik/Kraftläget%20i%20år/VE_13_2011.pdf, 2011-04-11.

Swedish Energy 2011b. Kraftläget i Sverige Elproduktion. http://svenskenergi.se/upload/Statistik/Kraftl%c3%a4get/vrapp.pdf , 2011-09-28.

Swedish Energy Agency 2010a. Energiläget 2010. (The Energy Situation 2010), http://www.energimyndigheten.se, 2011-09-13.

Swedish Energy Agency 2010b. Vindkraftsstatistik 2010. (Wind Power Statistics 2010). http://www.energimyndigheten.se, 2011-09-13.

Swedish Environmental Protection Agency 2010a. Nu vet vi det här. Vindkraftens miljöpåverkan – resultat från forskning 2005 – 2009 inom Vindval. (Now we know this. Wind power effects – result of research 2005–2009 within Vindval), Swedish Environmental Protection Agency, Stockholm.

Swedish Environmental Protection Agency 2010b. Förnybara energikällors inverkan på de svenska miljömålen. (Renewable energy sources effects on the Swedish environmental goals). Report 6391. Swedish Environmental Protection Agency, Stockholm.

UNCED 1992. Agenda 21, the United Nations Programme of Actions from Rio. Department of Public Information, United Nations, New York.

UNEP Outlook 2007. GEO Year Book. United Nation Environmental Programme. http://www.unep.org/yearbook/2007/, 2011-03-15.

Uzzell, D. 2000. The psycho-spatial dimensions of global environmental problems. Journal of Environmental psychology 20, 307–318.

Waldo, Å., & M. Klintman 2010. Attityder och delaktighet vid etablering av vindkraft till havs. (Attitudes and participation at establishing of wint power at sea). Report No 635, Swedish Environmental Protection Agency, Stockholm. (Summary in English)

Vindlov 2011. Vindlov – allt om tillstånd. http://www.vindlov.se/sv/Steg-for-steg/, 2011-09-28. (In Swedish).

Vindval 2009. Syntesarbete inom Vindval. Del Vindkraftens påverkan på människors intressen, Naturvårdsverket, Stockholm. (In Swedish)

Wolsink. M. 2007. Planning of renewables schemes. Deliberative and faie decision-making on landscape issues instead of reproachful accusation on non-cooperation, Energy policy 35, 2692-2704.

WCED 1987. Our common future. World commission on environment and development, Oxford University Press, Oxford.

WSSD 2002. World summit on sustainable development. Johannesburg Summit 2002. Key outcomes of the summit. UN Department of Public Information, New York.

Chap 3. Health and Illness

Alves-Pereira, M., & N. A. A. Castelo Branco 2007a. In-home wind turbine noise isconductive to vibroacoustic disease Proceedings of the 2nd International Meeting on Wind Turbine Noise, Lyon, France.

Alves-Pereira, M., & N. A. A. Castelo Branco 2007b. Vibroacoustic disease: Biological effects of infrasound and low-frequency noise explained by mechanotransduction cellular signalling. Progress in Biophysics and Molecular Biology, 93(1-3), 256-279.

Work Environment Agency. 2005. Buller. Arbetsmiljöverkets föreskrifter om buller samt allmänna råd om tillämpning av föreskrifterna (AFS 2005:16). Arbetsmiljöverket, Stockholm. (In Swedish).

Babisch, W. 2002. The noise/stress concept, risk assessment and research needs. Noise & Health 4(16), 1-11.

Babisch, W. 2008. Road traffic noise and cardiovascular risk. Noise & Health 10, 27-33.

Babisch, W., Beule, B., Schust, M., Kersten, N., & H. Ising 2005. Traffic noise and risk of myocardial infarction. Epidemiology 16(1), 33-40.

Babisch, W., & I. van Kamp 2009. Exposure-response relationship of the association between aircraft noise and the risk of hypertension. Noise & Health 11(4), 161-168.

Björkman, J., & Y. Jalming, 2009. Påverkan av skuggor från vindkraftverk- Examensuppsats. Högskolan i Halmstad, Halmstad.

Castelo Branco, N. A. A., & M. Alves-Pereira 2004. Vibroacoustic disease. Noise & Health 6(23), 3-20.

Harding, G., Harding, P., & A. Wilkins 2008. Wind turbines, flicker, and photosensitive epilepsy: Characterizing the flashing that may precipitate seizures and optimizing guidelines to prevent them. Epilepsia 49(6), 1095-1098. doi: 10.1111/j.1528-1167.2008.01563.x

Hygge, S. 2005. Bullers effekter på människor. I: M. Johansson och M. Küller. Svensk Miljöpsykologi. Studentlitteratur, Lund. (In Swedish)

ISO 2003. Acoustics-Assessment of noise annoyance by means of social and socio-acoustic surveys. ISO/TS 15666:2003(E). ISO, Geneva, Switzerland.

Jakobsen, J. 2005. Infrasound emission from wind turbines. Journal of low Frequency Noise, Vibration and Active Control 24(3), 145-155.

Johansson, M., & M. Küller 1995. Svensk Miljöpsykologi. Studentlitteratur, Lund. (In Swedish).

Jung, S. S., & W.-S. Cheung 2008. Experimental identification of acoustic emission characteristics of large wind turbines with emphasis on infrasound and low-frequency noise. Journal of the Korean Physical Society 53(4), 1897-1905.

Kantarelis, C., & J. G. Walker, 1988. The identification and subjective effect of amplitude modulation in diesel engine exhaust noise. Journal of Sound and Vibration 120(2), 297-302.

Leventhall, G. 2006. Infrasound from wind turbines – fact, fiction or deception. Canadien Acoustics 34, 29-34.

Lindkvist, P., & M. Almgren, 2010a. Ljudisolering i bostadshus mot ljud från vindkraft. Bygg & teknik 3/2010, 60-62. (In Swedish).

Lindkvist, P., & M.Almgren 2010b. Kommentar till Bertil Perssons artikel "Lågfrekvent buller kan stoppa landvindkraften". Bygg & teknik 6/2010. (In Swedish).

Madsen, K. D., & T. H. Pedersen 2010. Low Frequency Noise from Large Wind Turbines (Technical Report Delta AV 1272/10). DELTA, Hörsholm, Denmark.

Miedema, H. M. E., & C. G. M. Oudshoorn 2001. Annoyance from transportation noise: Relationships with exposure metrics DNL and DENL and their confidence intervals. Environmental Health Perspectives 109(4), 409-416.

Møller, H., & C. S. Pedersen 2010. Lavfrekvent støj fra store vindmøller. Aalborg Universitet, Aalborg, Denmark.

National Board on Health and Welfare 2005. Allmänna råd. Buller inomhus (SOSFS 2005:6). Socialstyrelsen, Stockholm. (In Swedish).

Nilsson, M. E., & C. Eriksson 2009a. Buller. In Socialstyrelsen (Ed.), Miljöhälsorapport 2009, kap. 15, 165-179. Socialstyrelsen, Stockholm. (In Swedish).

Nilsson, M. E., & C. Eriksson 2009b. Validering av miljöhälsoindikatorer för buller. Socialstyrelsen, Stockholm. (In Swedish).

Nilsson, M., Bluhm, G., Eriksson, G., & K. Bolin 2011. Kunskapssammanställning om infra- och lågfrekvent ljud från vindkraftsanläggningar: Exponering och hälsoeffekter. Naturvårsdverket, Stockholm. (In Swedish).

O'Neal, R. D., Hellweg, R. D., & R. M. Lampeter 2011. Low frequency noise and infrasound from wind turbines. Journal of Noise Control Engineering 59, 135-157.

Pedersen, E. 2011. Health aspects associated with wind turbine noise—Results from three field studies. Noise Control Engineering Journal 59, 47-53.

Pedersen, E., & K. P. Waye, 2004. Perception and annoyance due to wind turbine noise – a dose-response relationship. Journal of the Acoustical Society of America 116(6), 3460-3470. doi: 10.1121/1.1815091

Pedersen, E., Hallberg, L.-M., & K. P. Waye 2007. Living in the vicinity of wind turbines – A grounded theory study. Qualitative Research in Psychology 4, 49-63.

Pedersen, E., & K. P. Waye 2007. Wind turbine noise, annoyance and self-reported health and well-being in different living environments. Occupational and Environmental Medicine 64(7), 480-486. doi: 10.1136/oem.2006.031039

Pedersen, E., van den Berg, F., Bakker, R., & J. Bouma 2009. Response to noise from modern wind farms in The Netherlands. Journal of the Acoustical Society of America, 126(2), 634-643. doi: 10.1121/1.3160293

Pedersen, T. H. 2011. Sammenhaeng mellan vindmollestoj og helbredseffekter (AV 1017/11). DELTA, Hörsholm, Danmark.

Persson, B. 2010. Lågfrekvent buller kan stoppa landsvindkraften. Bygg & teknik, 6/2010. (In Swedish).

Pierpont, N. 2009. Wind Turbine Syndrome: A Report on a Natural Experiment. K-Selected Books, Santa Fe, NM.

Pohl, J., Faul, F., & R. Mausfeld, 2000. Belästigung durch periodichen Schattenwurf von Windenenergieanlagen. Laborpilotstudie. Institut für Psychologie der Christian-Albrechts-Universität zu Kiel, Kiel, Germany.

Salt, A. N., & T. E. Hullar 2010. Responses of the ear to low frequency sounds, infrasound and wind turbines. Hearing Research 268(1-2), 12-21. doi: 10.1016/j.heares.2010.06.007

Selander, J., Nilsson, M. E., Bluhm, G., Rosenlund, M., Lindqvist, M., & G.,Nise, et al. 2009. Long-term exposure to road-traffic noise and myocardial infarction. Epidemiology 20(2), 272-279.

Seunghoon, L., Kyutae, K., Wooyoung, C., & L. Soogab 2011. Annoyance caused by amplitude modulation of wind turbine noise. Noise Control Engineering Journal 59, 38-46.

Shepherd, D., McBride, D., Welch, D., Dirks, K.N., & E.M. Hill 2011. Evaluating the impact of wind turbine noise on health-related quality of life. Noise and Health 13, 333-339.

Smedley, A. R. D., Webb, A. R., & A. J. Wilkins 2010. Potential of wind turbines to elicit seizures under various meteorological conditions. Epilepsia 51(7), 1146-1151. doi: 10.1111/j.1528-1167.2009.02402.x

Sugimoto, T., Koyama, K., & K. Watanabe 2008. Measurement of infrasound generated by wind turbine generator SICE Annual Conference 2008. SICE, Tokyo.

Swedish Board of Housing Building and Planning. (2009). Vindkraftshandboken. Planering och prövning av vindkraftverk på land och i kustnära vattenområden. Boverket, Karlskrona. (In Swedish) van den Berg, F., Pedersen, E., Bouma, J., & R. Bakker 2008. Project WINDFARMperception. Visual and acoustic impact of wind turbine farms on residents (FP6-2005-Science-and-Society-20. Specific Support Action, Project no. 044628. UMCG, Groningen, The Netherlands.

van den Berg, G. P. 2004a. Do wind turbines produce significant low frequency sound levels? 11th International Meeting on Low Frequency Noise and Vibration and its Control (pp. 1–8). Maastricht, The Netherlands.

van den Berg, G. P. 2004b. Effects of the wind profile at night on wind turbine sound. Journal of Sound and Vibration 277(4-5), 955-970. doi: 10.1016/j.jsv.2003.09.050

van den Berg, G. P. 2005. The beat is getting stronger: The effect of atmospheric stability on low frequency modulated sound of wind turbines. Journal of low Frequency Noise Vibration and Active Control, 24(1), 1-24.

WHO 1948. Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference, New York, 19–22 June, 1946; signed on 22 July 1946 by the representatives of 61 States (Official Records of the World Health Organization, no. 2, p. 100) and entered into force on 7 April 1948.

WHO 2000. Guidelines for Community Noise. World Health Organization, Geneva.

WHO2009. Night Noise Guidelines for Europe. World Health Organization Regional Office for Europe, Copenhagen.

WHO 2011. Burden of Disease from Environmental Noise. World Health Organization Regional Office for Europe, Copenhagen.

WSP 2009. Uppskattning av antalet exponerade för väg, tåg- och flygbuller överstigande ekvivalent ljudnivå 55 dBA. WSP, Stockholm. (In Swedish).

Zwicker, E., & H. Fastl 1990. Psychoacoustics: Facts and Models. Springer Verlag, Berlin.

Öhrström, E., Skånberg, A., Svensson, H., & A. Gidlöf Gunarsson 2006. Effects of road traffic noise and the benefit of access to quietness. Journal of Sound and Vibration 295, 40-59.

Chap 3 Economy and Businesses

AGO Apparaisal Group One. 2009. Wind Turbine Impact Study. Oskosh, Appraisal Group One, Wisconsin.

Alvarez-Farizo, B., & N. Hanley 2002. Using conjoint analysis to quantify public preferencesover the environmental impacts of wind farms. An example from Spain. Energy Policy 30, 107-116.

BBC Research Consulting 2000. Potential Economic Benefits from a Commercial Wind Power Facility in Eddy County. Report prepared for New Mexico Energy, Minerals and Natural Resources Department, BBC Research & Consulting, Denver, Colorado.

Bergmann, A., Hanley, N. & R. Wright 2006. Valuing the attributes of renewable energy investments. Energy Policy 34, 1004-1014

Bergmann, A., Colombo, S. & N. Hanley 2008. Rural versus urban preferences for renewable energy developments. Ecological Economics 65, 616-625

Black & Veatch 2004. Economic Impact of Renewable Energy in Pennsylvania. Black & Veach Project, 135401, USA.

Bodén, B. 2009. Vindkraft i Jämtland. En studie relaterad till turism. Etour R 2009:21. Mittuniversitetet, Östersund. http://www.miun.se/ETOUR/Publikationer/Rapportserien/Vindkraft-i-Jamtland---En-studie-relaterad-till-turism/. (In Swedish).

Bolinger, M., & R. Wiser 2006. A comparative analysis of business structures suitable for farmer-owned wind power projects in the United States. Energy Policy 34(14), 1750-1761.

Borchers, A. M., Duke, J. M., & G. R. Parsons 2007. Does Willingness to Pay for Green Energy Differ by Source? Energy Policy 35, 3327-3334.

Brännlund, R., & B. Kriström, 1998. Miljöekonomi. Studentlitteratur, Lund. (In Swedish).

Daerga L, Edin-Liljegren A, Sjölander P. 2008. Quality of life in relations to physical, psychosocial and socio-economic conditions among reindeer-herding Sami. Int J Circumpolar Health 67, 10–28.

Dimitropoulos, A. & A. Kontoleon 2009. Assessing the determinants of local acceptability of wind farm investment: A choice experiment in the Greek Aegean Islands. Energy Policy 37, 1842-1854.

ECONortwest 2002. Economic Impacts of Wind Power in Kittitas County. Final Report for the Phoenix Development Group. ECONortwest, Portland, OR.

Ek, K. 2006. Quantifying the environmental impacts of renewable energy: the case of Swedish wind power. I: Pearce, D. (editor), Environmental valuation in developed countries: Case studies. Edward Elgar, Cheltenham, 181-210.

ESS Group Inc. 2006. Draft Environmental Impact Statement – Marble River Wind Farm, Clinton and Ellenburg, New York. ESS Project No. A456-000. ESS Group, Inc. East Providence, RI. http://www.horizonwindfarms.com/northeast-region/under-dev/marble-river.htm, 2011-05-08.

EWEA European Wind Energy Association 2009. Wind Power 2009 European Statistics. http://www.ewea.org/fileadmin/ewea_documents/documents/statistics/generalstats_2009.pdf, 2011-05-08.

GAO United States Accountability Office 2004. Renewable energy. Wind Powers contribution to electric power generation and impact on farms and rural communities. http://www.gao.gov/new.items/d04756.pdf, 2011-05-08.

Goldberg, M., Sinclair, K., & M. Milligan 2004. Job and Economic Development Impact (JEDI) Model: A User-Friendly tool to Calculate Economic Impacts from Wind Projects. Prepared for Global WINDPOWER 2004, March 28–31, 2004. NREL/CP-500-35953. Golden, CO: National Renewable Energy Laboratory.

Gotlands Tidning 2010. Vindkraft har varit viktig för socknen. Tidningsartikel 2010-08-16. www.helagotland.se/gt. (In Swedish).

Groothuis, P. A., Groothuis, J. D., & J. C. Whitehead 2008. Green vs. green:

Measuring the compensation required to site electrical generation windmills in a viewshed. Energy Policy 36, 1545–1550

Vindval 2012a. Vindkraftens effekter på landlevande däggdjur. – en syntes. (The effects of wind power on terrestrial mammals – a synthesis report). Vindval, Swedish Environmental Protection Agency, Stockholm.

Hoen, B., Wiser, R., Cappers, P., Thayer, M., & G. Sethi 2009. The Impact of Wind Power Projects on Residential Property Values in the United States: A Multi-Site Hedonic Analysis. Ernest Orlando Lawrence Berkley National Laboratory, Berkley, CA.

Joly, D. T., Brossard, T., Cavailhès, J., Hilal, M., Tourneaux, F-P., Tritz, C., & P. Wavresky 2009. A quantitative approach to the visual evaluation of landscape. Association of American geographers 99(2), 292-308. doi: 10.1080/00045600802708473

Jämtlands läns kommuner 2010. Policydokument: Lokal nytta. Låt inte vindens utvecklingskraft blåsa bygden förbi. Policy om vindkraftens lokala nytta, kommunerna i Jämtlands län. http://www.bd.komforb.se/download/18.2709bddb12c08a79de780002188/Beslut+Kommunf%C3%B6rbundet+Norrbotten+Policy+om+vindkraftens+lokala+nytta.pdf, 2011-05-08.

Koundouri, P., Kountouris, Y., & K. Remoundou 2009. Valuing a wind farm construction: A contingent valuation study in Greece. Energy Policy 37, 1939-1944.

Krueger, A. D. 2007. Valuing public preferences for offshore wind power: A choice experiment approach. Doktorsavhandling. University of Delawere, Newark, USA.

Kuijken, E 2009. Wind farms at the Smøla Archipelago (Norway). Convention on the Conservation of European Wildlife and Natural Habitats. 29th meeting, Bern, 23–26 November 2009.

Kågebro, E., & M. Vredin Johansson , 2008. Ekonomiska verktyg som beslutsstöd i klimatanpassningsarbete. FOI-R—2530—SE. Försvarsanalys, Stockholm. (In Swedish).

Ladenburg, J., & A. Dubgaard 2007. Willingness to pay for reduced visual disamenities from offshore wind farms in Denmark. Energy Policy 35: 4059-4071.

Federation of Swedish Farmers (Lantbrukarnas Riksförbund) 2011. Vindkraftens affärshemligheter. http://www.lrf.se/Energi/Vindkraft/, 2011-09-15.

Lantz, E. 2009. Economic Development Benefits from Wind Power in Nebraska: A Report for the Nebraska Energy Office. Technical Report NREL/TP-500-44344, June 2009. National Renewable Energy Laboratory, Golden, CO. http://www.nrel.gov/docs/fy09osti/44344.pdf>, 2010-09-13.

Lantz, E., & S. Tegen 2008. Variables Affecting Economic Development of Wind Energy. National Renewable Energy Laboratory. NREL/CP-500-43506. Conference Paper presented at Windpower 2008, Houston Texas.

Lantz, E., & S.Tegen 2009. Economic Development Impacts of Community Wind Projects: A Review and Empirical Evaluation. NREL/CP-500-45555. Golden, CO: National Renewable Energy Laboratory.

Larsen, M. 2002. Konsekvenser av vindkraft för rennäringen i Jämtlands län – en pilotstudie. http://cvi.se/uploads/pdf/Kunskapsdatabas%20samhalle/planering/kommunal%20planering/2.Renvindrapportlansst%20Jamtl.pdf, 2011-03-25.

Lilley, M. B., Firestone, J., & W. Kempton 2010. The Effect of Wind Power Installations on Coastal Tourism. Energies 3, 1-22, doi:10.3390/en3010001.

Longo, A., Markandya, A., & M. Petrucci 2008. The internalization of externalities in the production of electricity: Willingness to pay for the attributes of a policy for renewable energy. Ecological Economics 67, 140-152.

Meyerhoff, J., Ohl, C. & V. Hartje, 2010. Lanscape externalities from onshore wind power. Energy Policy 38, 82-92.

Miljööverdomstolen 2009. MÖD 2009-09-16, M 7051-07. http://www.tofr.nu/Global/06-vagledande-domar/03-miljooverdomstolen/vindkraft/090616-m7051-07.pdf. (In Swedish)

Miljööverdomstolen 2011. Mark- och Miljööverdomstolen meddelar dom i mål rörande tillstånd till vindkraftsparker i Västernorrlands och Jämtlands län (mål nr M 824-11, 825-11 och 847-11). http://www.hogstaforvaltningsdomstolen.se/Om-Sveriges-Domstolar/Pressrum/Nyheter-och-pressmeddelanden/Mark--och-Miljooverdomstolen-meddelar-dom-i-mal-rorande-tillstand-till-vinkraftsparker-i-Vasternorrlands-och-Jamtlands-lan-mal-nr-M-824-11-825-11-och-847-11/. (In Swedish)

Moran, D. 2005. The economic valuation of rural landscapes. AA211 study for SEERAD. Scottish Agriculural College. http://www.snh.org.uk/pdfs/strategy/landscapes/Annex.pdf, 2011-09-30.

Moreno, B., & A. J. Lopez, 2008. The effect of renewable energy on employment. The case of Asturias (Spain). Renewable and Sustainable Energy Reviews 12: 732–751.

Navrud, S. & K. Grönvik Bråten 2007. Consumers´preferences for green and brown electricity: a choice modelling approach. Revue d'economie politique 5,117.

NFO World Group 2003. Investigation into the potential impact of wind farms on tourism in Wales. Report for Wales Tourist Board. NFO World Group, Edinburgh.

Norges Vassdrag- och Energidirektorat NVE 2004. Olje- og Energidepartementet. Norge. http://www.regjeringen.no/nb/dep/oed/dok/tildelingsbrev-og-tilsagnsbrev/norges-vassdrags--og-energidirektorat-nv.html?id=445820, 2011-05-04. (In Norwegian)

Northwest Economic Associates NEA 2003. Assessing the Economic Development Impacts of Wind Power. Final Report for National Wind Coordinating Committee. Northwest Economic Associates, Vancouver, WA.

Pedden, M. 2006. Analysis: Economic Impacts of Wind Applications in Rural Communities. Department of Energy, NREL National Renewable Energy Laboratory, U.S:

Pettersson, M. 2008. Renewable Energy Development and the Function of Law. A Comparative Study of Legal Rules Related to Planning, Installation and Operation of Windmills. Doctoral thesis. Department of Business Administration and Social Sciences Division of Social Science, Luleå University of Technology.

Ratliff, D. J., Hartman, C. L. & E. R. Stafford 2010. An Analysis of State-Level Economic Impacts from the Development of Wind Power Plants in San Juan County, Utah. doi/GO-102010-3005. Department of Energy, U.S:

Riddington G., McArthur D., Harrison A., & H. Gibson 2008. The economic impacts of wind farms on Scottish tourism – A report for the Scottish Government. http://www.scotland.gov.uk/Publications/2008/03/07113554/0, 2011-02-15.

Riddington G., McArthur D., Harrison A., & H. Gibson 2010. Assessing the Economic Impact of Wind Farms in Tourism in Scotland: GIS, Surveys and Policy Outcomes. International Journal of Tourism Research 12, 237-252.

Scottish Government 2008, The Economic Impacts of Windfarms on Scottish Tourism. http://www.scotlamd.gov.uk/Publications/2008/03/007113507/1, 2010-09-27

Sims, S., Reza, G., & P. Dent 2008. Modelling the impact of wind farms on house prices in the UK. International Journal of Strategic Property Management 12, 251-269.

Skarin, A., & M. Hörnell-Willebrand 2011. Spillningsinventering. En metodbeskrivning av datainsamling och analys för att studera renens habitatval i relation till vindkraftsutbyggnader. Vindval, rapport 6459. Naturvårdsverket, Stockholm. (Summary in English).

Sundqvist, T., &. P. Söderholm 2002. Valuing the Environmental Impacts of Electricity Generation: A Critical Survey. Journal of Energy Literature VIII(2), 3-41.

Svenska Kraftnät 2011. (Swedish National Grid). Elcertifikat. Internet: https://elcertifikat.svk.se/cmcall.asp, 2011-02-08)

Swedish Sami Association, 2011. Rennäring. www.sapmi.se/nar_1_0.html, 2011-09-01. (In Swedish)

Swedish Energy Agency 2011. Vindpilotprojekt. http://energimyndigheten.se/sv/Om-oss/Var-verksamhet/Framjande-av-vindkraft1/Forskningsprogram/Utvecklingsprojekt1/, 2011-02-08. (In Swedish)

Swedish Energy Agency 2011. Gemensam svensk-norsk elcertifikatmarknad. http://www.energimyndigheten.se/Foretag/Elcertifikat/Gemensam-svensk-norsk-elcertifikatmarknad/, 2011-10-25. (In Swedish)

Swedish Environmental Protection Agency 2011a. The Right of Public Access. http://www.naturvardsverket.se/en/In-English/Start/Enjoying-nature/The-right-of-public-access/ 2011-08-12.

Swedish Environmental Protection Agency 2011b. Planeringsverktyg för vindkraftens effekter på tamren. http://naturvardsverket.se/sv/Start/Verksamheter-med-miljopaverkan/Energi/Vindkraft/Vindval/Planeringsverktyg-for-vindkraftens-effekter-pa-tamren/, 2011-08-24. (In Swedish)

Swedish Wind Energy 2010. Vindkraft i sikte. http://www.svenskvindenergi.org (In Swedish)

Swedish Wind Energy 2011. VindRen. http://www.vindkraftsbranschen.se/rapporter/vindren/, 2011-09-01. (In Swedish)

Swedish Wind Energy & Swedish Sami Association, 2011. VindRen – Vindenergi och Rennäring i samverkan. http://www.sapmi.se/pro_9_0.html, 2011-09-01. (In Swedish)

Tidskrift Norrlandsförbundet 2009. Ökad sysselsättning i vindkraftens spår. Tidskrift Norrlandsförbundet, nr 1, 2009. http://www.norrland.info. (In Swedish).

Warren, C. R. & M. McFadyen 2010 Dose community ownership affect public attitudes to wind energy? A case study from south-west Scotland. Land Use Policy 27, 204-213.

Wizelius, T. 2009. Vindkraft på lantbruk- Handbok för lantbruk (andra upplagan). Nätverket för Vindbruk: Vindform förlag. http://www.natverketforvindbruk.se, 2010-10-13 (uppdaterad dec 2011). (In Swedish)

Wizelius, T. 2010a. Vindkraft tillsammans – Handbok för vindkraftskooperativ. Nätverket för Vindbruk: Vindform förlag. http://www.natverketforvindbruk.se, 2010-10-13 (uppdaterad dec 2011). (In Swedish).

Wizelius, T. 2010b. Lokalt ägd vindkraft—Handbok för kommuner. Nätverket för Vindbruk: Vindform förlag. http://www.natverketforvindbruk.se, hämtad 2010-10-13 (uppdaterad dec 2011). (In Swedish).

Wiser, R., Bolinger, M., Barbose, G., Belyeu, K., Hand, M., & D. Hiemiller 2006. Annual Report on U.S. Wind Power Installation, Cost and Performance Trends. U.S. Department of Energy, USA.

Östersundsposten 2009. Angående bygdeersättning. Östersundsposten 2009-11-14. http:// www.ostersundsposten.se. (In Swedish)

Chap 4 Landscape

Agterbosch, S., Meertens, R.M., & W.J.V. Vermeulen 2009 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. 2010 A three-dimensional view of public participation in Scottish land-use planning: empowerment or social control). Planning Theory 9, 248-264.

Aitken, S. C. 2002. Public participation, technological discourses and the scale of GIS. In W. Craig, T. Harris and D. Weiner, eds., Community Participation and Geographic Information Systems. Taylor and Francis, London and New York, 357-366.

Berggren-Bärring, A-M., & P. Grahn, 1995. Grönstrukturens betydelse för användningen. Institutionen för landskapsplanering. Rapport 95:3 Institutionen för landskapsplanering, SLU, Alnarp, Ultuna. (In Swedish).

Berglund, U., Eriksson, M., Nord, J., Butler, A., Antonson, H., Hammarlund, K., Hedfors, P., & A. Åkerskog 2011. Om landskap och landskapsanalys för väg och järnväg – ett kunskapsunderlag med fokus på begrepp och exempel. Rapport 2011:1. Institutionen för Stad och Land, SLU, Alnarp. (In Swedish).

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

Björk, J., Albin, M., Grahn, P. Jakobsson, H., Ardö, J., & Wadbro, J., Östergren, P-O, E Skärbäck 2008. Recreational values of the natural environment in relation to neighbourhood satisfaction, physical activity, obesity and wellbeing. Journal of Epidemiology and Community Health 62: e2, doi:10.1136/jech.2007.062414

Bodén, B. 2009. Vindkraft i Jämtland. En studie relaterad till turism. Etour R 2009:21. Mittuniversitetet, Östersund. www.miun.se/ETOUR/Publikationer/Rapportserien/Vindkraft-i-Jamtland---En-studie-relaterad-till-turism/, 2010-02-01. (In Swedish)

Breukers, S., & M. Wolsink 2007. Wind power implementation in changing institutional landscapes. An international comparison. Energy Policy 35, 2737-2750.

Calvo-Iglesias, M. S. 2005. Characterization and dynamics of cultural landscapes with GIS and remote sensing for planning and management. Application in a northern area of the province of Lugo (NW Spain). Thesis doctoral, Universidad de Santiago de Compostela.

Clarke, S. 2009. Balancing environmental and cultural impact against the strategic need for wind power. International Journal of Heritage Studies 15, 175-191.

Cosgrove, D. 1998. Social Formation and the Symbolic Landscape, 2nd edition. University of Wisconsin Press, Madison.

Cosgrove, D., & V. Della Dora 2009. High places: cultural geographies of mountains, ice and science. I.B. Taurus, London.

Coss, R.G. 1991. Evolutionary Persistance of Memory-Like Processes. Concepts in Neuroscience 2, 129-168.

Council of Europe 2011. Landscape and Wind turbines. CEP-CDPATEP, 2011, 11E. http://www.coe.int/t/dg4/cultureheritage/heritage/landscape/reunionconf/6econference/CEP-CDPATEP(2011)11_en.pdf

Cowell, R. 2007. Wind power and the planning problem: the experience of Wales. Environmental Policy and Governance 17, 291-306.

Cowell, R. 2010. Wind power, landscape and strategic, spatial planning – The construction of ‘acceptable locations’ in Wales. Land Use Policy 27(2), 222–232.

Dalton, G.J., Lockington D.A. & T.E. Baldock 2007. A survey of tourist operator attitudes to renewable energy supply in Queensland, Australia Renewable Energy 34, 567-586.

Daniel, T. C., 2001. Whither scenic beauty? Visual landscape quality assessment for the 21st century. Landscape and Urban Planning 54, 267-281.

Devine-Wright, P. 2009. Rethinking NIMBYism: The Role of Place Attachment and Place Identity in Explaining Place-protective Action. Journal of Community & Applied Social Psychology 19, 426-441.

Devine-Wright, P., & Y. Howes 2010 Disruption to place attachment and the protection of restorative environments: A wind energy case study. Journal of Environmental Psychology 30(3), 271-280.

Douglas, C. H., & M. R. Douglas 2005. Patient-centred improvements in health-care built environments: perspectives and design indicators. Blackwell Publishing Ltd. Health Expectations 8, 264–276

Ek K. 2005. Public and private attitudes towards 'green' electricity: the case of Swedish wind power. Energy Policy 33, 1677–1689.

Ellis, G., Cowell, R., Warren, C., Strachan, P., & J. Szarka 2009a. Expanding Wind Power: A Problem of Planning, or of Perception? Planning Theory & Practice 10(4), 523-532.

Ellis, G., Cowell, R., Warren, C., Strachan, P. & J. Szarka 2009b. Inledning Windpower: Is there a "planningproblem. Planning theory and practice 10(4) 521-522.

Ellis, G., Murtagh, B., & Copeland, L. 2010. The Future of the Planning Academy. RTPI. http://www.qub.ac.uk/research-centres/TheInstituteofSpatialandEnvironmentalPlanning/FileStore/Filetoupload,219338,en.pdf

Council of Europe 2000. European Landscape Convention, Article 1. European Treaty Series, No 176. http://www.conventions.coe.int.

Fainstein, S. (2010). The Just City. Cornell University Press, New York.

Falkenbergs kommun. Vindbruksutredning, underlag till översiktsplan, http://www.falkenberg.se/download/18.1b40ccf8132a60fb19580008806/vindbruks-utredning_r%C3%A4ttelse+111021_mindre.pdf, 2012-02-03. (In Swedish)

Firestone, J., & W. Kempton 2006. Public opinions on large offshore wind-power: Underlying factors. Energy Policy 35, 1584-1598.

Gee, K. 2010. Offshore wind power development as affected by seascape values on the German North Sea Coast. Land Use Policy 2(27), 185-194.

Grahn, P., & C. Larsson 1997. Stadens grönområden. Hur de används och vad som tilltalar besökarna. Department of landscape planning, SLU, Alnarp. (In Swedish)

Grahn, P., & U. Stigsdotter 2003. Landscape Planning and Stress. Urban Forestry & Urban Greening 2, 1-18.

Grahn, P., Stigsdotter U., & A-M Berggren Bärring 2005. A planning tool for designing sustainable and healthy cities. The importance of experienced characteristics in urban green open spaces for people's health and well-being. In: Quality and significance of green urban spaces. Conference proceedings, April 14-15, 2005. Van Hall Larenstein, Velp, The Netherlands, 29-38.

Gray, T., Haggett, C. & D. Bell 2005. Wind farm siting—the case of offshore wind farms. Ethics, Place and Environment 8(2), 127–140.

Haggett, C. 2010. Public perceptions of offshore wind energy. Energy Policy 39(2), 503-510.

Hartig, T. 1993. Testing Restorative Environments Theory. Doctoral Dissertation. University of California Irvine.

Healey, P. 2006. Territory, integration and spatial planning. In. M. Tewtwr-Jones & P. Allmendinger; Territory, Identity and Spatial Planning. Routledge, Oxon.

Helldin J-O, Jung J, Neuman W, Olsson M, Skarin A & Widemo F. 2012. Vindkraftens effekter på landlevande däggdjur. – en syntes. (The effect of wind power on terrestrial mammals – a synthesis report). Vindval, Swedish Environmental Protection Agency, Stockholm.

Hernandez, B., Hidalgo, M.C., Salazar-Laplace, M.E., & S. Hess 2007. Place attachment and place identity in natives and non-natives. Journal of environmental psychology 27, 310-319.

Hiller, J., & P. Healey 2008. Contemporary Movements in Planning Theory. Ashgate Publishing Limited, Aldershot.

Holden, M. 2008. Social learning in planning. Seattles´sustainable development codebooks. Landscape and Urban Planning 69, 1-40.

Hoppner, C., Frick, J., & M. Buchecker 2008. What drives peopoes´willingness to discuss local landscape development? Landscape research 33, 604-622.

Jallouli, J., & G. Moreau 2009. An immersive path-based study of wind turbines' landscape: A French case in Plouguin. Renewable Energy 34, 597–607.

James, P., & J. W. Gittins 2007. Local Landscape Character Assessment: An Evaluation of Community-led Schemes in Cheshire. Landscape Research 32(4), 423 – 442.

Jay, S. A. 2008. At the Margins of Planning. Offshore Wind Farms in the United Kingdom. Ashgate Publishing Limited, Aldershot.

Jobert A., Laborgne, P., & S. Mimler 2007. Local acceptance of wind energy: Factors of success identified in French and German case studies. Energy Policy 35, 2751-2760.

Johansson, M., & M. Henningsson 2011. Social-Psychological Factors in Public Support for Local Biodiversity Conservation. Society and Natural Resources 24, 717–733. http://pdfserve.informaworld.com/856069_775702109_934930038.pdf.

Johansson, M., & T. Laike 2007. Intention to Respond to Local Wind Turbines: The Role of Attitudes and Visual Perception. Wind Energy 10, 435–451.

Jones, C. R., & R. J. Eiser 2010. Understanding 'local' opposition to wind development in the UK: How big is a backyard? Energy Policy 38, 3106-3117.

Jones, M. 2009. The European Landscape Convention and the question of public participation. In K.R. Olwig and D. Mitchell, eds. Justice, Power, and the Political LandscapeRoutledge, London, 231-251. Swedish Board of Agriculture, 2012. Landskapselement. http://www.jordbruksverket.se/amnesomraden/stod/miljoersattningar/naturochkulturmiljoeriodlingslandskapet/villkor/landskapselement.4.510b667f12d3729f91d80009127.html, 2012-01-26. (In Swedish)

Kaplan R. 1985. The analysis of perception via preference: a strategy for studying how the environment is experienced. Landscape Planning 12, 161-176.

Kaplan, R., & Kaplan, S. 1989. The Experience of Nature. Cambridge University Press, New York.

Kaplan, S. 1990. Parks for the future: A psychological perspective. I: G. Sorte ed. Parks for the future, 4-22. Stad & Land 85, SLU, Alnarp.

Kaplan, R., Kaplan, S., & R. L. Ryan 1998. With people in mind. Island Press, Washington D.C.

Khan, J. 2003. Wind power planning in three Swedish municipalities. Journal of Environmental Planning and Management 46, 563-582.

Kempton, W., Firestone, J., Lilley, J., Rouleau, T., & P., Whitaker 2005. The offshore wind power debate: views from Cape Cod. Coastal Management 33, 119–149.

Krohn, S., & S. Damborg 1999. On public attitudes towards wind power. Renewable Energy 16, 954-960.

Ladenburg, J. 2009. Visual impact assessment of offshore wind farms and prior experience. Applied Energy 86, 380–387.

Lambert, D., Martins, L. & M. Ogborn 2006. Currents, visions and voyages: historical geographies of the Journal of Historical Geography 32, 479-493.

Lewis, J. L. 2008. Contemporary Reflections on Changing Landscape Structure in the Pacific Northwest. In: A. Lawrence (Ed.), Taking Stock of Nature: participatory biodiversity assessment for policy planning and practice. Cambridge University Press, Cambridge, UK.

Lindén, A-L., & M. Klintman 2003. The Formation of Green Identities – Consumers and Providers. I: A. Biel, B. Hansson, M. Mårtensson (Red.) Individual and Structural Determinants of Environmental practice. Ashgate, Aldershot.

Lindström, M., Johansson, M., Herrmann, J & O. Jonsson 2006. Attitudes towards the conservation of biological diversity. Journal of Environmental Planning and Management 49(4), 495-513.

Lothian, A. 2008. Scenic Perceptions of the Visual Effects of Wind Farms on South Australian Landscapes. Geographical Research 46(2), 196-207.

Mercer, D. 2003. The Great Australian Wind Rush and the Devaluation of Landscape Amenity. Australian Geographer 34, 91-121

Ministry of the Environment 2009. Enklare och snabbare handläggning av vindkraft. http://www.sweden.gov.se/sb/d/11615/a/120491, 2011-09-17. (In Swedish)

Ministry of the Environment 2010. Folk och natur 2010 – framtidens friluftsliv. (In Swedish)

Moore-Colyer, R., & A. Scott 2005. What kind of landscape do we want? Past, present and future perspectives. Landscape Research 30, 501-523.

Möller, B. 2006. Changing wind-power landscapes: regional assessment of visual impact on land use and population in Northern Jutland, Denmark. Applied Energy 83, 477–494.

Möller, B. 2010. Spatial analyses of emerging and fading wind energy landscapes in Denmark. Land Use Policy 27, 233–241.

Nadaï, A., & D. van der Horst 2010. Wind power planning, landscapes and publics. Land Use Policy 27, 181–184.

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

Nielsen, F. B. 2002. A formula for success in Denmark, in: M. J. Pasqualetti, P. Gipe & R. W. Righter (Eds) Wind Power in View: Energy Landscapes in a Crowded World. Academic Press, San Diego.

Nordström, P. 2000. Kulturmiljö och vindkraft. Riksantikvarieämbetet, Stockholm. (Summary in English).

Nordström, P. 2003. Sveriges kust- och skärgårdslandskap. Kulturhistoriska karaktärsdrag och känslighet för vindkraft. Rapport från Riksantikvarieämbetet 2003:4. Riksantikvarieämbetet, Stockholm. (In Swedish) http://www.dialog.raa.se/cocoon/forlag/visa.html?id=1826

Olwig, K.R.2002. Landscape, nature, and the body politic: from Britain's renaissance to America's new world. University of Wisconsin Press, Madison.

Olwig, K. R. 2009. The practice of landscape "conventions" and the just landscape: The case of the European Landscape Convention. In: K.R. Olwig and D. Mitchell, eds., Justice, Power, and the Political Landscape. Routledge, London. 198-212.

Ottosson, J., & P. Grahn 1998. Utemiljöns betydelse för äldre med stort vårdbehov. Stad och Land Nr 155. SLU, Alnarp. (In Swedish).

Parsons, R. Tassinary, L.G., Ulrich, R., Hebl, M. & M. Grossman-Alexander, 1998. The View from the Road: Implications for Stress Recovery and Immunization. Journal of Environmental Psychology 18, 113-140.

Pasqualetti, M. J. 2002. Living with wind power in a hostile landscape. In: Pasqualetti, M., Gipe, P., Righter, R.W. (Eds.), Wind Power in View: Energy Landscapes in a Crowded World. Academic Press, San Diego, 83–99.

Pedersen E. &. K. Persson-Waye 2005. Perception and annoyance due to wind turbine noise: a dose–response relationship. J Accoust Soc Am 116, 3460-3470.

Peters, K. 2010. Future Promises for Contemporary Social and Cultural Geographies of the Sea. Geography Compass 4, 1260–1272

Swedish Board of Housing Building and Planning, 2007. Landskapets upplevelsevärden – vilka är de var finns de? Karlskrona: Boverket, http://www.boverket.se, 2011-12-20. (In Swedish).

Swedish Board of Housing Building and Planning, 2009a. Vindkraftshandboken. Planering och prövning av vindkraftverk på land och i kustnära vattenområden. Karlskrona: Boverket. http://www.boverket.se, 2010-01-12. (In Swedish).

Swedish Board of Housing Building and Planning, 2009b. Vindkraft och landskapet. Karlskrona: Boverket. http://www.boverket.se, 2010-01-12. (In Swedish)

Swedish Board of Housing Building and Planning, 2011. PBL. Kunskapsbanken Karlskrona: Boverket. http://www.boverket.se/Vagledningar/PBLkunskapsbanken/Oversiktsplanering/Om-oversiktsplanering/Vad-ar-en-oversiktsplan/, 2011-11-13. (In Swedish)

Swedish Environmental Protection Agency, 2010. Planering och kommunikation kring vindkraft i havet. En studie av lokala förankringsprocesser. Rapport Nr 6350 Vindval. Naturvårdsverket, Stockholm. (Summary in English).

Swedish Environmental Protection Agency, 2012. Vindkraftens effekter på fåglar och fladdermöss (The effect of wind power on birds and bats). Vindval, Environmental Protection Agency, Stockholm.

Swedish Environmental Protection Agency, 2012. Vindkraftens effekter på marint liv (The effect of wind power on marine life). Vindval, Swedish Environmental Protection Agency, Stockholm

Swedish National Heritage Board, 2008. Kulturmiljö under vatten. En rapport till vägledning för arkeologer och handläggare verksamma inom kulturmiljöområdet. Rapport från Riksantikvarieämbetet 2008:5. Riksantikvarieämbetet, Stockholm. http://www.raa.se/publicerat/9789172095250.pdf (In Swedish)

Swedish National Heritage Board, 2010. Hållbar landskapsutveckling – hur blev det? Rapport från Riksantikvarieämbetet. 2010, Riksantikvarieämbetet, Stockholm. http://www.raa.se/publicerat/rapp2010_1.pdf (In Swedish)

Swedish National Institute of Public Health, 2008. Gå ut min själ. Forskningsöversikt om hälsoeffekter av utevistelser i närnatur. Statens Folkhälsoinstitut. Östersund. http://www.fhi.se, 2012-02-05. (Summary in english).

Regleringsbrev 2005. Regleringsbrev för budgetåret 2006 avseende länsstyrelserna 2005-12-20. (In Swedish)

Rydberg, D. 2001. Skogens sociala värden. Skogsstyrelsens förlag, Jönköping. (In Swedish).

Scott, A.J., & P. Shannon 2007. Local Landscape Designations in Scotland: Opportunity or Barrier to Effective Landscape Management? Landscape and Urban Planning 81, 257-269.

Searles, H. F. 1960. The Nonhuman Environment in Normal Development and in Schizophrenia. International Universities Pres, New York.

Swedish Forest Agency 2004. Skogens sociala värden. Hur kan skogens sociala värden tas tillvara bättre för att främja en hållbar utveckling? Skogsstyrelsens förlag, Jönköping. (In Swedish)

SOU Statens Offentliga Utredningar 2000. Framtidens miljö allas vårt ansvar. Betänkande från Miljömålskommittén. SOU 2000:52. Miljödepartementet, Stockholm. (Summary in English)

SOU Statens Offentliga Utredningar 2005. Får jag lov? Om planering och byggande. PBL-kommittén, Miljödepartementet, Statens offentliga utredningar 2005:77, Stockholm. (In Swedish)

SOU Statens Offentliga Utredningar 2008. Prövning av vindkraft. Delbetänkande av Miljöprocessutredningen. SOU 2008:86. Miljöprocessutredningen, Stockholm. (In Swedish)

Sporrong, U. 1996. Studier till kultur-miljöprogram i Sverige. Riksantikvarieämbetet, Stockholm. (In Swedish)

Swaffield, S.R., & R.J. Foster 2000. Community perception of landscape values in the South Island high country. A literature review of current knowledge and evaluation of survey methods. Science for conservation 159. Department of Conservation, Wellington New Zealand.

Thayer R. L., & C. Freeman 1987. Public perceptions of a wind energy landscape. Landscape Urban Plan 14, 379-398.

Toke, D. 2005. Explaining wind power planning outcomes: some findings from a study in England and Wales. Energy Policy 33(12), 1527–1539.

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

Tsoutsos, T., Tsouchlaraki, A., Tsiropoulos, M. & M. Serpetsidakis 2009. Visual impact evaluation of a wind park in a Greek island. Applied Energy 86, 546–553.

Ulrich, R.S., Simons, R.F., Losito, B.D., Fiorito, E., Miles, M.A. & M. Zelson 1991. Stress Recovery During Exposure to Natural and Urban Environments. Journal of Environmental Psychology 11, 201-230.

Ulrich, R.S. 1993. Biophilia, Biophobia, and Natural Landscapes. The Biophilia Hypothesis. In: S.R. Kellert & E.O. Wilson, Eds. The Biophilia Hypothesis. The Island Press, 73-137.

Uzzell, D. 1991. Environmental psychological perspectives on landscape. Landscape Research 16(1), 3-10.

van den Bergh, A.E, Koole, S.L., & N.Y. van der Wulp 2003. Environmental preference and restoration: (How) are they related? Journal of Environmental Psychology 22, 135-146.

van den Berg, A.E., & T. Hartig 2007. Preference for Nature in Urbanized Societies: Stress, Restoration, and the Pursuit of Sustainability. Journal of Social Issues 63(1), 79--96

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, 2705-2714.

Warren C.R., Lumsden C., O'Dowd S. & R.W. Birnie 2005. 'Green on green': Public perceptions of wind power in Scotland and Ireland. Journal of Environmental Planning and Management 48, 853-875.

Warren C.R., & R.W. Birnie 2009. Re-powering Scotland: Wind Farms and the 'Energy or Environment?' Debate. Scottish Geographical Journal 125, 97-126

Widemo, F. 2007. Vindkraftens inverkan på fågelpopulationer- kunskap, kunskapsbehov och förslag till åtgärder. Kunskapsöversikt till Sveriges Ornitologiska Förening. http://movesofnet.proof.se/apps/file.asp?Path=1&ID=2102&File=Vindkraftens+inverkan.pdf (In Swedish)

Wolsink, M. 2010. Near-shore wind power—Protected seascapes, environmentalists' attitudes, and the technocratic planning perspective. Land Use Policy 27(2), 195-203.

Wolsink, M. 2009. Planning: Problem "carrier" or problem "source"? Planning theory and practice 10(4), 521-547.

Wolsink, M. 2007. Planning of renewables schemes. Deliberative and fair decision-making on landscape issues instead of reproachful accusation of non-cooperation. Energy policy 35, 2692-2704.

Woods, M. 2003. Conflicting environmental visions of the rural: windfarm development in Mid Wales. Sociologia Ruralis 43, 271-288.

Zube, E., Sell, J., and J. Taylor 1982. Landscape perception. Research, application and theory. Landscape Planning 9, 1-33.

Chap 5 Acceptance and Support

Agterbosch, S. & S. Breukers 2008. Socio-political embedding of onshore wind power in the Netherlands and North Rhine-Westphalia. Technology Analysis & Strategic Management 20(5), 633-648.

Agterbosch, S., Glasbergen, P. & W. J. V. Vermeulen 2007. Social barriers in wind power implementation in The Netherlands: Perceptions of wind power entrepreneurs and local civil servants of institutional and social conditions in realizing wind power projects. Renewable and Sustainable Energy Reviews 11, 1025-1055.

Aitken, M. 2010a. Wind power and community benefits: Challenges and opportunities. Energy Policy 38, 6066-6075.

Aitken, M. 2010b. Why we still don't understand the social aspects of wind power: A critique of key assumptions within the literature. Energy Policy 38, 1834-1841.

Ajzen, I. 1988. Attitudes, personality and behaviour. The Dorsey Press, Chicago, USA.

Bell, P. A., Greene, T., Fisher, J., & A.S. Baum 2001. Environmental Psychology, fifth edition. Lawrence Erlbaum Associates Inc., New Jersey, USA.

Bell D., Gray T. & C. Haggett 2005. The 'Social Gap' in Wind Farm Siting Decisions: Explanations and Policy Responses. Environmental Politics 14(4), 460-477.

Berglund, U., Eriksson, M., Nord, J., Butler, A., Antonson, H., Hammarlund, K., Hedfors, P., & A. Åkerskog 2011. Om landskap och landskapsanalys för väg och järnväg – ett kunskapsunderlag med fokus på begrepp och exempel. Rapport 2011:1. Institutionen för Stad och Land, SLU, Alnarp. (In Swedish).

Boholm, Å., Grimes, M., Löfstedt, R., Binde, P., & U. Strandberg 2000. National Objectives Local Objections – Railroad Modernization in Sweden. Center for Public Sector Research, Göteborg University.

Boholm Å. 2008. The public meeting as a theatre of dissent: risk and hazard in land use and environmental planning. Journal of Risk Research 11(1-2), 119-140.

Boholm, Å. 2005. Riskbedömningars ontologi och epistemologi: Hallandsåsen och dess vatten i: I. Brinck, S. Halldén, A.-S. Maurin & J. Persson (red.) Risk och det levande mänskliga. Nya Doxa, Nora. (In Swedish).

Boholm, Å., & R. Löfstedt red. 2004. Facility Siting: Risk, Power and Identity in land use planning. Earthscan, London.

Breukers S., & M. Wolsink 2007. Wind power implementation in changing institutional landscapes: An International Comparison. Energy Policy 35, 2737-2750.

Büscher, B. E. 2006. Making Political Ecology edited by Roderick Neumann. Development and Change 37, 1150–1152. doi: 10.1111/j.1467-7660.2006.00516_7.x

Council of Europe 2000. European Landscape Convention, Art. 1. European Treaty Series, No 176. http://www.conventions.coe.int.

Council of Europe 2008:3. Council of Europe Conference on Ministers Responsible for Spatial and Regional Planning, CEMAT CoE. St. Petersburg 27 June, 2008. http://www.coe.int/t/dg4/cultureheritage/heritage/, 2011-10-24.

Cowell, R. 2010. Wind power landscape and strategic, spatial planning- The construction of acceptable locations in Wales. Land Use Policy 27, 222-232.

deLaval, S. 1998. Gåtur, metod för utvärdering. Nordisk Arkitekturforskning, Nr 4, 1998. (In Swedish).

Devine-Wright P. 2009. Rethinking NIMBYism: The Role of Place Attachment and Place Identity in Explaining Place-protective Action. Journal of Community & Applied Social Psychology 19, 426-441.

Devine-Wright P. 2005. Beyond NIMBYism: towards an Integrated Framework for Understanding Public Perceptions of Wind Energy. Wind Energy 8(2), 125-139.

Devine-Wright, P., and H. Devine-Wright 2004. Beyond NIMBYism; towards an Integaretd framework for understanding public perceptions of wind energy. Wind Energy doi:10.1002/we-124. John Wiley and Sons Ltd.

Dryzek, J. 2000. Deliberative Democracy and Beyond. Oxford University Press, Oxford.

Eagly, A. H., S. Chaiken 1993. The Psychology of Attitudes. Harcourt Brace College Publishers, New York.

Ellis G., Cowell R., Warren C., Strachan P. & J. Szarka 2010. Expanding Wind Power: A Problem of Planning, or of Perception? Planning Theory & Practice 10(4), 523-532.

Ellis, G., Barry, J., & C. Robinson, 2007. Many ways to say no, different ways to say yes. Applying Q methodoly to understand public acceptance of wind farm proposals. Journal of Environmental Planning and Management 50(4), 517-551.

European Parliament and Directive 2003/4/ec. On public access to environmental information, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:041:0026:0032:EN:PDF 2011-05-15

European Parliament and Directive 2003/35/ec. Providing for public participation in respect of the drawing up of certain plans and programmes relating to the environment, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:156:0017:0024:EN:PDF 2011-05-15

Gardner, G. T., & P. C. Stern, 2002. Environmental Problems and Human Behaviour, second edition. Pearson Custom Publishing, Boston.

Habermas, J. 1989. The structural transformation of the public sphere: An inquiry into a category of bourgeois society (T. Burger, Trans.). MIT Press, Cambridge, MA.

Hallgren, L. 2003. I djupet av ett vattendrag. Doctoral diss. Dept. of Landscape Planning, Ultuna, SLU. Acta Universitatis agriculturae Sueciae. Agraria, 379. (In Swedish)

Hajer, M., & W.A. Versteeg 2005. A decade of discourse analysis of environmental politics: achievements, challenges, perspectives. Journal of environmental Policy & Planning 7(3), 175-184.

Hammarlund, K. 2005. Att planera för vindkraft i människors vardag. Kulturgeografiska Institutionen, chorus 2005:2. Handelshögskolan, Göteborgs Universitet. (In Swedish).

Hammarlund, K. in progress: Sixth Framework Programme, priority 6.1.3.1.1.1. Project: Distant Offshore Wind farms with No Visual Impact in Deepwater. SLU, Alnarp.

Hedqvist, R. 2002. Trovärdighet en förutsättning för förtroende. Styrelsen för psykologiskt försvar, Stockholm. (In Swedish).

Henecke, B., & J. Khan 2002. Medborgardeltagande i den fysiska planeringen. Institutionen för Sociology, Lund Universitet. (In Swedish)

Jones C. R., & J. R. Eiser 2010. Understanding 'local' opposition to wind development in the UK: How big is a backyard? Energy Policy 38, 3106-3117.

Jones C. R., & J. R. Eiser 2009. Identifying predictors of attitudes towards local onshore wind development with reference to an English case study. Energy Policy 37, 4604-4614.

Jorbert A., Laborgne P., & S. Mimler 2007. Local acceptance of wind energy: Factors of success identified in French and German case studies. Energy Policy 35, 2751-2760.

Kahn, J. 2004. Local Politics of Renewable Energy. Project Planning, Siting Conflicts and Citizen Participation. Environmental and Energy Systems Studies, Lund University.

Kahn, J. 2003. Wind Power Planning in Three Swedish Municipalities. Journal of Environmental Planning and Management 46(4), 563-581.

Klintman, M., & Å. Waldo 2008. Erfarenheter av vindkraftsetablering: Förankring, acceptans och motstånd. Rapport Nr 5866. Naturvårdsverket, Stockholm. (Summary in English).

Lezaun J., & L. Soneryd 2007. Consulting citizens: technologies of elicitation and the mobility of publics. Public Understanding of Science 16, 279-297.

County Administration Boardof Dalarna 2010. Vindkraft kring Siljan – en landskapsbedömning, Länsstyrelsens rapportserie 2010:02, http://www.w.lst.se/template/NewsPage.aspx?id=9522, 2011-05-15. (In Swedish)

Lynch, K. 1960. The image of the city. The MIT Press, Cambridge.

McLaren Loring, J. 2007. Wind energy planning in England, Wales and Denmark: Factors influencing project success. Energy Policy 35, 2648-2660.

Mels, S. 2001. Vindkraftverk, protester och planering. En konfliktstudie av Öland. Examensarbete vid Institutionen för teknik och samhälle, Malmö Högskola. (In Swedish)

Mels, S., & L.Aronsson 2010. Planering och kommunikation kring vindkraft i havet. En studie av lokala förankringsprocesser. Rapport Nr 6350. Naturvårdsverket, Stockholm. (Summary in english).

Nilsson, B., & A-K. Waldemarson 2007. Kommunikation samspel mellan människor. 3:e uppl. Studentlitteratur, Lund. (In Swedish).

Ogden, J. 2007. Health Psychology, a textbook (fourth edition). Open University Press, Maidenhead.

Oles, T., & K. Hammarlund 2011. The European Landscape Convention, Wind Power, and the Limits of the Local: Notes from Italy and Sweden. Landscape Research 36(4), 471-485.

Olwig, K. 1996. Recovering the Substantive Nature of Landscape. Annals of the Association of American Geographers 86(4).

Ostrom, E. 1990. Governing the Commons. Cambridge University Press, USA.

Pasqualetti, M., Gipe, P., & R. W. Righter 2002. Wind Power in View: Energy Landscapes in a Crowded World. University Press, San Diego, USA.

Ramirez, J. L. 1997. SYNEKDOKE – Om begreppsfenomenologi och om retorik som praktikens kunskapsteori. Bidrag till forskarkonferensen ”Kunnskap og handling II”, Lund.

Soneryd, L. 2002. Environmental Conflicts And Deliberative Solutions. A case study of public participation in EIA in Sweden. Studies in Sociology 5, Örebro.

Stoner, J. A. F. 1961. A comparison of individual and group decisions involving risk. Unpublished masters's thesis. MIT, MA, Cambridge.

Svensk Vindkraftförening 2010. Uppförandekod för vindkraftsprojektörer. http://www.natverketforvindbruk.se/Global/om%20n%C3%A4tverket/Uppf%C3%B6randekod_Vindkraft100326.pdf, 2011-10-11. (In Swedish).

Swedish Board of Housing Building and Planning 2009. Framgångsfaktorer för översiktsplanering. http://www.boverket.se/Global/Webbokhandel/Dokument/2009/Framgansfaktorer_for_oversiktsplanering.pdf, 2012-04-23. (In Swedish).

Swedish Board of Housing Building and Planning 2010. Stöd till planering för vindkraft. Snart 200 kommuner har sökt. http://www.boverket.se/Global/Webbokhandel/Dokument/2010/Stod-till-planering.for-vindkraft.pdf, 2012-04-23. (In Swedish).

Swedish Board of Housing Building and Planning 2011. Medborgardialog om vindkraft – exempel från 7 kommuner. Boverket, Karlskrona. http://www.boverket.se/Global/Webbokhandel/Dokument/2011/Medborgardialog_om_vindkraft.pdf. (In Swedish).

Swofford, J., & M. Slattery 2010. Public attitudes of wind energy in Texas: Local communities in close proximity to wind farms and their effect on decision-making. Energy Policy 38, 2508-2519.

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

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, 2705-2714.

Waldo, Å., & M. Klintman 2010. Attityder och delaktighet vid etablering av vindkraft till havs. Rapport Nr 635, Naturvårdsverket, Stockholm. (Summary in English).

Warren C. R., & M. McFadyen 2010. Does community ownership affect public attitudes to wind energy? A case study from south-west Scotland. Land Use Policy 27, 204-213.

Wolsink M. 2010. Planning: Problem ”Carrier” or Problem ”Source”? Planning Theory & Practice 10(4), 539-543.

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, 2692-2704.

Wolsink M. 2005. Wind power implementation: The nature of public attitudes: Equity and fairness instead of 'backyard motives'. Renewable and Sustainable Energy Reviews 11, 1188-1207.

Åstorps municipality 2011. Vindbruksplan för Åstorps kommun. Planeringsunderlag till översiktsplanen. Samrådshandling 2011-02-11. (In Swedish)

Chap 6. Discussion, Conclusions and Recommendations

Agterbosch, S., Meertens, R. M., & W. J. V. Vermeulen 2009. The relative importance of social and institutional conditions in the planning of wind power projects. I: Renewable and Sustainable Energy Reviews 13(2), 393–405.

Aitken, M. 2010. A three-dimensional view of public participation in Scottish land-use planning: empowerment or social control). Planning Theory 9, 248-264.

Ajzen, I. 1988. Attitudes, personality and behaviour. The Dorsey Press, Chicago, USA.

Auhagen, A. E., & H. W. Bierhoff 2001. Responsibility. The many faces of a social phenomenon. Taylor & Francis, United Kingdom.

Bell, P.A., Greene, T., Fisher, J., & A.S. Baum 2001. Environmental Psychology, fifth edition. Lawrence Erlbaum Associates Inc., New Jersey, USA.

Bell D., Gray T., & C. Haggett 2005. The 'Social Gap' in Wind Farm Siting Decisions: Explanations and Policy Responses. Environmental Politics 14(4), 460-477.

Berglund, U., Eriksson, M., Nord, J., Butler, A., Antonson, H., Hammarlund, K., Hedfors, P., A. Åkerskog 2011. Om landskap och landskapsanalys för väg och järnväg – ett kunskapsunderlag med fokus på begrepp och exempel. Rapport 2011:1. Institutionen för Stad och Land, SLU, Alnarp. (In Swedish).

Bodén, B. 2009. Vindkraft i Jämtland. En studie relaterad till turism. Etour R 2009:21. Mittuniversitetet, Östersund. (In Swedish)

Bolinger, M. & R. Wiser 2006. A comparative analysis of business structures suitable for farmer-owned wind power projects in the United States. Energy Policy 34(14), 1750-1761.

Clarke, S. 2009. Balancing environmental and cultural impact against the strategic need for wind power. International Journal of Heritage Studies 15, 175-191.

Cosgrove, D. 1998. Social Formation and the Symbolic Landscape, 2nd edition. University of Wisconsin Press, Madison.

Cosgrove, D. & V. Della Dora 2009. High places: cultural geographies of mountains, ice and science. I.B. Taurus, London.

Coss, R.G. 1991. Evolutionary Persistence of Memory-Like Processes. Concepts in Neuroscience 2, 129-168.

Cowell, R. 2007. Wind power and the planning problem: the experience of Wales. Environmental Policy and Governance 17, 291-306.

Cowell, R. 2010. Wind power, landscape and strategic, spatial planning—The construction of 'acceptable locations' in Wales. Land Use Policy 27(2), 222–232.

Damsgaard N., & K. Byman 2009. Svenska folkets kunskap och attityd kring energifrågor – en Vägval energi-undersökning. IVA, Stockholm. http://www.iva.se/energi, 2010-10-06. (In Swedish).

deLaval, S. 1998. Gåtur, metod för utvärdering. Nordisk Arkitekturforskning, Nr 4. 2008. (In Swedish).

Devine-Wright, P., & H. Devine-Wright 2004. Beyond NIMBYism; towards an Integaretd framework for understanding public perceptions of wind energy. Wind Energy doi:10.1002/we-124. John Wiley and Sons Ltd.

Devine-Wright, P. 2009. Rethinking NIMBYism: The Role of Place Attachment and Place Identity in Explaining Place-protective Action. Journal of Community & Applied Social Psychology 19, 426-441.

Ek K. 2005 Public and private attitudes towards 'green' electricity: the case of Swedish wind power. Energy Policy 33, 1677–1689.

Ek, K. 2006. Quantifying the environmental impacts of renewable energy: the case of Swedish wind power. I: Pearce, D. (editor), Environmental valuation in developed countries: Case studies. Edward Elgar, Cheltenham, 181-210.

Eagly, A.H., & S. Chaiken 1993. The Psychology of Attitudes. Harcourt Brace & Company, Orlando.

Ellis G., Cowell R., Warren C., Strachan P. & J. Szarka 2010. Expanding Wind Power: A Problem of Planning, or of Perception? Planning Theory & Practice 10(4), 523-532.

Council of Europe 2000. European Landscape Convention, Article 1. European Treaty Series, No 176. http://www.conventions.coe.int

European Commission 2008. Attitudes of European Citizens towards the Environment. Special Eurobarometer 295. Wave 68.2 – TNS Opinion and Social.

European Parliament and European Council directive 2009/28EG 2009.on the promotion of the use of energy from renewable sources. Official Journey of the European Union 5.6. 2009. http://eur-lex.europa.eu, 2010-02-01.

Gardner, G.T., & P.C. Stern 2002. Environmental Problems and Human Behaviour, second edition. Pearson Custom Publishing, Boston.

Goldberg, M., Sinclair, K., & M. Milligan 2004. Job and Economic Development Impact (JEDI) Model: A User-Friendly tool to Calculate Economic Impacts from Wind Projects. Prepared for Global WINDPOWER 2004, March 28–31, 2004. NREL/CP-500-35953. Golden, CO: National Renewable Energy Laboratory.

Grahn, P., & U. Stigsdotter 2003. Landscape Planning and Stress. Urban Forestry & Urban Greening 2, 1-18.

Grahn, P., Stigsdotter U., & A-M, Berggren Bärring 2005. A planning tool for designing sustainable and healthy cities. The importance of experienced characteristics in urban green open spaces for people's health and well-being. In: Quality and significance of green urban spaces. Conference proceedings, April 14–15, 2005. Van Hall Larenstein, Velp, The Netherlands, 29-38.

Gray, T., Haggett, C. & D. Bell 2005. Wind farm siting—the case of offshore wind farms. Ethics, Place and Environment 8(2), 127–140.

Hammarlund, K. 2005. Att planera för vindkraft i människors vardag. Kulturgeografiska Institutionen, chorus 2005:2. Handelshögskolan, Göteborgs Universitet. (In Swedish).

Harper, C. 2011. Environment and Society. Human Perspectives on Environmental Issues. Fifth Edition. Pearson Prentice Hall, New Jersey.

Hedberg, P. 2011. Inställningen till olika energikällor i Sveriges län 1999–2004, resp 2005–2010. SOM Rapport 2011:25. Göteborgs Universitet: SOM-institutet (Samhälle Opinion Media). http://www.som.gu.se/digitalAssets/1339/1339612_2011-inst--llningen-till-olika-energik--llor.pdf, 2011-12-13. (In Swedish).

Hedqvist, R. 2002. Trovärdighet en förutsättning för förtroende. Styrelsen för psykologiskt försvar, Stockholm. (In Swedish).

Henecke, B., & J. Khan 2002. Medborgardeltagande i den fysiska planeringen – en demokratiteoretisk analys av lagstiftning, retorik och praktik. Sociologiska institutionen, Lunds universitet. (In Swedish)

Hoen, B., Wiser, R., Cappers, P., Thayer, M., och G. Sethi 2009. The Impact of Wind Power Projects on Residential Property Values in the United States:

A Multi-Site Hedonic Analysis. Ernest Orlando Lawrence Berkley National Laboratory, Berkley, CA.

Hygge, S. 2005. Bullers effekter på människor. I: M. Johansson och M. Küller. Svensk Miljöpsykologi. Studentlitteratur, Lund. (In Swedish).

IPCC (International Panel of Climate Change) 2007. Climate Change 2007. The IPSS fourth assessment report. Synthesis report. IPCC, New York.

Jay, S. A. 2008. At the Margins of Planning. Offshore Wind Farms in the United Kingdom. Ashgate, Aldershot.

Jones C. R. & J. R. Eiser 2009. Identifying predictors of attitudes towards local onshore wind development with reference to an English case study. Energy Policy 37, 4604-4614.

Jones, C. R. & R. J. Eiser 2010. Understanding 'local' opposition to wind development in the UK: How big is a backyard? Energy Policy 38, 3106-3117.

Johansson; M., & M. Küller. 2005. Svensk Miljöpsykologi. Studentlitteratur, Lund. (In Swedish).

Johansson, M. & T. Laike 2007. Intention to Respond to Local Wind Turbines: The Role of Attitudes and Visual Perception. Wind Energy 10, 435–451.

Jobert A., Laborgne, P. & S. Mimler 2007. Local acceptance of wind energy: Factors of success identified in French and German case studies. Energy Policy 35, 2751-2760,

Jämtlands läns kommuner 2010. Policydokument: Lokal nytta. Låt inte vindens utvecklingskraft blåsa bygden förbi. Policy om vindkraftens lokala nytta, kommunerna i Jämtlands län. (In Swedish)

Khan, J. 2004. Local Politics of Renewable Energy. Project Planning, Siting Conflicts and Citizen Participation. Environmental and Energy Systems Studies, Lund University.

Krueger, A. D. 2007. Valuing public preferences for offshore wind power: A choice experiment approach. Doktorsavhandling. University of Delawere, Newark, USA.

Lantz, E. & S. Tegen 2008. Variables Affecting Economic Development of Wind Energy. National Renewable Energy Laboratory. NREL/CP-500-43506. Conference Paper presented at Windpower 2008, Houston Texas, June 1–4, 2008.

Lantz, E. & S. Tegen 2009. Economic Development Impacts of Community Wind Projects: A Review and Empirical Evaluation. NREL/CP-500-45555. Golden, CO: National Renewable Energy Laboratory.

Lezaun J., & L. Soneryd 2007. Consulting citizens: technologies of elicitation and the mobility of publics. Public Understanding of Science 16, 270-297.

Leventhall, G. 2006. Infrasound from wind turbines – fact, fiction or deception. Canadien Acoustics 34, 29-34.

Lindström, M., Johansson, M., Herrmann, J & O. Jonsson 2006. Attitudes towards the conservation of biological diversity. Journal of Environmental Planning and Management 49(4), 495-513.

Lindström M. & R. Küller 2008. Sustainable Development Priorities in four Swedish Communities; Priorities, Responsibility and Empowerment. Environment, Development, Sustainability 10, 311-336.

Mercer, D. 2003. The Great Australian Wind Rush and the Devaluation of Landscape Amenity. Australian Geographer 34, 91-121.

Millennium Declaration 2000. Millenniedeklarationen och millenniemålen. (Millennium Declation and the Environmental Goals) http://www.sweden.gov, 2010-11-05.

Miljömålsrådet 2010. Miljömålen. Svensk konsumtion och global miljöpåverkan. Naturvårdsverket, Stockholm. (In Swedish).

Möller, B. 2006. Changing wind-power landscapes: regional assessment of visual impact on land use and population in Northern Jutland, Denmark. I: Applied Energy83, 477–494

Möller, B. 2010. Spatial analyses of emerging and fading wind energy landscapes in Denmark. Land Use Policy 27, 233–241.

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

Nadaï, A., & D. van der Horst 2010. Wind power planning, landscapes and publics. Land Use Policy 27, 181–184.

Navrud, S. & K. Grönvik Bråten 2007. Consumers´preferences for green and brown electricity: a choice modelling approach. Revue d'economie politique 5, 117.

Northwest Economic Associates NEA 2003. Assessing the Economic Development Impacts of Wind Power. Final Report for National Wind Coordinating Committee. Northwest Economic Associates, Vancouver, WA.

Nilsson, M., Bluhm, G., Eriksson, G., & K. Bolin 2011. Kunskapssammanställning om infra- och lågfrekvent ljud från vindkraftsanläggningar: Exponering och hälsoeffekter. (In Swedish).

Ogden, J. 2007. Health Psychology, a textbook (fourth edition). Open University Press, Maidenhead.

Olwig, K. R.2002. Landscape, nature, and the body politic: from Britain's renaissance to America's new world. University of Wisconsin Press, Madison.

Ottosson, J., & P. Grahn 1998. Utemiljöns betydelse för äldre med stort vårdbehov. Stad och Land Nr 155. SLU, Alnarp. (In Swedish).

Pedersen, E., & K. P. Waye 2004. Perception and annoyance due to wind turbine noise – a dose-response relationship. Journal of the Acoustical Society of America 116(6), 3460-3470. doi: 10.1121/1.1815091

Pedersen, E., Hallberg, L.-M., & K. P. Waye 2007. Living in the vicinity of wind turbines – A grounded theory study. Qualitative Research in Psychology 4, 49-63.

Pedersen, E., & K. P. Waye 2007. Wind turbine noise, annoyance and self-reported health and well-being in different living environments. Occupational and Environmental Medicine 64(7), 480-486. doi: 10.1136/oem.2006.031039

Pedersen, E., van den Berg, F., Bakker, R., & J. Bouma 2009. Response to noise from modern wind farms in The Netherlands. Journal of the Acoustical Society of America 126(2), 634-643. doi: 10.1121/1.3160293.

Pedersen, E. 2011. Health aspects associated with wind turbine noise—Results from three field studies. Noise Control Engineering Journal 59, 47-53.

Pedersen, T. H. 2011. Sammenhaeng mellan vindmollestoj og helbredseffekter (AV 1017/11). DELTA, Hörsholm, Danmark.

Riddington, G., McArthur, D., Harrison, A., & H. Gibson 2008. The economic impacts of wind farms on Scottish tourism – A report for the Scottish Government. http://www.scotland.gov.uk/Publications/2008/03/07113554/0.

Searles, H. F. 1960. The Nonhuman Environment in Normal Development and in Schizophrenia. International Universities Press, New York.

Shepherd, D., McBride, D., Welch, D., Dirks, K.N., & E.M. Hill 2011. Evaluating the impact of wind turbine noise on health-related quality of life. Noise and Health 13, 333-339.

Sims, S., Reza, G. & P. Dent 2008. Modelling the impact of wind farms on house prices in the UK. International Journal of Strategic Property Management 12, 251-269.

Sporrong, U. 1996. Rural Landscape and Landscape Composition. Studier till kultur-miljöprogram i Sverige. Riksantikvarieämbetet, Stockholm. (In Swedish)

Swedish Wind Energy 2010. Vindkraft i sikte. http:// www.svenskvindenergi.org (In Swedish)

Swedish Board of Housing Building and Planning 2007. Landskapets upplevelsevärden – vilka är de var finns de? Karlskrona: Boverket, http://www.boverket.se, 2011-12-20. (Summary in English).

Swedsh Board on Housing Building and Planning 2009. Vindkraftshandboken. Planering och prövning av vindkraftverk på land och i kustnära vattenområden. Boverket, Karlskrona. (In Swedish)

Swofford J. & M. Slattery 2010. Public attitudes of wind energy in Texas: Local communities in close proximity to wind farms and their effect on decision-making. Energy Policy 38, 2508-2519.

Toke, D. 2005. Explaining wind power planning outcomes: some findings from a study in England and Wales. Energy Policy 33(12), 1527–1539.

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

Ulrich, R. S. 1993. Biophilia, Biophobia, and Natural Landscapes. The Biophilia Hypothesis. In: S.R. Kellert & E.O. Wilson, Eds. The Biophilia Hypothesis. The Island Press, 73-137.

UNCED 1992. Agenda 21, the United Nations Programme of Actions from Rio. Department of Public Information. United Nations, New York.

Uzzell, D. 2000. The psycho-spatial dimensions of global environmental problems. Journal of Environmental psychology 20, 307–318.

van den Berg, G. P. 2004. Do wind turbines produce significant low frequency sound levels? 11th International Meeting on Low Frequency Noise and Vibration and its Control, 1-8. Maastricht, The Netherlands.

Warren C. R., Lumsden C., O'Dowd S. & R. W. Birnie 2005. 'Green on green': Public perceptions of wind power in Scotland and Ireland. Journal of Environmental Planning and Management 48, 853-875.

Warren C. R., & R. W. Birnie 2009. Re-powering Scotland: Wind Farms and the 'Energy or Environment?' Debate. Scottish Geographical Journal 125, 97.126

Warren C. R., & M. McFadyen 2010. Does community ownership affect public attitudes to wind energy? A case study from south-west Scotland. Land Use Policy 27, 204-213.

Wizelius, T. 2009. Vindkraft på lantbruk- Handbok för lantbruk (andra upplagan). Nätverket för Vindbruk: Vindform förlag. http://www.natverketforvindbruk.se (uppdaterad dec 2011). (In Swedish).

Wizelius, T. 2010a. Vindkraft tillsammans – Handbok för vindkraftskooperativ. Nätverket för vindbruk; Vindform förlag. http://www.natverketforvindbruk.se (uppdaterad dec 2011). (In Swedish).

Wizelius, T. 2010b. Lokalt ägd vindkraft—Handbok för kommuner. Nätverket för vindbruk; Vindform förlag. http://www.natverketforvindbruk.se (uppdaterad dec 2011). (In Swedish).

Wolsink M. 2005. Wind power implementation: The nature of public attitudes: Equity and fairness instead of 'backyard motives'. Renewable and Sustainable Energy Reviews 11, 1188-1207.

Wolsink, M. 2007. Planning of renewables schemes. Deliberative and fair decision-making on landscape issues instead of reproachful accusation of non-cooperation. Energy policy 35, 2692-2704.

Wolsink, M. 2010a. Near-shore wind power—Protected seascapes, environmentalists' attitudes, and the technocratic planning perspective. Land Use Policy 27(2), 195-203.

Wolsink M. 2010b. Planning: Problem "Carrier" or Problem "Source"? Planning Theory & Practice 10(4), 539-543.

WSSD 2002. World summit on sustainable development. Johannesburg Summit 2002. Key outcomes of the summit. UN Department of Public Information, New York.

WHO 2009. Night Noise Guidelines for Europe. World Health Organization Regional Office for Europe, Copenhagen.

Appendix 1

Electricity certificates contributes to the expansion of all renewable energy

Electricity certificates is basically an evidence of that one (1) MWh renewable energy has been produced and measured in accordance with the Electricity Certificates Act (2003:113).

All types of energy using renewable energy sources have the same opportunities to participate in the electricity certificate system, not just wind power. Approved establishments are entitled to certificates for 15 years. These certificates can then be sold to quota obligated buyers to provide an additional source of income besides the electricity price in order to stimulate the use of renewable energy sources. It is ultimately electricity consumers who pay the electricity certificate system, except for the electricity-intensive industry. Energy sources in the electricity certificate system that are classified as renewable under the Electricity Certificates Act (2003:113) are:

- Wind power
- Sun energy
- Wave energy
- Geothermal energy
- Biofuels according to Regulation (2003:120) on electricity certificates enligt förordning (2003:120) om elcertifikat
- Hydropower
  – Small scale hydro power that by the end of 2003 had an installed effect of maximum 1,500 kW per production unit
  – new power plants
  – resumed operation in closed power plants
  – increased production capacity in existing power plants
  – power plants that no longer can obtain long-term profitable production due to authority decisions or extensive remodeling
- Peat in CHPs.

The number and percentage of certificates issued per type of energy in the years 2004–2010 shows that biofuels had by far the largest share of certificates, then hydropower, followed by wind power. Other types of energy were a negligible proportion. Number and percentage of certificates per energy type 2004–2010 (Svenska Kraftnät: https://elcertifikat.svk.se/cmcall.asp, 2011-02-08)

Biofuels	68 541 486 certificates	71 %
Hydropower	15 639 423 certificates	16 %
Wind power	12 198 591 certificates	13 %
Other	666 certificates	0 %

Wind power has in recent years received an increasing share of certificates. The average price for certificates during the period 2010-02-08-2011-02-08 was 292.18 SEK/MWh and the average price during 2004-2010 was 244.48 SEK/MWh (Svenska Kraftnät, elcertifikat.svk.se, 2011-02-08).

The Swedish Parliament has decided to extend the certificate system to 2035 to further stimulate the development of renewable energy by adopting Proposition 2009/10:133 "Higher goals and further development of the electricity certificate system." This means that the approved facilities to be built by 2020 will be able to receive certificates for 15 years. Meanwhile, declarations of intent are submitted by Sweden and Norway, where it is agreed that a joint certificate market will be established as from 2012 (Swedish Energy Agency, 2011, www.energimyndigheten.se, 2011-10-25).

Subsidies for wind power

Support for the expansion of wind power will be issued in the form of certificates. (There may be local and regional support that is not covered not covered by this review). It is also likely that the long-term nature of the certificate system has a greater national impact on wind power establishments than short-term support. It requires profitable operations to justify investments.

Previously it has been possible to obtain government subsidies for the development of wind power in the form of investment, but this is no longer possible. From 2007 to 31-12-2010, it was possible for municipalities and County Administration Boards to seek support from the Swedish Board of Housing, Building and Planning for the planning of wind power. But that possibility is also over now.

Until 2012 runs the Energy Agency's Wind Pilot Project "*Technological development and market introduction in interaction*" whose premise is to create a support for collaboration between government and industry with the aim of improving the conditions for large-scale wind power development. The support can also be used to create knowledge about wind power and to facilitate processes for planning and permits. Overall, these elements aim to improve the conditions for sustainable development of wind power. The project funding was 350 million EUR for the period 2003–2007 and 350 million EUR for the period 2008–2012. Following projects have received funding in the framework of Wind Pilot Project

Table 1. Granted projects within the Wind Pilot Project 2003–2012 (Swedish Energy Agency, www.energimyndigheten.se, 2011-02-08)

Project	Recipient	Support [MSEK]	Expected electricity production [TWh/year]	Commissioning	Final report
Lillgrund	Vattenfall AB	213	0,33	2007	2009
Uljabuouda	Skellefteå Kraft AB	35	0,08	2009–2010	2010
Big scale wind power in Northern Sweden	Svevind AB	115	0,197	2009–2011	2011
Demonstration facility	Sveriges Vindkrafts-kooperativ	10	0,0093	2010	2011
Big scale wind power in Southern Sweden forest areas	Arise Windpower AB	50	0,14	2009–2010	2011
Storrun	Storrun AB	26,25	0,08	2009	2011
Havsnäs	NV Nordisk Vindkraft AB	20	0,256	2009–2010	2011
Wind farm Vänern	Vindpark Vänern Kraft AB	40	0,089	2009–2010	2012
Big scale wind power in mountain areas	o2 Vindkompaniet AB	72,5	0,26	2011	2012
Pilot studies at Kriegers Flak	Vattenfall AB	9,45	–	–	2009
Vindval	EPA	70	–	–	–
Total		**661,2**	**1,44 TWh/year**	**–**	**–**

The Effects of Wind Power on Human Interests

A Synthesis

MARIANNE HENNINGSSON, SOFIA JÖNSSON, JOHANNA BENGTSSON RYBERG, GÖSTA BLUHM, KARL BOLIN, BOSSE BODÉN, KRISTINA EK, KARIN HAMMARLUND, INGA-LENA HANNUKKA, CARINA JOHANSSON, SANNA MELS, TOM MELS, MATS NILSSON, ERIK SKÄRBÄCK, PATRIK SÖDERHOLM, ÅSA WALDO, INGEGÄRD WIDERSTRÖM AND NIKLAS ÅKERMAN

REPORT 6545

SWEDISH EPA
ISBN 978-91-620-6545-4
ISSN 0282-7298

Wind power has a part to play in the necessary development of renewable energy. At the same time, it has impacts on the environments in which people live. This report summarizes research, chiefly from Europe and the United States, into the effects of wind power on human interests. One chapter is concerned with health, covering issues such as noise, shadows, and perceptions of annoyance. Another charts the local benefits of wind power projects, including new employment opportunities, as well as their impacts on tourism, recreation and reindeer herding.

The report goes on to consider landscape analysis, planning and amenity values. The European Landscape Convention calls for an integrated approach to landscape and talks about public participation in planning. The fourth chapter ties together the sections mentioned and, based on a presentation of methods and concrete examples, discusses the process of securing acceptance and support for wind power.

The report presents research findings that are of direct use in the process of dialogue and decision making on wind power. It is aimed at officials working for county administrative boards and local authorities, decision makers and developers, and the general public.

Vindval is a programme that collects knowledge on the environmental impact of wind power on the environment, the social landscape and people's perception of it. It is aiming to facilitate the development of wind power in Sweden by improving knowledge used in IEAs and planning- and permission processes. Vindval finances research projects, analyses, syntheses and dissemination activities. The programme has a steering group with representatives for central and regional authorities and the wind power industry.

Swedish EPA SE-106 48 Stockholm. Visiting address: Stockholm - Valhallavägen 195, Östersund - Forskarens väg 5 hus Ub, Tel: +46 10-698 10 00, fax: +46 10-698 10 99, e-mail: registrator@naturvardsverket.se Internet: www.naturvardsverket.se **Orders** Ordertel: +46 8-505 933 40 orderfax: +46 8-505 933 99, e-mail: natur@cm.se Address: CM Gruppen, Box 110 93, SE-161 11 Bromma. Internet: www.naturvardsverket.se/publikationer