Large-scale Wind Power in Denmark

– New Perspectives on Ownership

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Abstract:

In this M.Sc. thesis the question of, which factors influence the local acceptance of wind power is investigated. Aim of the research is furthermore to discuss how new forms of co-ownership can contribute to building up and maintaining this acceptance in Denmark.

In the theoretical part of the thesis it is shown that local acceptance of wind power may be influenced by a variety of factors. These factors depend on processes at three interlinked levels. These insights are combined in a conceptual model. Ownership is identified as one significant factor in this model.

Based on an analysis of the existing ownership structure for wind power in Denmark, five basic forms of ownership are identified. By setting context-dependent criteria for new forms of ownership, these basic forms are combined into four new models of co-ownership. Two of these new forms do exist in Denmark, and are investigated in a case study.

From the investigation of the cases it is concluded that local anchorage of the responsible planning authority may be crucial to gain local acceptance and overall project permission in these forms of co-ownership. This local character of planning is closely associated with local forms of ownership.

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Preface

This M.Sc. thesis was written during the 10th semester of the study programme Environmental Management, in the Department of Development and Planning at Aalborg University, in the spring of 2007.

All references in this report are indicated in accordance with the recent version (as of January 2007) of the 15th edition of the Chicago Manual of Style. The author's surname, year of publication and page number are referred to in the text, when citing directly. In case of more than three authors the primary author's name along with 'et al.' is given. For a publication where no author is given, the organisation behind the publication is noted. If the year of publication is not given it is referred to as 'n.d.'. Figures and tables are numbered according to the number of the chapter and a continuous number.

The thesis report includes five appendices. Appendices B to E contain shortened transcripts of the conducted interviews. I would in this regard like to thank all interviewees for their kindness and helpfulness. The interview partners were: Anne Grete Holmsgaard, member of the Danish Parliament; Asbjørn Bjerre, director of the Danish Wind Turbine Owners' Association; Søren Hermansen, manager of Samsø Energy Academy and Jens Larsen, project manager at Copenhagen Environment and Energy Office. Finally, I would like to thank my supervisor Frede Hvelplund for his continuous support and a number of very inspiring as well as constructive discussions.

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Karl Sperling

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Figures and Tables

1. Introduction

A reliable energy supply is an essential element for any kind of economic development, and the purchase of energy may account significantly for the gross domestic product of a country. At the same time, world energy use has increased more than tenfold over the course of the 20th century. The main energy sources that facilitated this increase were fossil fuels, such as coal, oil and gas, and nuclear power. Due to, among others, ongoing industrialisation and rising energy demand in developing countries, a further increase in world energy consumption can be expected in the 21st century (Twidell and Weir 2006, 2-3). Two main problems associated with this development are the finite deposits of the major fossil fuels, and the emissions resulting from the use of these fossil fuels. One such emission is carbon dioxide (CO_2), the main contributor to global warming[1]. It is therefore necessary to expand renewable energy[2] (RE) supplies, replace these with existing fossil fuel based supplies and use energy more efficiently (Twidell and Weir 2006, 3). Many national energy plans therefore include factors, such as the following, that address the above considerations: increased harnessing of renewable energy supplies, increased efficiency of energy supply and end-use, reduction in pollution, consideration of lifestyle (Twidell and Weir 2006, 4).

Renewable Energy and European Policy

In a recent proposal the European Commission (2007) calls for the fulfilment of four targets and objectives. These are:

- Reduction of greenhouse gas emissions from developed countries by 30% by 2020
- Improving energy efficiency by 20% by 2020
- Raising the share renewable energy by 20% by 2020
- Increasing the level of biofuels in transport fuel to 10% by 2020

Raising the share of RE from currently 7% to 20% within the next thirteen years will require commitment from all member states, and renewable energy sources (RES) that can be promoted in order to fulfil this goal include wind, solar, photovoltaic, biomass and biofuels, geothermal and heat pumps (European Commission 2007; CEU 2007). Wind power currently is the major European 'near market' RE technology, and it can therefore be expected that it will provide the bulk of new RE generation (Szarka 2006).

[1] In this context the term global warming is synonymous with terms like greenhouse effect and climate change, and can be defined as a rise of the earth's average surface temperature that is accelerated by human activities, such as the burning of fossil fuels and deforestation (European Commission 2007). One of Page's (2005) suggestions is the term *human climate disruption*.

[2] Other terms are sustainable energy or green energy and they can be defined as 'energy obtained from natural and persistent flows of energy occurring in the immediate environment' (Twidell and Weir 2006, 7).

Danish Future Vision on Energy

With respect to the future of the Danish energy system the current Danish government intends to work with a number of long-term policy challenges. These include security of and lower dependence with regard to energy supply; global climate change; growth and economic development (TRM 2005, sec. 1; TRM 2007). The vision of Denmark becoming independent of fossil fuels in the long-term forms the basis for these policy challenges. To solve these problems the government set goals for the year 2025. Besides the reduction of fossil fuel consumption by 15% compared to the current (2007) consumption, freezing of the total energy consumption are the core elements of the 2025 vision. These goals are to be realised by enhancing efforts in the following areas (TRM 2007):

- Efficient production and consumption of energy
  - Energy savings shall be increased to 1.25% annually
- Development of new and more efficient energy technologies
  - Financial support for R&D and demonstration projects shall be increased annually
- Increase the share of RES
  - Doubling the amount of RES to contribute to at least 30% of the energy consumption in 2025
  - Share of biofuels in the transport sector to be increased to 10% by 2020

To reach the goal of 30% RE in 2025 it is likely that wind power is going to play a major role (TRM 2007). A recent study shows that it is technically feasible to extend the share of wind power in the total electricity consumption to 50% by 2025. This would entail a doubling of the existing capacity from around 3,000 MW to around 6,000 MW in 2025. It is estimated that this could on the hand be achieved by replacing existing smaller, older inland turbines with larger ones, without the need for reinforcements in the transmission grid. At the same time, increasing the wind power capacity offshore from the existing and planned 825 MW to more than 2,000 MW in 2025 could contribute to reaching this goal (EA 2007). Considering the current stagnation[3] with regard to the development of new capacity it will be necessary to discuss how such a development can be stimulated.

1.1 Phases of Wind Power Development in Denmark

Since the late 1970's the capacity of wind power in Denmark has been continuously increasing. Wind power is in this regard the major source of renewable electricity, contributing to 18.5% of the total electricity consumption in Denmark in 2005 (ENS 2006a, 7). This corresponds to the production of around 6 million kWh of electricity by around 5200 windmills (ENS 2006b; ENS 2007a). Together, Combined Heat and Power (CHP) production units and wind power already today cover around 50%

[3] Between 2003 and 2007, so far, the effective increase in capacity was 20 around MW, whereas the increase between 1998 and 2002 was around 1,400 MW (ENS 2007).

of the electricity demand in Denmark (Lund and Münster 2006). Wind power is therefore developing from an alternative energy source into a major source of electricity within the Danish energy system. During the *alternative,* first phase conditions for wind power were different compared to the ongoing *large-scale,* second phase. The features of these two phases are described in the following.

First Phase – Development of an Alternative Technology

The development of modern windmills in Denmark dates back to the 1950's, but it first got increased attention after the oil price shocks in the 1970's. From around 1975 until around 1996 the development of wind power into a reliable niche technology took place. Compared to other countries the main goal in this phase was to develop proven technology that could form the basis for a national turbine industry, rather than to achieve a technological breakthrough by developing high-end wind turbines with large capacities. This process can be characterised as an array of incremental innovations, in which the bottom-up, trial and error activities of actors played a major role (Kamp, Smits and Andriesse 2004; Garud and Karnøe 2003; Karnøe 1999). These features were apparent both on a small-scale business level, where a community of practitioners engaged in learning processes of practical experimentation, and on the national R&D level, where technological practice rather than fundamental engineering science was in focus (Karnøe 1999). An important feature of this development were learning processes based on interaction and knowledge transfer between turbine producers, turbine owners and researchers, which enabled a participatory rather than competitive development of wind power technology (Kamp, Smits and Andriesse 2004; Garud and Karnøe 2003). A similar process took place on a local level, where mainly farmers developed into 'owner-users', began to establish small wind turbine businesses and organised meetings at which knowledge was shared (Garud and Karnøe 2003). With increasing turbine sizes and investments local cooperatives were established, and the majority of turbines erected between 1984 and 1994 were cooperatively owned (DVF n.d.). By the year 1996 wind power contributed 3.5% to the electricity consumption, and 120,000 individuals were involved in owning as much as 4,000 turbines (Hvelplund 2006; ENS 2007). The political framework influenced this development by setting different types of policy mechanisms[4] according to the different stages of technological progress (Nielsen 2005).

Second Phase – Large-Scale Integration of Wind Power

In Denmark, wind power has entered a second phase of development, which has been taking place since around 1996. It became a major source of electricity, but at the same time has reached a scale where it attracts increasing political and economic resistance, because it on the one hand poses a

[4] According to Nielsen (2005, 101) seven policy mechanisms have influenced wind power as a techno-economic innovation. These are: Research, Development, Demonstration and Information (RDD&I; started in 1976); Investment subsidies (1979 – 1989); Quotas (capacity goals from 1985 onwards); Business development (new approval schemes after 1990); Planning (wind power siting as part of longer term municipal planning); Power purchase agreements (until 1992, then replaced by the feed-in tariff); Environmental taxation (electricity tax exemption and CO_2 subsidy).

business risk to conventional power companies, and on the other, may generate significant surplus electricity, which has to be sold cheaply at the Nordpool[5] market (Hvelplund 2006). In practice the significant increase in wind power capacity between 1996 and 2002 also meant significant investments for the state in the form of for example feed-in tariffs[6], not only for increasing inland turbines, but also for large offshore wind farms. During the last years reduced financial incentives for wind power combined with increasing investment costs for larger wind turbines were among the main reasons for the current stagnation in deployment. Furthermore, the increasing density of wind turbines at inland sites has led to an increase in local opposition. At the same time, this coincides with a change in the ownership structure away from cooperative ownership (Hvelplund 2006) towards a more private. Other characteristics of the second phase are that although wind power is becoming a major source of electricity, overall Danish CO_2 emissions could not be reduced. In fact, as preliminary statistics indicate, CO_2 levels in 2006 were slightly higher than in the year before (ENS 2007b). One reason for this is that fossil fuel power plant capacity has not been reduced, and surplus capacity of wind power has to be exported instead of helping to eliminate excess emissions in Denmark (Danish Government 2003). Moreover, up until now it is mostly larger power plants that balance production fluctuations. The main technological challenge will therefore be to integrate wind power and CHP plants into the existing supply system to be able to balance these fluctuations[7] (Lund and Münster 2006).

Besides the economic, political and technological effects of the second phase, there are a number of features of wind power that may have significant effects on a social level, and that gain in significance with increasing market share (Hvelplund 2005, 232; Wüstenhagen, Wolsink and Bürer 2007, 2684):

- The small-scale character of wind turbines may be associated with a relative increase of local projects and siting decisions, and consequently growing visibility.
- RE technologies tend have lower energy densities than conventional power plants. This means that the relative visual impact per MWh of capacity tends to be higher.
- In case of wind power the 'extraction' of the energy source and the conversion to electricity are integrated. Moreover, one way of increasing the capacity of wind turbines is

[5] The Nordpool market is the Nordic electricity market for Norway, Sweden, Finland and the two Danish electricity systems – Eastern and Western Denmark (Østergaard 2006).

[6] Instead of giving direct subsidies, a more 'liberal' measure would be the inclusion of external effects (emissions etc.) into energy prices. Otherwise RE technologies and existing technologies do not compete on a level playing field. Market acceptance therefore depends on a choice between short-term costs and long-term profits (Wüstenhagen, Wolsink and Bürer 2007, 2684.

[7] Investing in small-scale, flexible energy systems, such as heat pumps, may be a feasible solution (Lund and Münster 2006). Another suggestion is the storage of excess electricity and its utilisation for transport purposes – either for hydrogen production or for application in electric vehicles (Sørensen et al. 2004).

to build them higher. This means that RE plants, especially wind turbines, harness energy in a more visible way.

- This also means that the conversion of RE tends to happen closer to the residences of energy consumers. As a consequence, visibility of RE plants is higher and the (environmental) impacts come closer to residences.

The above points underline that the impacts of wind power are concentrated locally, and that due to the site-dependency of electricity production the ability to choose 'less visible' sites is limited. In relation to the abovementioned large-scale replacement of existing inland windmills it is likely that the overall pattern of visibility will change significantly before 2025. Due to the technological progress towards larger and fewer turbines in the future, overall turbine density and visibility are likely to decrease. Möller (2006) has shown that it is possible to replace 400 old turbines with 50 new turbines without increasing overall visibility of wind turbines in the County of Northern Jutland. It is however likely, that large turbines will cause a less homogeneous pattern of visibility. This development has been ongoing in the last couple of years, and means that in some locations turbine visibility will be increasingly higher while reducing visibility in other locations. Moreover, the landscape impact of wind turbines will even increase in areas, which already are characterised by a high turbine visibility (Möller 2006). Together with a lack of local involvement, an increased concentration of turbines at only a few sites might have a negative influence on people's perceptions of wind power living close to these sites in the near future (Möller 2006).

1.2 Problem Description

Danish wind power has reached a point at which it no longer can be considered an alternative source of electricity, but where it is necessary to realise that wind power is about to become a major element of the energy system. Consequently, it is necessary to not only adapt the existing system in order to balance an increasing share of wind power, but to develop an energy system that can be based on wind power and other alternative energy sources. The second phase of wind power development is characterised by a number of features that pose new challenges to the economic, technological and local acceptance of the technology.

Economic acceptance:

Increasing the capacity of wind power is related to increasing investments for the state. These higher investments can currently not be compensated by selling wind power economically at the spot market, which is due to the problem of surplus capacity described above. In combination with an uncertain and insufficient financial framework this has created a situation, in which investments in wind power are not attractive for any player on the market. This is enhanced by the fact that turbine size is increasing, making investments in wind power more expensive. Offshore wind power is even

more expensive than inland wind power, and the investment risks may be too high for most actors. Under current conditions it can therefore be expected that the focus during the next years will remain on the replacement of inland turbines.

Technological acceptance:
The increase in wind power capacity and the decrease of conventional power plant capacity need to happen simultaneously, if an effective reduction in CO_2 emissions wants to be achieved and the production of surplus capacity wants to be avoided. This will require a better integration of wind power into the existing system.

Local acceptance:
As a technology being mainly owned and developed by local people during the first phase of development, wind power was well accepted in Denmark. Cooperatives played an important role in raising the engagement and motivation of local communities this regard. With increasing turbine size a trend towards individually owned wind power emerged, resulting in the common perception that large-scale wind power developments cannot be handled by cooperatives. At the same time, the turbines of the future are likely to result in higher local impacts, which make it necessary that these turbines are locally accepted. Local involvement will therefore be necessary in relation to future wind power deployment.

The issue of economic acceptance is discussed elsewhere (see Meyer 2003; Meyer and Koefoed 2003; Hvelplund 2005; Hvelplund 2006; Toke 2007; Hvelplund and Meyer 2007). Also technological acceptance is gaining increasing attention in the literature (see Lund 2005; Lund and Münster 2006; Lund 2006; Akhmatov 2006). Up until now it was not necessary to discuss the issue of local acceptance in a Danish context. The above considerations show, however, that local resistance towards wind turbines is likely to increase in the future, and that local acceptance is an important prerequisite for successful wind power deployment.

2. Research Design

2.1 Research Questions

Based on the considerations in the Introduction the following primary research question is formulated:

Which factors influence the local acceptance of wind power, and how can new forms of co-ownership contribute to building up and maintaining this acceptance in Denmark?

This question consists of two sub-questions:

(1) Which factors influence the local acceptance of wind power

(2) How can new forms of co-ownership contribute to building up and maintaining this acceptance in Denmark?

The sub-questions are consecutively investigated in the study with the results of question (1) forming the basis for question (2). This is explained in the following.

2.2 Research Methodology

The Theoretical Part

One main goal of the research is to be able to draw conclusions about why a local community in certain cases accepts a wind power development in its neighbourhood, and why it opposes such a development in other cases. In the Introduction it is indicated that a change in the ownership structure of wind turbines might be related to a changing degree of local acceptance of wind power. This proposition is examined by developing a conceptual model for wind power acceptance. The conceptual model guides the overall research in this study and serves to answer the first research sub-question (1). The conceptual model is developed in Chapter 3 by investigating the following questions:

- *Which forms of public acceptance with regard to wind power do exist?*
- *What are the reasons for local opposition to wind power projects?*
- *Under which conditions does local acceptance of wind power projects evolve?*

The conceptual model is illustrated in Figure 2.1.

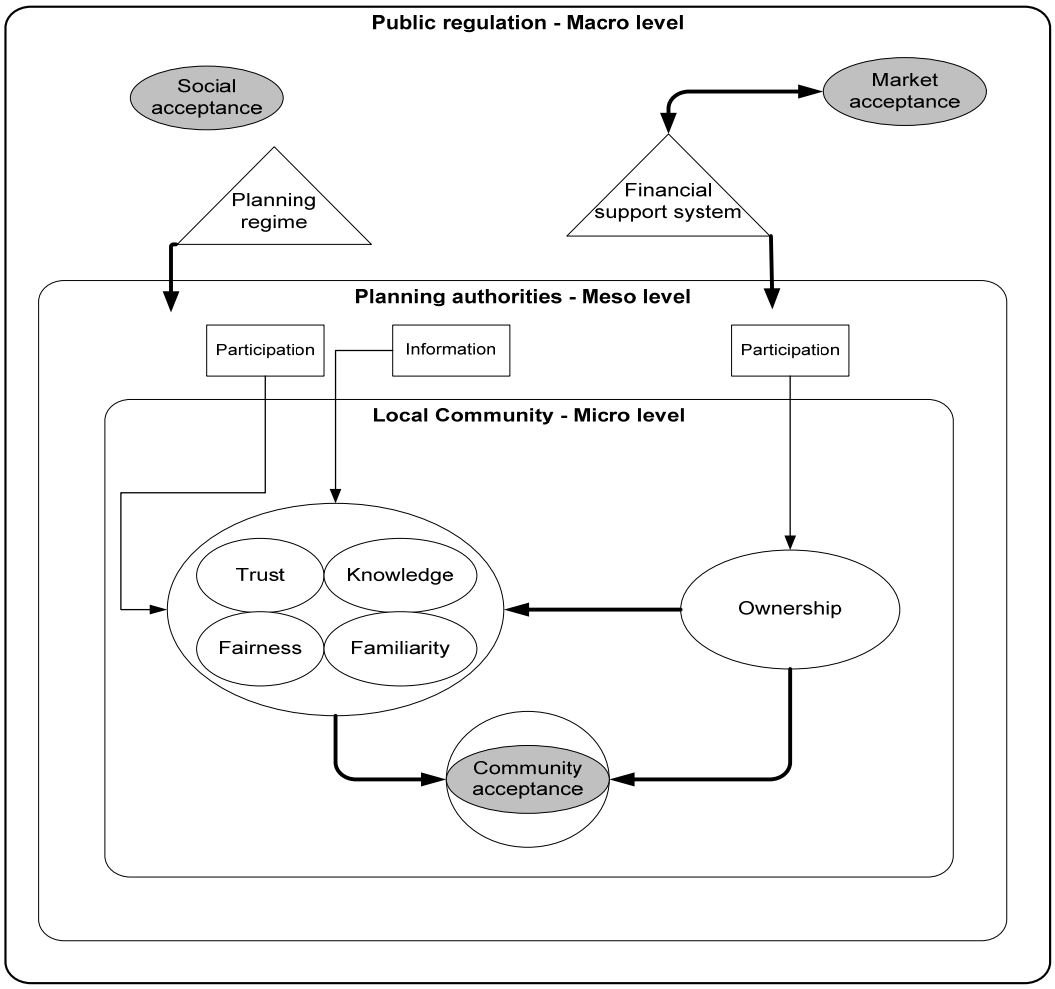

Figure 2.1 Conceptual model for the research.

The main data sources are drawn from a review of a growing number of contemporary literatures concerned with the acceptance of RE technologies. The conceptual model presented here (and in detail in Chapter 3) seeks to combine the most relevant findings from this recent research into one model. Based on this conceptual model ownership is identified as a major factor influencing the local acceptance of wind power projects in a community.

This finding forms the basis for formulating the second sub-question (2), which is split into the following questions:

- *Which forms of ownership for wind power do exist in Denmark?*
- *What are the motivations of actors in these ownership forms?*
- *How can existing forms of ownership be combined to ensure local acceptance?*

The goal of this part of the theory is to make statements about which forms of ownership are likely to attract local acceptance, but also can secure the development of wind power projects. The discussion

of existing as well as new types of (co-)ownership in this regard involves a rather abstract viewpoint on the Danish system. Ownership is seen in the context of the second phase of Danish wind power development. In relation to this abstract discussion two main assumptions are made:

- Existing forms of ownership cannot fulfil the requirements of the second phase of Danish wind power development
- Wind power deployment takes place on different levels in society (as shown in the conceptual model). A democratic process for the development of wind power projects, which is able to combine these levels, is therefore favoured. Such a democratic process is, among others, reflected in ownership models that combine different forms of ownership, i.e. co-ownership.
- Selecting an ownership type that is likely to increase local acceptance has positive effects regarding the outcome of the wind power project, but is not the only requirement for project success. These requirements are context-dependent.

Relating to the introduction, the current situation is briefly discussed here again, drawing on two interviews with Anne Grete Holmsgaard, a parliamentary energy expert, and Asbjørn Bjerre, director of the Danish Wind Turbine Owners' Association. Since only one parliamentary member was interviewed, there is a chance for political bias in the interview information. It was sought to minimise this chance by data triangulation with official reports. The discussion of new forms of co-ownership in Chapter 4 is based both on the conceptual model, but also on cases as such, which are characterised by two new forms of co-ownership. The results from the case studies are therefore used in an almost abductive (Holt-Jensen 1999, 67) manner, where they first inform the conceptualization of new co-ownership forms, and are then later discussed in relation to the conceptual model.

The Case Studies

The investigation of new forms of co-ownership is based on a multiple case study of the wind farms at Middelgrunden and Samsø. These cases are selected based on the ownership discussion in Chapter 4. Each case represents a new form of ownership, and they are among the most recent wind power developments in Denmark. According to Yin (2003, 13) case studies are used to investigate *'a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly defined'*. In this study the conceptual model can be seen as the context with the case studies as examples for ownership placed within this context. The aim of the case studies is to apply the conceptual model, and at the same time to contribute to its development. That is, to find out if there in a practical Danish context other factors that have an influence on local acceptance can be identified. For this reason the following guiding question is investigated:

- *How was local acceptance and project success ensured in the cases of Middelgrunden and Samsø?*

Both case studies involved an interview with a representative of the responsible planning organisation. In the case of Middelgrunden this was Jens Larsen, who has been one of the main developers, and continues to be involved in the project. On Samsø this was Søren Hermansen, who has been involved in the major energy projects on Samsø. The interviews were semi-structured in nature, and based on an exploratory approach. This means that, for instance the main characteristics leading to local acceptance in the planning processes were in focus, instead of the opinion of all affected actors (which was assumed to reflect a positive attitude due to the planning success, and which would have required a survey instead). A second source of information was documents about the cases, which were to obtain general information. The cases are compared and linked to the conceptual model by summarising how indicators for local acceptance (community participation, network stability) are represented (in the planning process), and by determining additional local acceptance factors that were relevant. The structure of the study is illustrated in Figure 2.2.

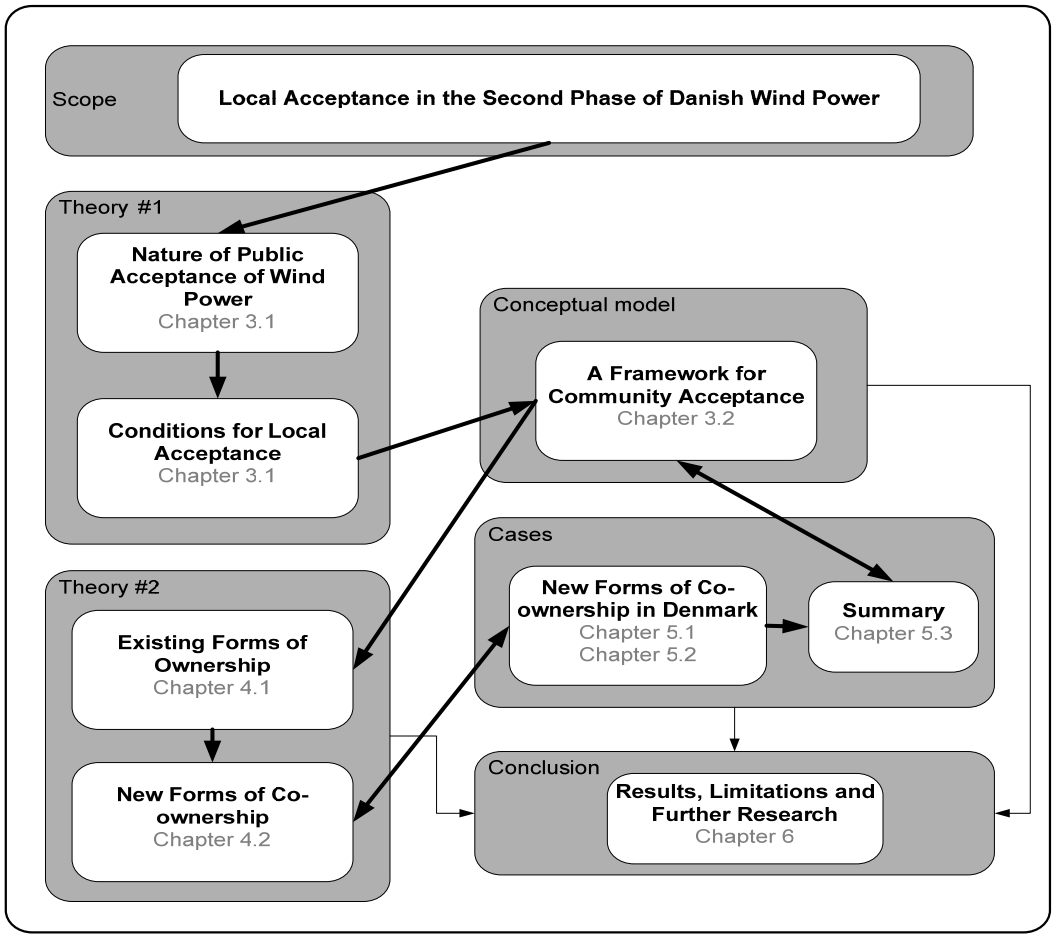

Figure 2.2 Illustration of the structure of the study.

3. The Social Perception of Wind Power

In this chapter different types of social acceptance regarding wind power are introduced, before it is examined how local resistance and local acceptance come about. Factors that influence the public perception of wind power are described, and conditions for local acceptance are identified. The findings of this discussion are integrated into a multi-level theoretical framework for wind power acceptance.

3.1 The Nature of Public Acceptance of Wind Power

The degree of acceptance of wind power on different levels of society obviously is one of the determinants for the success of national wind power programmes. While the technical and economic parameters for achieving increases in production capacity seem to be rather well understood, attention is increasingly paid to wider processes of institutional and societal capacity building (Szarka 2006). With regard to increasing the production output of wind power, Szarka (2006) highlights the promotion of technological process, reductions in costs and prices, and indeed social acceptance as associated objectives. Top-down national government agendas, driven by international agreements often focus on the first two factors, while failing to engage communities, and so arousing distrust and opposition (Szarka 2004). This issue has in recent years become a major concern for policy makers, planners and researchers. Wüstenhagen, Wolsink and Bürer (2007) distinguish three levels of social acceptance with regard to renewable energy technologies: *socio-political* acceptance, *community* acceptance and *market* acceptance.

While *market* acceptance is the process of market adoption of a renewable energy innovation, *socio-political* acceptance refers to the acceptance of policies or technologies on a very general level in society. Opinion polls indicate that this public acceptance for RE technologies and policies is high in many countries (Wüstenhagen, Wolsink and Bürer 2007) – including Denmark (ACNielsen A/S 2006). Such a positive general attitude of the public can be misleading, as the false assumption that any wind power project will be accepted, may be a consequence. In fact, *'many of the barriers for achieving successful* [RE] *projects at the implementation level can be considered as a manifestation of lack of social acceptance'* (Wüstenhagen, Wolsink and Bürer 2007, 2685). Despite the generally high support for wind power in the UK, for instance, only a small share of contracted wind power projects is actually commissioned (Toke 2002). According to Toke (2002) one might argue that there is a connection between the very small number of commissioned wind power projects in the UK and the fact that virtually no wind turbines are owned by local communities. Socio-political acceptance in the form of general public support for wind power seems to be different from *community* acceptance,

which denotes the specific acceptance of RE projects, including siting[8] decisions, in a local community, with main stakeholders being residents and local authorities (Wüstenhagen, Wolsink and Bürer 2007). In the case of high public support and implementation problems at the local level there seems to be a difference between the attitude of individuals towards wind power in general and their attitude towards wind farms in particular (Wolsink 2007a).

It is worth noting here that it might be appropriate to use a more 'positive' term when discussing the perceptions of the public with regard to wind power. The term *acceptance* in a top-down fashion assigns a somewhat passive role to the (local) actors 'affected' by a specific wind power development. The term might be rather misleading as it emphasizes wind power as some kind of intrusion into a local community that needs to be dealt with. Another term could be *support* since this is usually associated with more active and positive (bottom-up) attitudes. While *acceptance* of wind power may be a minimum necessary condition to achieve planning success, *support* may be even more desirable as it implies some degree of involvement of the public, and drastically increases the chances of successful planning. The term acceptance is used in the following sine it is the more common term in the literature reviewed in relation to this study.

Public Perceptions of Wind Power Socially Constructed

Bell, Gray and Haggett (2005) call the difference between a high public support for wind energy and the low success rate achieved in planning of specific wind power projects, the *social gap*. It can be assumed that the social gap is caused by a sufficient number of individuals, which in general have a positive attitude to wind power, but oppose a particular wind power development. This can be called the *individual gap* (Bell, Gray and Haggett 2005). This kind of behaviour of local residents has frequently been labelled NIMBY[9] attitude by decision makers, assuming that a purely selfish attitude together with the mere vicinity of a RE development causes a local community to resist, thus, implying a kind of unqualified behaviour among these local people (Wolsink 2006; Wolsink 2007a). The NIMBY label is often used as legitimization for not considering the actual arguments put forward by local people (Wolsink 2006). Instead, developers may be inclined to react with another simplistic attitude, which has been termed TINA[10] attitude (Upreti and van der Horst 2004).

One main type of criticism concerning NIMBY is that the label does not provide any explanation for the actual causes of opposition (Wolsink 2007a). On the contrary, *local opposition cannot be explained by the egoistical motives of local residents […] there is a complex relationship between the inclinations to behave in a NIMBY fashion and perceived negative consequences* (Wolsink 2007a,

[8] Siting decisions are decisions about the conditions (where?, how?, by whom?) for the installation of RE plants (windmills, biogas plants etc.).
[9] NIMBY: 'Not – in – my – backyard'.
[10] TINA: 'There – is – no – alternative'.

1203). In other words, there must be specific reasons that cause local residents to develop a negative attitude towards a wind power project. Understanding these reasons is crucial to understanding the nature of local opposition to RE projects, and thus is an essential step towards finding possibilities to ensure local acceptance of such projects.

Bell, Gray and Haggett (2005) offer three explanations for opposition to wind power developments at the project level. If a minority of people is able to make decisions – namely against the implementation of the project – the explanation can be a *democratic deficit*. It remains somewhat unclear in this explanation if the minority in this context is to be understood as a local group of opponents against the national majority of supporters. It can be argued that if the local community as a whole represents the minority, their reasons to oppose a certain wind power development may be regarded as more legitimate, than if it were a small group of opponents within the community (a minority within a minority) determining the project outcome. In this sense, a democratic deficit may be beneficial in protecting a local community from unfair developments.

Although people in general may support wind power, their support is not unconditional. In case the consequences of a certain development interfere with their personal values, one can speak of *qualified support* (Bell, Gray and Haggett 2005). The third explanation for the social gap, the *self-interest* explanation, may be valid if people unconditionally reject any wind power project in their neighbourhood. Bell, Gray and Haggett (2005, 465) compare this situation to a multi-person prisoner's dilemma, in which it is *collectively rational for the public good (wind energy) to be produced but it is individually rational for each individual to 'free-ride' on the contributions of others (not have a wind farm in their area)*. Only the latter of the three explanations may be the closest to the NIMBY concept (Bell, Gray and Haggett 2005; Wolsink 2007a). Interestingly enough, the findings of Maruyama, Nishikido and Iida (2007) indicate that self-interest behaviour of wind power opponents might be one motivation for other people to invest in community wind power.

Qualified or not, one very important reason for people to oppose wind power, when confronted with a specific development, seems to be the preservation of the value of the landscape (Wolsink 2007a; Wolsink 2007b Möller 2006). It is difficult to assess whether landscape issues actually determine people's attitude towards a project or whether they are used as arguments to increase the chances in winning the debate, as it seems that 'more profound' arguments are better accepted in public debates than reasons motivated by self interest (Bell, Gray and Haggett 2005; Rose and Suffling 2001). Due to the nature of RE technologies[11] annoyance factors, such as noise, light and shadow flicker, impact

[11] As indicated in the introduction, many RE technologies are characterised by a discrepancy between global benefits and local impacts.

on birds and impact on nature in the case of wind power, do, however, play a significant role at the project level (Wolsink 2007b).

In general, one should keep in mind that public perceptions of wind power are neither static nor that different individuals in a community will have uniform perceptions of the same project. In fact, Gross (2007) classified a community in New South Wales, Australia that was subject to her case study according to six categories: winners, losers, moral proponents, moral objectors, neutrals and silent majority. Only moral objectors and proponents were biased in such a way that the planning process would hardly influence on their attitude, and that the outcome of the project was the most decisive factor (Gross 2007). For the other categories it is very likely that issues of fairness and equity significantly influence their attitude – instead of NIMBY motives (Wolsink 2007a). In this regard Wolsink (2006, 87) notes that the *'imbalance between costs and benefits at the local and the individual level explains oppositional behaviour'*.

No matter what the perceptions of individuals of a new technology are, it seems to be clear that opinions of people will alter as soon as they are directly confronted with an application of this technology (Wolsink 2007a). Several authors have discussed the concept of *familiarity*, which is related to a decline of negative public perceptions of wind power projects over time (Pasqualetti 2001; Devine-Wright 2005; Wolsink 2007a). The level of acceptance can accordingly be illustrated in an U-shaped curve, where support for wind power will usually be high before a project in the neighbourhood is announced, will decrease considerably after the project proposal, and will be positive again some reasonable time after turbine construction. Devine-Wright (2005), however, in his review of empirical studies concludes that a simple, linear relationship between experience and perception is unlikely, and that the above concept, cannot be generalised. One can therefore not assume that all resistance to wind power projects will vanish some time after construction, independent from the type of the project. On the contrary, the announcement of a project seems to be a highly critical event, and maintaining positive public attitudes is crucial at this point.

The above considerations indicate that public perceptions of wind power are not only motivated by specific physical attributes of the turbines, but that contextual, political, socio-economic, social, local and personal aspects play a role in shaping the public opinion about wind power (Devine-Wright 2005). Thus, as Devine-Wright (2005, 126-127) argues, more attention needs to be paid to the socially constructed nature of this public opinion, by investigating *'how wind farms are developed as much as what is developed and how people come to make sense of the impact of an unfamiliar technology upon the places in which they live'*.

As mentioned earlier, this process of constructing local attitudes towards wind power is heavily influenced by the way individuals perceive *fairness* in decision-making, and *equity* with regard to the outcomes of a specific project (Wolsink 2007a; Wolsink 2007b). In line with Bell, Gray and Haggett's (2005) notion of the multi-person prisoner's dilemma Wolsink (2007a, 1203) notes *'that the crucial factor is not that residents have strong intentions to shift the burden to others, but that they consider it unfair that others, or the decision makers, shift the burden to them'*. This explanation further stresses the relativity in how physical annoyance factors are perceived; i.e. differences in planning processes and outcomes will yield different degrees of local support for similar wind power developments. Gross (2007) distinguishes two types of fairness that may be influential in this regard: *procedural*[12] *fairness* and *outcome fairness*. Outcome fairness is related to the judgement of an outcome against societal standards or common values (Skitka, Winquist and Hutchinson 2003); i.e. judging if the outcome will benefit the whole community. According to Gross (2007), it is likely that (perceived) fair procedures (i.e. decision-making processes) will result in (perceived) fair outcomes. In addition, *outcome favourability* is related to the personal judgement and preference of positive rather than negative outcomes (Skitka, Winquist and Hutchinson 2003). In some cases people tend to accept outcomes, formerly perceived as negative, if the decision-making process is fair, which is described as the *fair process effect* (Skitka, Winquist and Hutchinson 2003). Among the six categories of community members mentioned above, there are differences in which type of fairness has the greatest influence. Gross (2007, 2734) calls this *outcome bias effect, 'whereby people who stand to gain or lose (winners and losers) have a strong preference for a particular outcome and are therefore unlikely to view the fairness of the process impartially'*. In practice this means that while wind power supporters (winners) tend to view both the (panning) process and outcome as fair, there is a tendency that people with neutral or negative attitudes (losers) do not regard either of these as fair (Gross 2007). Gross (2007) furthermore concludes that winners and losers are likely to be created already during the planning process, as the interviewees in her pilot study assessed fairness before the planning decisions were known.

Conditions for Local Acceptance

As the fairness of the process outcomes seems to depend on the fairness of the process itself (Gross 2007), it is worthwhile investigating, which features add to the fairness of planning processes. According to Maguire and Lind (2003, 134) the primary principles of procedural justice (or fairness) include: the ability to express opinions freely and to be heard (voice); being treated with respect; being given adequate information; the impartiality of the decision maker; and the dependency of decisions on appropriate information. These principles are related to *public participation*, which is

[12] Following Wolsink (2007b) it could be suggested to use the terms *process fairness* or *decision-making fairness* instead, as perceived fairness is related to the actual decision-making process and not to the legal procedure as described in rules and regulations. These two processes will be different in reality.

one of the four variables involved in wind energy project planning, next to *network stability, public acceptance* and *planning success* (McLaren Loring 2007, 2649). For her case studies McLaren Loring (2007) developed indicators for each of the variables, and then assessed several wind energy projects according to those indicators. In addition, she investigated the relationships between the variables.

Her results (McLaren Loring 2007, 2656-2658) indicate that higher levels of participation tend to be associated with higher stability in networks of wind supporters, but not with higher stability of opposing networks. Furthermore, an increased use of participatory methods during the planning process may increase the public acceptance of the project, although it seems that participation is not a necessary condition for acceptance. This means that a lack of participatory methods might not necessarily be detrimental to the project. There seems to be a stronger correlation between project acceptance and planning success, as high levels of the former are related to high levels of the latter, also in case of the opposite. Thus, projects with high levels of participatory planning are more likely to be publicly accepted and successful. A stable network of project supporters does not seem to be a necessary condition for project success, whereas the presence of an organised opponent group can dramatically reduce the chances of project success (McLaren Loring 2007). This might imply that the absence of wind power opponents is more important than the presence of a supporting network. The question is, whether it is easier to gain support for a project than to convince the opponents. In other words, a question could be if the methods to obtain support for a wind power project the same as those that 'prevent' the formation of opposing networks.

The above sections indicate that there is a series of factors that have an impact on the degree of public support for wind power. This section is an attempt to give a summary of the most important conditions that need to be given or established in order to ensure a sufficient degree of public support. Bell, Gray and Haggett (2005) suggest different approaches for dealing with the three explanations of the social gap. To overcome the *democratic deficit* it might be appropriate to make use of a mixed system, in which both political measures (direct public vote) and more social measures, such as collaborative planning aimed at consensus building and public participation, are applied. One way of responding to the explanation of *qualified support* would be to modify key features of the wind power project, so that they would meet the specific support criteria of this group. Another way would be to modify, reduce or even remove the qualifications on people's support by trying to change their mind (Bell, Gray and Haggett). Wind farm opponents are often attributed with a lack of knowledge and misconceptions, thus being influenced by more personal or psychological factors (Wolsink 1988). While this may be true, it seems to be obvious that it is partly caused by developers and general wind power supporters, who either failed to provide information or misinformed the public (Bell, Gray and Haggett 2005). On the one hand there might be a lack of knowledge and appreciation of the significance of wind power with regard to a renewable energy policy, and on the other, the public

might lack knowledge with regard to specific (physical) impacts of wind power projects (Bell, Gray and Haggett 2005). It is therefore necessary to pay attention to the specific information needs of a local community, and build up trust through participatory methods, before information can be provided in an accessible and comprehensible way (Bell, Gray and Haggett 2005; McLaren Loring 2007).

Besides the type of *financial support system*, and the aforementioned *landscape* and preservation values, Wolsink (2007b) emphasizes the *planning regime* and the *degree of local ownership* as variables effecting positive wind power project decisions. In line with Bell, Gray and Haggett (2005) he underlines the decisive significance of collaborative planning (Wolsink 2007b). Apart from geographically varying landscapes and culturally varying preferences thereof, a lack of locally organized and popularly owned wind power, and a lack of political support for local collaborative approaches are accordingly factors that reduce the implementation success (Wolsink 2007b). Gross' (2007) list of local residents' suggestions to confer greater legitimacy on outcome could be seen as such an collaborative approach[13].

Community Wind Power, Public Participation and Local Support

In this regard, recent research stresses the need for involving the public in wind power developments, either financially, through collaborative planning methods, or both (Toke 2005; Hvelplund 2005; Szarka 2006; Toke 2007; Breukers and Wolsink 2007). It is interesting to note that according to Szarka (2006) the technological state of the art of wind turbines requires large-scale investments that can no longer be realised through small-scale financing and ownership. Thus, there is a need to find new ways of enhancing community participation and stakeholder involvement (Szarka 2006). Toke (2005), on the other hand, argues that community-owned wind power is not necessarily about 'small' projects, and that market-based schemes, such as the UK Renewables Obligation (RO), would actually establish favourable conditions for independent investors, such as cooperatives.

In response to wind power attitudes motivated by *self-interest*, straight-forward economic measures like financial compensation might already prove effective in increasing people's personal benefits, and thus their perceived utility (Bell, Gray and Haggett 2005; Wolsink 2006). Shareholding in community or privately owned wind energy developments could be a second response to the self-interest 'phenomenon' (Bell, Gray and Haggett).

[13] Gross (2007, 2734) collected suggestions according to the aforementioned primary principles of procedural justice (Consultation process, Information, Voice, Issues; Maguire and Lind 2003, 134). Suggestions included: an early and open consultation process; information that is impartial and concerns renewable energy in general; impact assessment reports should be available and conducted by independent authorities; meetings where all participants have a voice and that are restricted to local community residents; clear arguments for or against all issues related to the community.

The benefits of community-owned wind power schemes in this context are manifold and will therefore be briefly discussed in the following. To begin with, there seems to be a direct relation between ownership type and degree of local support for wind power developments. As the experiences from Denmark indicate, *'people seem to like wind turbines, when they own them, and are not annoyed by the noise and visual inconveniencies; especially when receiving a fair compensation'* (Hvelplund 2005, 237). This means that people's acceptance of wind turbines will depend on the extent to which some of the economic benefits of the development are given to the people who have to live with the impacts of these turbines (Hvelplund 2006). In practice, it is necessary to consider the economic as well as socio-political effects of community ownership, which both may have the potential to reduce local opposition (Bell, Gray and Haggett 2005). In case perceived financial unfairness is the cause of opposition, local ownership of shares may be a solution. If, however, a lack of control over the siting process is the reason, then a more comprehensive involvement of local people in the planning, development and management of the project may be more appropriate (Bell, Gray and Haggett 2005). As a matter of act, a combination of these principles may prove most beneficial as *'the community wind power system becomes highly effectual when there is a synergy between the people who set up the system and the people who participate in it'* (Maruyama, Nishikido, Iida 2007, 2764). Maruyama, Nishikido, Iida (2007) conclude in this regard that environmental, economic and social commitment may all be reasons for people to invest in wind power, and that community wind power offers the possibility to incorporate such concerns into a single project. Toke (2007) suggests that local ownership is associated with a mobilisation of local networks in support of wind power schemes at the planning level, and that local investment may have a higher deployment rate possible. Moreover, besides increasing support for existing turbines, community wind power seems to have the potential to generate positive attitudes towards even further wind power developments in the neighbourhood of local people (Andersen et al. 1997 cited in Krohn and Damborg 1999).

3.2 A Framework for Community Acceptance

In the sections above, several factors that influence public attitudes towards wind power in general, and wind power projects in particular, are discussed. In contrast to the assumptions associated with the NIMBY concept, wind power perceptions are socially constructed and depend on a variety of factors. These factors differ in type and significance between the various levels in society, essentially causing different attitudes on these different levels, also in the minds of individuals. Examples for these phenomena are the individual and the social gap, where a positive attitude towards wind power in general (social acceptance) conflicts with the rejection of a particular wind power project, resulting in a lack of community acceptance. Market acceptance is in this sense associated with the technical and economic feasibility of wind power.

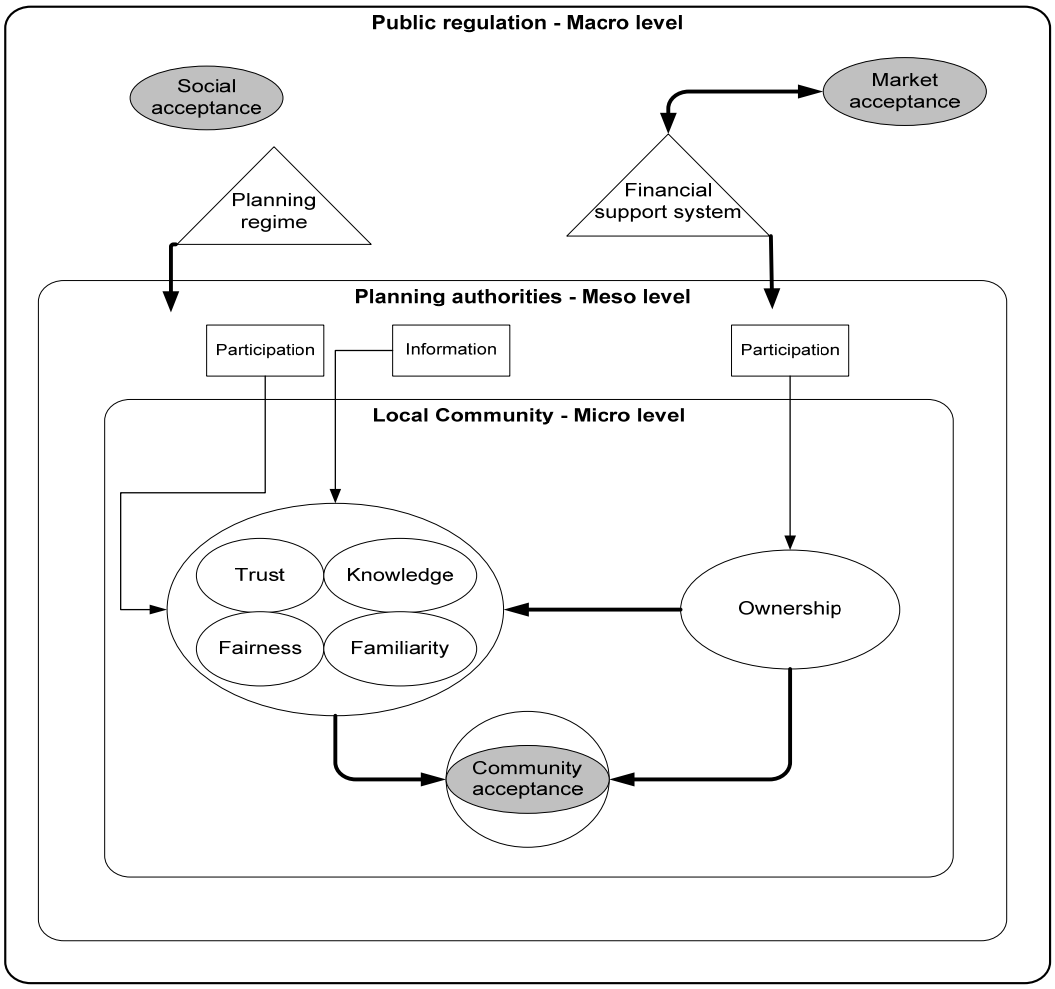

Figure 3.1 Multi-level framework for the social construction of community acceptance.

Figure 3.1 is one way to illustrate the conditions under which community acceptance[14] can develop. The starting point of this model is the intention to achieve public acceptance on the *micro level* in order to increase the chances of success of specific projects, as is discussed above (see McLaren Loring 2007). In detail this means that the majority of people in a local community should accept both the environmental and landscape impacts that the final installation will cause, and by this accept the overall wind power project. Bell, Gray and Haggett (2005) note that there is no absolute fix to the problem of the landscape impact of wind turbines. Relocating the turbines to offshore sites could reduce the visual (and other) impacts, but this will involve a significant increase in costs and therefore cannot be seen as a universal option. Another solution is to make sure that people's perception of the upcoming project will be positive. The processes that might help ensure such a positive perception are described in the following.

[14] The terms community acceptance and local acceptance are used here in a equivalent manner, although local acceptance certainly is not limited to communities. Community as a term is used in the model since it complements social acceptance and market acceptance, as introduced by Wüstenhagen, Wolsink and Bürer (2007).

On the *macro level*, public regulation provides the regulatory framework for the implementation of wind power projects. The degree of *market acceptance* on the macro level, influences the way in which *financial support systems* for wind power are set up. This means that favourable economic conditions will increase market acceptance of the technology. In an ideal situation a feedback loop will be created that helps policy-makers to adjust the support system for wind power according to the level of market acceptance, i.e. the stages of commercial maturity[15]. *Social acceptance* – although not only present at this level – is influential at this level as it has an impact on how policy makers see the necessity to design wind power support programmes. At this level, positive public opinion polls might be influential, as they indirectly might contribute to easing the decision-making process with regard to these programmes. As described earlier, it is necessary here to set up an appropriate *planning regime* that can channel the generally positive public opinion by defining actors and planning tasks at the *meso level*. Such a planning regime would for instance support collaborative approaches between actors at the meso level and the micro level. The understanding of the meso level can in this respect be based on the actor network discussed in Maruyama, Nishikido, Iida (2007, 2765), with the main actors at this level being planners (local authorities) and developers (builders). Together, planning regime and financial support system stretch into and determine the further processes taking place on the meso and micro level. On the meso level, this influence eventually manifests itself in the way the specific wind power project is planned and implemented. Finally, the *micro* level can be defined as a local community of individuals, affected by the project, upon whose attitude the success of the project depends.

With regard to the ultimate 'construction' of community acceptance on the micro level, the following assumptions are made. Public *participation* is not included as a factor as such on the micro level here. It is rather seen as an instrument or context through which some of the other factors are facilitated. *Knowledge* does not refer to the general knowledge about wind energy and its association with social acceptance, but it refers to the knowledge about the particular wind power project in the community, and its specific decision-making processes. *Ownership* is included as it is linked to direct economic incentives for the community, and because financial *participation* is very likely to increase community acceptance. The assumption is that people who (are willing to) own something are also willing to accept that possession. *Familiarity* obviously is a matter of time. Participatory approaches might, however, significantly shorten the period of low acceptance. Moreover, familiarity may be an important element in changing the minds of moral opponents over time. One might also associate familiarity with experience, where people may have more positive attitude towards new projects,

[15] The example of a multidimensional approach to (flexible) policymaking, developed by Foxon and others (2005), allows for policy responses according to the requirements of RE technologies at different stages of maturity. These stages include: Basic R&D and Demonstration projects (Pre-commercial), Supported Commercial and Commercial.

when they have taken part in some form of wind power development before. Ownership, familiarity and community acceptance may be closely related in this sense. *Trust* may have an influence, as people tend to better accept decisions taken by people they trust. Since people are likely to have confidence in the very decisions they contributed to, this factor can be built through participation as well. Together with trust knowledge may be one of the basic requirements for community acceptance, and they may have a mutual influence on each other. Trust may be needed to first of all acknowledge the information provided by developers, and knowledge can create trust, as the transparency of actions may help legitimize these actions and actors. Of course, information and knowledge can also prevent a 'shock' reaction that might be triggered when wind turbines suddenly 'appear' in people's backyards. *Fairness*, as discussed above, can refer to the fairness of the process and the fairness of the outcome with the likeliness of fair processes resulting in fair outcomes (see Gross 2007), and the perception that if the overall project is considered to be fair, it also is acceptable. Fairness is related to ownership and knowledge in a way that people owning (shares in a) wind turbine might consider it fair (or favourable) that they receive these economic benefits, and the more people are educated about the local (context) of the project and its benefits for the community, the more they might see it as fair.

It should be noted that trust, knowledge, familiarity and fairness in this model are seen as personal sociological constructs and may therefore differ in the perceptions of people. Due to their close relation with each other they are grouped together in the model. This means that trust and fairness, for instance, might be inseparable. On the other hand, all the factors illustrated within the micro level are variables not only in their dependence on individual judgements, but also in their significance for the construction of community acceptance. Clearly, while planning approaches, such as public participation have an influence on these constructs (factors) and thus on the attitude of people, people also construct their view on the same planning process through these factors, as expressed in the degree of acceptance. The planning regime and financial support system should be targeted at improving local attitudes towards specific wind power projects, but are also decisive for if there is a will to start these projects and the possibility of community *ownership*. As described above, the factors may also condition and influence each other. Some factors might be more important than others. For most people ownership and especially some form of financial benefit might be more important than participating in the planning process. For this reason ownership is included as a separate factor. Participation through local ownership certainly influences people's view of the planning process, and thus acceptance. In return, once trust and a perception of fairness are established, people might be more inclined to also own parts of the project. Also, the pattern of acceptance in a community may not be uniform (see Gross 2007). Moral proponents might almost unconditionally accept the project beforehand, while the negative attitude of moral opponents might not be changed by whatever kind of planning procedure.

Since opinion polls from many European countries indicate a general positive attitude towards wind power, it is assumed here that the majority of local communities does not consist of moral wind power opponents, but that there is at least a 'silent' or 'neutral' majority before local projects are started. This assumption makes it likely that in most cases the attitudes of people can be influenced by the planning procedures to some degree. The model described here suggests how this influence on public attitudes may come about. It is likely that the factors mentioned here have a positive influence with regard to building community acceptance because they can be seen as being associated with the perception of *closeness* to the project. In this respect, *physical closeness* is related to landscape value and visual aspects, i.e. vicinity to the turbines, and closeness to actors and planning processes, which is created by participatory planning, could be called *mental closeness*.

3.3 Summary

In this chapter a theoretical approach towards understanding wind power acceptance is taken. Previous research has identified a variety of factors and processes that influence the way in which social perceptions of wind power are constructed. The framework presented above offers a way to combine and link these previous results into one model. Based on this model the following concluding remarks can be made:

- The deployment of wind power has become a complex planning process. It is suggested here that this process takes place on three different levels. These levels are interlinked, and it is necessary to systematically analyse the linkages between them in order to understand the final outcomes of the planning process. This means that the three levels need to be considered as a whole, when certain wind power developments are to be planned.

- General public support for wind power does not mean that all wind turbines are locally accepted as well. At the same time, local resistance towards wind power projects cannot simply be labelled as the behaviour of 'selfish' opponents (NIMBY). Instead it is necessary to analyse factors such as fairness, trust, knowledge and familiarity in order to really understand the reasons for people to object against or support a specific project. These factors crucially influence the way people perceive a development in their neighbourhood.

- Ownership is an important factor for the whole system, as the way wind turbines are owned determines how costs and benefits are distributed between the three levels. While the benefits, such as CO_2 reduction and decreased oil dependency, are obvious

on the macro level, it is necessary to compensate for the impacts that affect the micro (and meso) level. Distant ownership without compensation may be detrimental to community acceptance, as not only the political benefits, but also the financial ones stay outside the local community. Thus it is necessary to find forms of ownership that distribute costs and benefits evenly between the three levels.

- The degree to which a community participates in the wind power development has an influence on how well to project is accepted by this community. Participation has an impact on how people perceive the planning process by stimulating the factors knowledge, trust, fairness and familiarity. Financial participation is closely related to ownership, and may be the final but not necessary product of participatory planning[16]. McLaren Loring (2007, 2650-2651) defines six indicators for community participation, which may be of relevance at different phases during the project. They are illustrated in Figure 3.2 in relation to the possible course of a planning process.

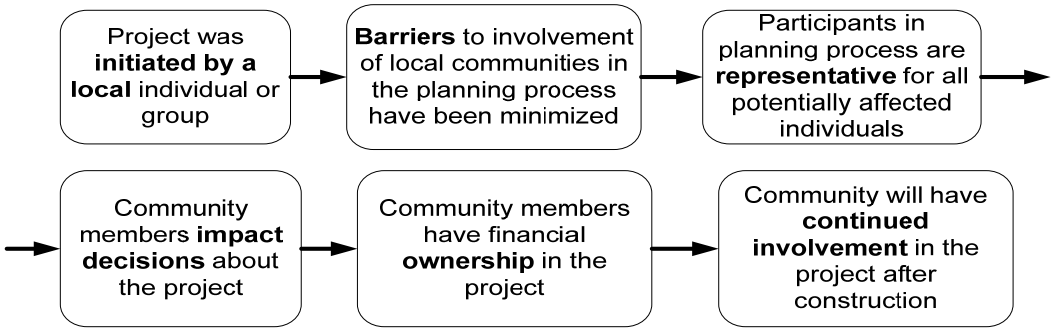

Figure 3.2 Six indicators for community participation in wind power developments. Based on McLaren Loring (2007).

In the next chapter the factor of ownership is discussed in detail in a Danish context.

[16] As indicated earlier, people might already accept a project as long as they feel well-informed, and may have the chance to impact planning decisions – without necessarily owning the final product.

4. Wind Power and Ownership

This chapter highlights the historical development of Danish wind power with regard to different forms of ownership. These existing, general ownership forms and the motivations behind them are briefly described. In the second part the focus is on forms of co-ownership. It is discussed how new forms of co-ownership may meet the challenges that the second phase of wind power development poses.

In the previous chapter the relation between ownership and local acceptance is elucidated. Just as local acceptance, also ownership is context-dependent. In the beginning of this chapter the ownership structure in relation to the historical context in Denmark is therefore briefly discussed. In the second part a more abstract look at new forms of co-ownership is taken.

4.1 Public Acceptance and Ownership in Denmark

Wind Power as Societal Movement

As indicated in the introduction, wind power development in Denmark can be characterised as a societal movement that supported both individual (mainly farmers) and cooperative ownership of wind turbines (Szarka 2004). This was enabled by the favourable interplay of *top-down planning* and *bottom-up activism*. Well-designed public policies that managed to combine national energy demands with requirements of local development can be seen as such a top-down approach. An example is the forwarding of 'feed-in tariff' agreements between wind electricity producers and power companies that fulfilled two policy objectives. One was related to security of supply and oil price shocks, along with a more environmentally friendly configuration of the energy sector. The other was related to industrial policy, where wind power development could help accelerate the shift from an agricultural to a manufacturing and service based economy (Szarka 2004). Bottom-up approaches had *'their roots in a rural economy characterized by a self-help ethos, pragmatism and technological incrementalism'* (Szarka 2004, 321). This created a local understanding and anchorage with regard to wind power. Szarka (2004, 325) notes that probably due to this kind of pro-wind societal consensus (or social acceptance for that matter), the activities of anti-wind organisations, such as 'Neighbours against Windmills', seemed fairly limited. According to Toke (2002) the Danish decision-making system for wind power development was mixed in a way that many *matters* were decided locally, and many *rules* were set nationally. Local authorities, for instance, had discretion over choice of sites for wind turbines, and whether cooperatives were going to be formed and how they were going to be managed was decided on a local level. Determining the size of permissible shareholdings per co-op member, prices for electricity produced from wind power and obligation of local authorities to find sites, on the other hand, was subject to national decision-making (Toke 2002).

Recent Planning Issues

Local planning authorities play a decisive role with regard to planning of new wind energy applications (McLaren Loring 2007). Their task is rather substantial, as they *'must balance the needs and views of the local public with the broader national targets and guidance for renewable energy developments'* (McLaren Loring 2007, 2648). In Denmark it has since 1994 been the task of local authorities to find new sites for wind energy developments within the framework of longer term municipal planning (Toke 2002; Nielsen 2005). Already before the change of government in 2001, however, national authorities began to focus their planning activities towards offshore wind power, and regional authorities did not see it as urgent to find onshore sites anymore (Holmsgaard 2007). In 2004 it became apparent that in relation to the Srapping Regulations (Skrotningsordning[17]) new onshore sites for wind turbines were still necessary. Therefore, municipalities have been asked again to make local plans for siting wind turbines in their area. This has in recent years conflicted with restructuring reforms at the regional and municipal level leading to delays in finding new sites. Thus, finding appropriate sites for wind turbines, besides economic insecurity, was until recently a major limiting factor in Danish wind power development (Holmsgaard 2007). This problem is emphasized by the fact that basically the only way for developers to currently get planning permission is by being part of the Scrapping Regulations (Bjerre 2007).

As discussed in Chapter 3, the phenomenon of the social gap can be one explanation for implementation difficulties at the project level. Although the social gap has practically been non-existing in Denmark, there are a few signs indicating that this issue may be of greater significance in the future. Recent opinion polls show that the majority of the population has a positive attitude towards the 'giant mills' of the future – less than towards wind power in general, though (Andersen 2007a; ACNielsen A/S 2006). These positive results might be attributed to the fact that the majority of people have not experienced the neighbourhood of a giant windmill yet (Andersen 2007a). When it comes to specific projects some cases of rather strong local resistance recently have entered the media. One example is the town Kappel on Lolland, an island in Southern Denmark, where more than 1.000 citizens are protesting against a project by DONG Energy, involving the erection of 9 large windmills. This happened although the local population had lived with a considerable amount of wind turbines on their island throughout the last couple of years (Andersen 2007b). One might argue that this somehow contradicts the factor of familiarity discussed in Chapter 3, but there may be two other factors that can explain resistance in this case. First, summerhouse owners are concerned about a decrease in value of their property due to the visual impact of the new turbines, and secondly, the fact that the project developer up until now does not involve the local community in the project and its economic benefits (Andersen 2007b). In fact, the value of property adds another, somewhat measurable, side to the landscape value factor, and underlines the need for at least a minimum of

[17] See Økonomi- og Erhvervsministeriet (2004)

financial involvement of affected citizens. In the above case people are complaining about not receiving a compensation for the loss in property value (Andersen 2007b). The above case is an example for how characteristics of the second phase of Danish wind power development

Ownership Structure

The historical structure of ownership for wind turbines in Denmark can be illustrated according to four basic forms. Figure 4.1 illustrates the distribution annually installed, new capacity according to the ownership forms, which are this discussed in the next subchapter. The fourth type, denoted as *other*, mainly includes municipalities and local utilities that have invested in wind power installations.

From Figure 4.1 it can be seen that cooperatives were the dominant form of ownership in the first 10 to 15 years of Danish wind power development. Although wind power at that time still was a niche technology in terms of contribution to overall electricity production, it was publicly well accepted when its major expansion began. One of the main reasons for this was this large degree of cooperative ownership (Hvelplund 2006). Until the middle of the 1990's the annual increase in wind power capacity was fairly moderate. The removal of the ownership restriction made it possible to own shares in wind turbines, which were not located in one's own community. This together with the legally guaranteed feed-in tariff might have been the main reason for a drastic increase in individual ownership until the year 2000 (DVF n.d.). In addition to the previous individual farmer type, efforts by private developers were presumably responsible for the increase in this category. This strong capacity increase also meant that wind power became a rather costly business for the state (Holmsgaard 2007). The announcement of a new tariff system after 2001, involving a lower payment rate per kWh, led to another increase in additional wind power capacity. It should be noted that there has not been made a systematic registration of ownership forms for wind turbines after 2002 (EMD 2006). With regard to cooperatively owned offshore farms, such as at

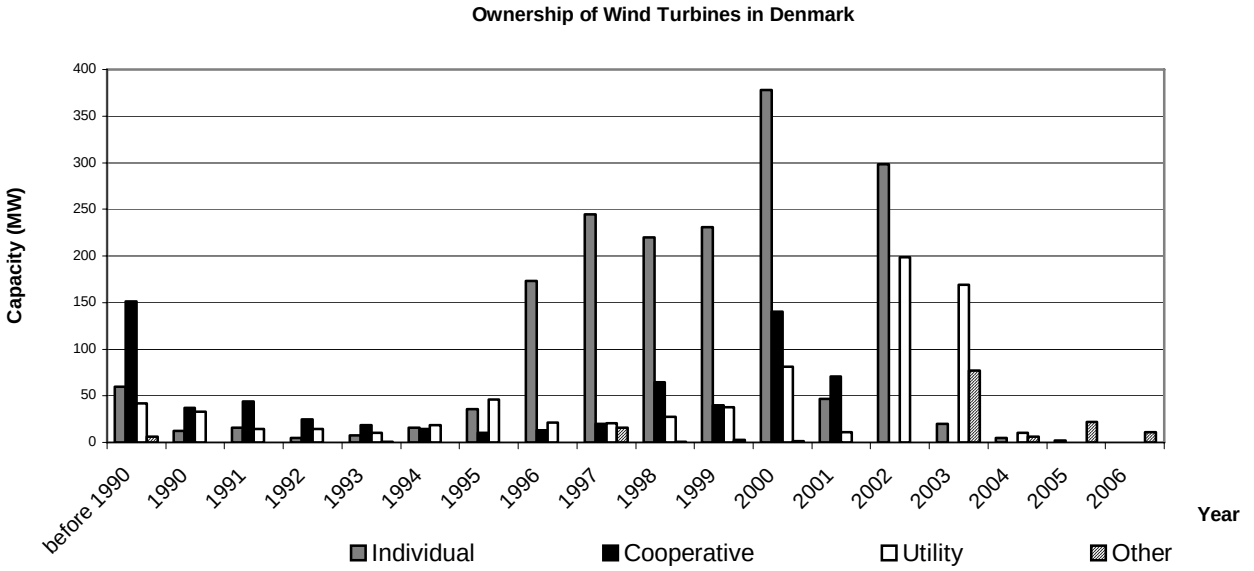

Figure 4.1 Annually installed wind power (in MW) according to ownership type. Based on EMD (2006).

Middelgrunden and Samsø, different statistics might list them in different categories, due the fact that also utilities and municipalities hold shares in them. The increase in utility owned wind power in 2002 and 2003 coincides with the construction of two utility-owned offshore farms at Horns Rev and Nysted/Rødsand. Due to the fact that there have not been any drastic increases in wind power capacity after 2002, it can be assumed that although there has not been a systematic registration the current ownership structure for wind power has remained stable since 2002. Figure 4.2 reflects the current ownership structure for wind turbines in Denmark.

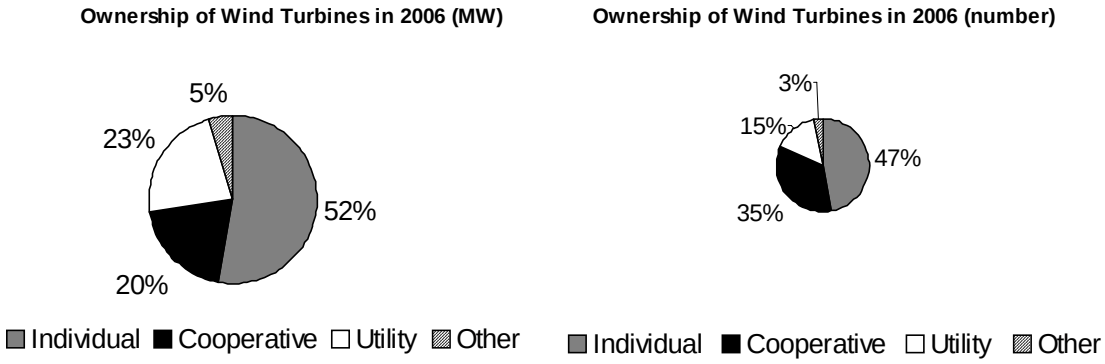

Figure 4.2 Shares of the four ownership types in total wind power figures as of 2006. Based on EMD (2006).

Figure 4.2 illustrates that individual forms of ownership are dominant both with respect to overall capacity and number of turbines. While cooperative ownership contributes to 20% of total wind

power capacity, every third wind turbine in Denmark is cooperatively owned. This difference can be explained by the smaller size and greater age of these turbines, which mainly were installed before the ownership restriction was abandoned. Individually and utility owned turbines were mainly installed after 1995, meaning that there are fewer and bigger turbines due to the technological progress.

Toke (2005) suggests that due the ownership restriction the perception was created that cooperatives and farmers should own smaller projects, whereas large projects should be carried out by utilities. This perception may be reflected in the fact that only a minor share of wind turbines built after 2001 is cooperatively owned. As mentioned above, one hindering factor for recent cooperative wind power development may certainly be the currently planning limitations of the Scrapping Regulations (Bjerre 2007). Together with the abovementioned problems in finding appropriate sites onshore this may well have inhibited wind power development, as planners need to obtain a scrapping certificate before getting permission to build. Such a certificate will usually be obtained by purchasing smaller, older turbines first, since replacing these is one of the main intentions behind the Scrapping Regulations. As described above, most of these turbines belong to cooperatives and farmers. While farmers might be satisfied with the financial benefits of selling their old turbine – and in fact their turbine site – to a distant developer, the same practice might undermine the very principles of local cooperatives. People may have accepted and supported turbines developed and owned within their community, but they might oppose bigger turbine projects by individual planners from outside their community. As a planning authority it is the task of the municipalities to ensure local support for these projects, but what is also needed are local ambassadors rooted in the local community that can help build up a feeling of *responsibility* regarding energy issues among the local population (Bjerre 2007).

4.2 Existing Forms of Ownership

The figure below illustrates the 5 existing forms of ownership that that can be identified in the Danish system. These forms are classified according to who owns the shares in the wind power installation. These ownership forms are briefly described in the following sections

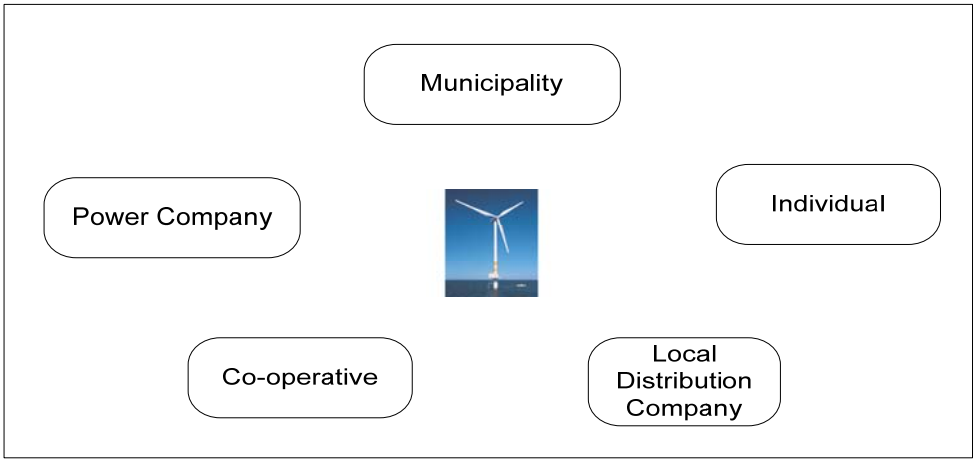

Figure 4.3 Existing forms of ownership for wind turbines in Denmark.

Individual Ownership

This form involves a group of or single private investors that own one or several wind turbines. The actors mostly are private people or companies. These actors cover the full investment costs, and all financial benefits of the project belong to them. The reasons for these actors to invest in wind power may be as different as the people themselves. Since the main things that 'can be done' with wind turbines are to produce and sell clean electricity as well as to test and develop the technology, financial profits, environmental concerns or straightforward entrepreneur-/craftsmanship may, however, be among the main reasons for these actors to invest in wind power. Another reason especially for farmers to invest might simply be because they can provide the site. This means that they might see another possibility of earning money with the land they own. While farmers (or anyone owning a piece of land) may be both *owner* and *host* of the turbine, they might consequently also rent or sell their land to other developers.

Cooperative Ownership

A cooperative of (electricity) consumers can be defined as *'a business owned and democratically controlled by consumers to provide themselves with goods and services on a not-for-profit basis'* (Hoyt 2004, 265). Wind power cooperatives are organisations, whose members hold a certain amount of shares in the wind turbines, which the cooperative collectively owns. This means that, profits from electricity production stay within the local community, similar to the above owner-host farmer type. Membership in the cooperative is voluntary and based on a relatively small financial investment in the wind project. This gives the member a say in the running of the project and a share in the profits (Toke 2002). Cooperatives can fulfil several purposes. One is to offer members the possibility to buy shares corresponding to their annual electricity consumption, and thereby have their consumption (virtually) covered by clean electricity. Economic incentives may be another reason for members to invest, but are of minor importance as the revenue in most cases is limited. Profit maximisation is also

not likely to be a main purpose of a wind cooperative since the possibilities for 'increasing' the output of wind turbines are rather limited (Hvelplund 2005)[18]. The electricity price would thus have to be increased, but this would reduce the utility of the consumer good, in this case being electricity (Hoyt 2004). Following Hoyt (2004) it can be suggested that cooperatives also offer a number of non-economic benefits, and may have environmental, social as well as political goals. Cooperatives initially may form in response to market failures, such as high prices and poor or unavailable services (Hoyt 2004). The oil price shocks in the 1970's may be examples for such market failures. Hoyt (2004) also shows that many (food) cooperatives nowadays mainly want to create a community, in which *social trust* can form, which can inspire engagement and further cooperation. These issues are related to the notions of trust and community acceptance, as presented in the previous chapter. Ensuring a community's influence and control over (local) electricity production may be another aim of cooperatives, giving a more active role to consumers. In general, wind power cooperatives may offer an alternative way of providing electricity, as their primary goal *'is not to maximize return on invested capital […] but also to provide the […] service in the best manner possible'* (Hoyt 2004, 280).

Power Company

This type of ownership involves the establishment of a wind turbine or wind farm by a public utility company or grid operator, in case these are separate enterprises. The main characteristic of these actors is that they are national or multinational enterprises, which have to compete with other large utilities on national or international markets. They are responsible for a large-scale supply of electricity, and therefore usually rely on rather substantial long-term investments in power production based on established technology; i.e. mainly fossil fuel and nuclear energy. Since almost half of the costs of such power plants are fixed costs, the economic profile of these actors may be characterised by considerable amounts of sunk costs (Hvelplund and Meyer 2007). Power companies are therefore interested in achieving a high return on investment and thus in yielding economic prices for the electricity they produce. This may lead to problematic situations, in periods when a surplus capacity of wind power leads to a decrease of the electricity price on the market (Morthorst 2006). Moreover, wind power is characterised by an even higher ratio of investment costs over running costs (Hvelplund 2006), which further reduces the price elasticity compared to traditional power production. This might mean that even if a single wind power project in itself is economic the 'price effect' might cause it to have adverse effects on the overall business. One might tend to assume that a power company rather chooses to build a wind farm, instead of risking that other actors invest in even

[18] Compared to, for instance the large-scale U.S. Retail Food Cooperatives (see Hoyt 2004), most inland wind power cooperatives are not (yet) 'full' cooperatives since they do not directly produce electricity for own consumption, but feed it into the national grid. Furthermore, they do not set the electricity price. A closed local system based on the cooperation between consumers, the local utility and the local grid operator could be considered as such a 'full' cooperative.

more ‘detrimental’ capacity. The power company could thus maintain some control over the development and keep the capacity increase ‘reasonable’.

In order for power companies to voluntarily invest in wind power, the economic incentives, such as wind power tariffs, need to be high. Offshore wind power, for instance, may offer a satisfying economy of scale for these actors. At the same time, their experience with large-scale electricity production as well as their R&D capacities can make them important investors with regard to these large projects. Although it may require long political discussions and planning procedures, power companies in theory are one of the few actors to provide some investment security for large-scale wind power applications. This is due to the fact that they have sufficient equity capital, which is otherwise invested in the existing infrastructure, or they can make investments ‘off the balance sheet’ (Toke 2007). Another, and possibly stronger, incentive may be the granting of CO_2 quotas to a power company in exchange for the construction of wind farms. But this would of course require some kind of agreement between state and company to ensure that the turbines are actually built. Finally, an incentive may be pure interest in technological innovation on the side of the company’s researchers and engineers. In summary, it is difficult to say if a power company generally is interested in investing in wind power. This depends very much on the economic setting. For the purpose of this thesis it is assumed that power companies in theory have the capacity to invest in large wind power applications, such as offshore farms.

Local Distribution Company

The distribution of electricity in municipalities in Denmark is either organised by the municipalities themselves or by consumer-owned local distribution companies. Also power production used to be the domain of local distribution companies and municipalities. Local power plants, however, are increasingly sold to the power companies. Local distribution companies are important actors, as they maintain the local grid, and consequently might have to deal with the local integration of wind power. While they might have an economic incentive in investing in wind power, they also have technical competence and are at the same time rooted in the community or region.

Municipality

In this model a public authority on the municipal or regional level owns the wind turbines. There may be several reasons for a municipality to invest in wind power with local or regional development certainly being the major reason. Since municipal authorities will have to deal with the siting of wind turbines in their area anyway, it might as well be convenient for them to financially participate in the project. Municipalities might in general be positive towards wind power developments, as part of the income from selling the electricity is taxed and stays within the municipality. On the other hand it is important to consider that municipalities located in areas with favourable wind conditions will

naturally ‘receive’ a relatively higher number of wind turbines. In these cases it is necessary to balance the financial benefits for the municipality with the relatively higher impacts on the local community.

4.3 New Forms of Co-Ownership

In this subchapter a rather abstract discussion of new forms of co-ownership is presented. The main assumption for this discussion is that different locations provide different contexts for wind power developments, mainly due to their geographical features. In addition, the second phase of wind power development represents a new context at each of these locations.

The second phase of wind power development in Denmark will require a second phase of ownership in order to meet the challenges that arise in relation to the development of the technology and the changing institutional framework. In addition to *local acceptance* and *investment security*, contribution to *regional development* may be another requirement that has to be met in order to implement wind power projects successfully. The significance of these requirements also depends on the particularities of the wind turbine site. In the discussion of the community acceptance model in Chapter 3 emphasis is furthermore put on the *equal distribution of costs and benefits* between the macro, meso and micro level. New forms of ownership should fulfil these requirements to provide an optimal set up for wind power developments. Below it is suggested how the existing five forms of ownership could be combined to fit the requirements of particular wind power projects. It is distinguished between four co-ownership types according to four general categories of sites. These categories are: inland, offshore, coastal-offshore and island. Although it may theoretically be possible to combine all the five basic ownership forms, this is hardly imaginable in practice. A local distribution company, for instance, is often closely associated with a municipality or region, and thus it is not necessary to have them both as main shareholders in one co-ownership model. For this reason not all possible combinations are discussed in the following.

The Inland Model

In this context inland locations can be defined as sites on the Danish main land (Jutland) and major islands (Sealand, Fyn) with a number of municipalities on them. Municipalities are relatively large and may be characterised by a variety of different landscapes. At inland locations it is therefore necessary to assess several sites according their specific features with regard to visibility and sensitivity (BirkNielsen 2007). Due to the future tendency towards more centralized wind farms and the present difficulties with finding and/or permitting sites for wind turbines, it can thus be assumed that careful siting and local acceptance are the main requirements for successful implementation of inland wind power. Second phase wind power means possibly higher costs at meso and micro level, in the form of planning challenges and (landscape) impacts. Appropriate planning and local

involvement are necessary to meet these requirements and to balance possible cost-benefit disequilibria. The combination of cooperative and municipality offers possibilities to find appropriate turbine sites in the community, and at the same time have a maximum of local support for the project. It furthermore ensures the involvement of other interested parties, such as nature protection agencies. Alternatively, a local distribution company can give technical support. Through its local anchorage the Inland Model also offers possibilities for regional development, which is desirable in remote areas. Compared to the Offshore Model, for instance, investment security has not the same priority, and the later involvement of Individual owners could cover possible financial bottlenecks. The combined ownership of a cooperative and a municipality or local distribution company can guarantee local acceptance through a compensation for the increased impacts on the local level, due to increasing turbine sizes. This means that the benefits on a macro level, which are a higher wind power capacity with bigger and possible fewer turbines, are balanced with the impacts of theses bigger turbines at the micro level. A suggestion for the Inland Model is illustrated in Figure 4.3.

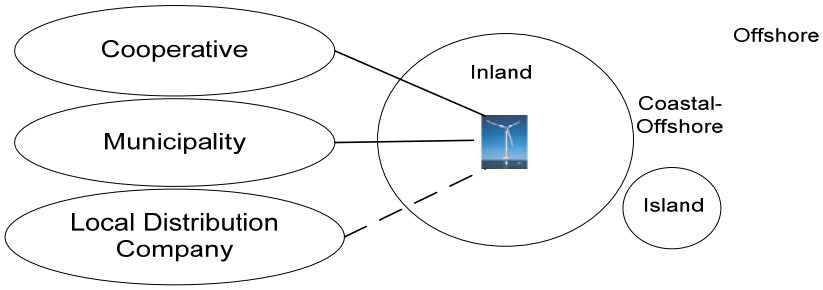

Figure 4.4 The Inland Model of Co-Ownership.

The Offshore Model

Offshore wind turbines are characterised by a large distance to the shore, and therefore by a very low visibility. Due to larger size of the turbines and the necessity for long-distance grid connections, investment security is one of the main challenges for offshore wind power. Due to the distance to local communities, general social acceptance is likely to be more important than local acceptance. Due to the scale and remoteness of the wind farms it also more likely that these projects are more significant for the national economy and political goals than for a particular regional development. This means that offshore wind farms represent both, high benefits and costs at mainly the macro level. Power companies may be one main important element in this model because of their financial and technical capabilities. Selling shares to individuals may be a way of involving the national public. This can also increase investment security. Additionally, cooperatively owned offshore turbines might help raise awareness among the public and ‘desensitize’ them with regard to large turbines. In this way people might be better prepared for applications in their own neighbourhood. The Offshore Model is illustrated below in Figure 4.4.

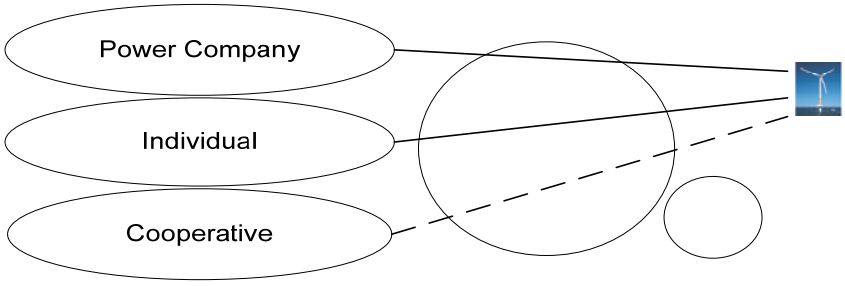

Figure 4.5 The Offshore Model of Co-Ownership.

Coastal-Offshore Model

Coastal-Offshore locations can be defined as sites of offshore wind power with a relatively short distance to the shore. This model can be seen as an intermediate model between the Offshore and the Inland Model. Local acceptance still is important because the turbines may be visible, especially if they are erected at harbour sites or close to recreational areas. In bigger cities people may be rather sensitive towards visual impacts in the harbour area, especially if it has cultural value. Depending on the size of the city it may be necessary to gain local or even regional acceptance. This can be achieved by a cooperative, where shareholders come from the wider region of the city. Local acceptance is also necessary where coastal landscapes are used for recreation and tourism. Turbines might be significant in scale, and therefore cooperation with the local distribution company or the power company is necessary. This cooperation may also be necessary because an offshore grid connection needs to be established. Furthermore, investment costs are likely to be higher than at inland locations.

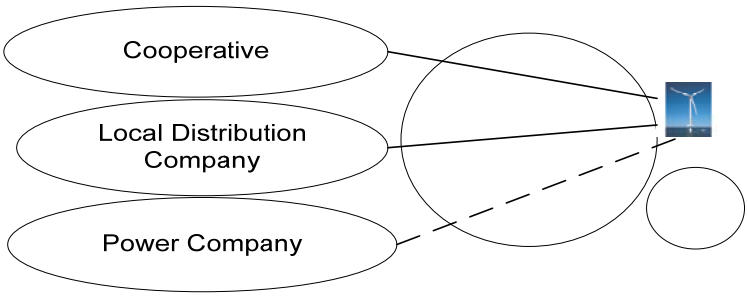

Figure 4.6 The Coastal-Offshore Model of Co-Ownership.

Island model

Island locations are characterised by a limited geographic dimension, and the presence of one or few municipalities, such as there is the approximate image of one island equals one community. On smaller islands landscape variability is lower, which limits choice of alternatives in wind turbine siting. No matter if landscape sensitivity is high, it is easier to make siting decisions – independent if for or against the project. The Island Model, as illustrated in Figure 4.4, is similar to the Inland

Model, except that its geographical scope is stricter defined. Regional development is crucial for an island's community. Moreover, many islands in Denmark have a good wind profile for both inland and offshore turbines. That means that in case investments in both types are planned, local acceptance is even more crucial. This is true also because an island's landscape often is considered unique, and one income source is tourism. Both, these landscape concerns and the need for regional development make municipalities an important part of this model. It seems also natural to offer all inhabitants the possibilities to own shares in the turbines to be erected on 'their' island. In some cases there might not be enough islanders to cover all of the investment costs. In this case the geographical scope of the cooperative could be broadened, or shares could be sold to individuals.

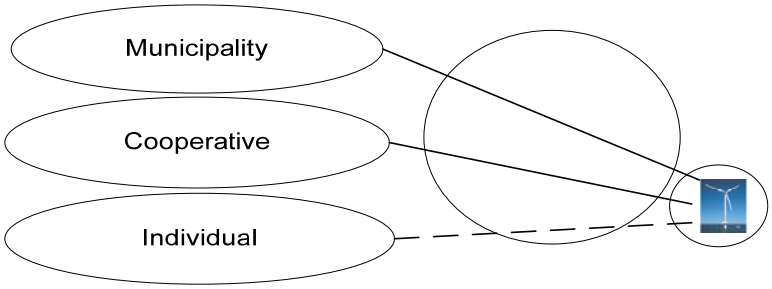

Figure 4.7 The Island Model of Co-Ownership.

It can be added that the combination of several ownership forms of the same type in one co-ownership model might also be an alternative. Several municipalities in one region, for instance, might together establish a large centralized wind farm in their area. It is hard to estimate in what way this would influence local acceptance in the 'receiving' municipality, but it would certainly add investment security to the project. Several cooperatives being involved in one project may be another alternative, but it would probably make more sense to combine these into one regional or national cooperative. This, however, would probably involve an intensive 'acquisition effort' to ensure the investment through gaining a sufficient number of members. It might furthermore even be a necessity to involve more than one (international) power company in large offshore projects, to ensure that the wind farm is established, in case one power company leaves the project (Stenvei 2007).

4.4 Summary

In the beginning of the chapter it is described how a general social acceptance for wind power in Denmark emerged in history. This acceptance is reflected both in public regulation and cooperative ownership. The importance of local initiatives and cooperatives for the early development of wind power is also reflected in the way the majority of new wind turbines were owned until the 1990's. A changing institutional framework for wind power on the macro level significantly changed the ownership structure towards more individually owned turbines in the second half of the 1990's.

Today the dominant form of ownership is Individual, with around 50% of the wind turbines and wind power capacity being owned individually, while cooperatives still are a significant form of ownership. In recent years utility-owned turbines gained in significance through the establishment of offshore wind parks. Besides the general slow-down in wind power deployment, the Scrapping Regulations from 2004 did not result in a significant development boost. This is related to the delays in finding new turbine sites in the municipalities. This situation calls for a stronger involvement of actors at the meso level, and at the micro level, because it is primarily smaller, meaning farmer- and cooperative-owned turbines that are subject to the 2004 agreement.

The second phase of wind power development is not only challenging with regard to public regulation, but also with regard to cooperative ownership. This is illustrated by the example of the Scrapping Regulations. There is a tendency that cooperatively owned turbines will be 'removed' first, thus taking away one supporting column for wind power in Denmark. When looking at the existing forms of ownership it becomes apparent that different actors have different motivations for investing in wind power. It is necessary to investigate these motivations to understand which role they can play in different contexts. Different geographical locations provide theses kinds of different contexts, and the motivations of one actor might be better suited with the requirements of a particular location than the motivations of another actor. Moreover, the capacities of actors to meet the requirements of the second phase of wind power development in different geographical contexts vary significantly. It is thus rather unlikely that there can be found one universal form of ownership that is suitable for any situation. On the contrary, carefully designed ownership models, in which the 'strengths' of actors are combined to meet the challenges of a location, are one way towards successful wind power developments.

In this chapter four suggestions for such new forms of co-ownership are introduced. In the next chapter two cases are presented, which represent two of the new co-ownership forms discussed here.

5. New Forms of Co-ownership in Denmark

The purpose of this chapter is to investigate how two of the new forms of co-ownership presented in the previous chapter may look in practice. For this reason two cases in Denmark are described and discussed. Attention is paid to how difficulties during the planning process were overcome and how local acceptance was ensured.

The two cases presented in this chapter are the Middelgrunden Wind Farm Cooperative in Copenhagen and Samsø, winner of the Renewable Energy Island Award in 1997. Both cases are relevant in the context of this study for two reasons. First of all, they are characterized by wind power installations that are considerable in size and capacity, and which have started production relatively recently. The cases are therefore relevant examples for the second phase of wind power development in Denmark. Secondly, new forms of ownership are involved in both cases. These new forms can be described as the island model as well as the coastal-offshore model, as discussed in the previous chapter. It should be mentioned that new forms of co-ownership have neither been implemented on inland sites nor offshore, yet. The experiences from Middelgrunden and Samsø thus may be valuable in the future, when new forms of ownership will be discussed for these sites.

5.1 Middelgrunden

The Middelgrunden Offshore Wind Farm (Middelgrunden) represents a special situation, due to its vicinity to a large city. Compared to other forms of coastal-offshore wind power Middelgrunden is less part of a natural landscape, but more an integral part of the cityscape. In a city, regional development may often be less important than in rural communities or on islands, thus eliminating one reason to establish a wind farm there. Due to the scarcity of space in a city, recreational areas and open spaces may have a higher significance than elsewhere in the countryside. Furthermore, it can be assumed that there will be a strong representation of interest groups. Establishing a wind farm of the coastal-offshore type close to a city will therefore involve significant political debates and a long planning process. The absence of direct neighbours may on the other ease the small-scale siting decisions.

General overview

The Middelgrunden wind farm is located on the Middelgrunden shoal that lies a few kilometres outside of the centre of Copenhagen. Middelgrunden consists of 20 turbines, which have an installed power of 2 MW, adding to a total installed capacity of 40 MW. The total height of the turbines is 102m and the expected annual electricity production amounts to 100 GWh (Vikkelsø, Larsen and Sørensen 2003). The wind farm started production between December 2000 and March 2001 after a planning process that had taken more than five years. Middelgrunden provides around 4% of the

electricity that is used in the city of Copenhagen. In relation to the national energy policy on the *macro level*, the wind farm means benefits in the form of 81,000 tons of virtually avoided annual CO_2 emissions[19] (Vikkelsø, Larsen and Sørensen 2003, 12). In 2005 the Midelgrunden Coop had been the largest wind farm based on cooperative ownership in the world (Larsen et al. 2005). The location of Middelgrunden is illustrated in Figure 5.1.

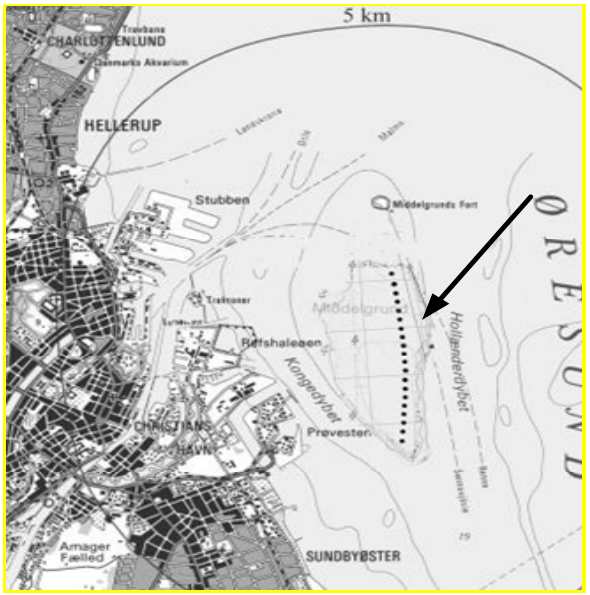

Figure 5.1 Location of the Middelgrunden Wind Farm. Retrieved from Middelgrunden Wind Farm Co-Operative (2001).

The total annual electricity production of the wind farm is expected to be 100 GWh during a normal wind year (Vikkelsø, Larsen and Sørensen 2003, 2). Between 2002 and 2006 the ten turbines owned by the Middelgrunden Wind Turbine Cooperative (Middelgrunden Coop) on average produced around 45 GWh of electricity per year (Middelgrundens Vindmøllelaug n.d.; Middelgrundens Vindmøllelaug I/S 2007).

Ownerhsip and Finances

Middelgrunden is based on a joint ownership between a cooperative and a utility. 10 of the turbines at Middelgrunden are owned by DONG Energy and the Middelgrunden Coop owns the other half. 10 of the turbines were originally owned by Copenhagen Energy (CE), which was owned by the Municipality of Copenhagen. Later on CE sold its shares for electricity production to Energi E2. Since June 2006 Energi E2 is part of DONG Energy – a 73%[20] state-owned power company, which provides around 60% of the electricity in Denmark (DONG Energy 2007, 2, 13). The Middelgrunden

[19] This seems to be only a symbolic number until actual CO_2 emitting power plant capacity is reduced.
[20] The utility SEAS-NVE and a number of other shareholders of the former Elsam utility, which is part of DONG now, hold the rest of the shares in DONG Energy since April 2006 (DONG Energy 2007, 8).

Coop was established as a partnership consisting of 40,500 shares, with in total 8,552 electricity consumers being owners of the cooperative (Vikkelsø, Larsen and Sørensen 2003, 7). Around 88% of the shareholders come from the Greater Copenhagen region, with 38% being shareholders from the city. They are mainly private people, companies, unions, foundations and organisations (Vikkelsø, Larsen and Sørensen 2003, 7). Middelgrunden Coop can therefore be considered as a *regional cooperative*, that due to the absence of 'neighbours' can offer the possibility of involvement for a larger community.

The total investment costs for all 20 turbines at Middelgrunden amounted to around 48.5 million €. The major share of this amount (around 37 million €) involved costs related to the turbines and foundations (Larsen et al. 2005, 2). The Middelgrunden Coop paid in total around 24 million € for the establishment of its 10 turbines (Larsen et al. 2005; Vikkelsø, Larsen and Sørensen 2003). These costs were significantly lower than installation and grid connection costs for other offshore farms in Denmark by that time (Larsen 2007). Main reasons for this were that a majority of contracted engineers came from the region, and that due to the short distance to the harbour transport costs were lower and many operations could be carried out onshore (Vikkelsø, Larsen and Sørensen 2003; Larsen 2007). Establishing the grid connection also involved less effort compared to 'real' offshore applications. Grid connections could be established to Amager Power Plant, which is 3.5 km away from Middelgrunden (Vikkelsø, Larsen and Sørensen 2003, 21). In general, all investment costs were shared between CE and the Middelgrunden Coop. Funding for carrying out the Environmental Impact Assessment (EIA) for the project was granted by DEA (Vikkelsø, Larsen and Sørensen 2003; Larsen 2007). This was possible because the project involved new technical and organisational aspects, based on the fact that it was going to be a cooperatively owned offshore wind farm. Most of the private shareholders own 5 shares since this was the optimum number under current Danish tax regulations by the time the cooperative was established. This number of shares represents an annual income of 400€, which was the maximum tax-free amount from electricity sale for private people (Vikkelsø, Larsen and Sørensen 2003, 25).

Each share represented an annual production of 1,000 kWh and was offered at an initial price of 570€. Although the cooperative managed to set up attractive loan offers with two banks, less than 5% of the shareholders actually used this opportunity (Vikkelsø, Larsen and Sørensen 2003). This indicates that the price of the shares was reasonable for most of the shareholders. The establishment of the project itself and income from the electricity production was the only security demanded by the banks (Vikkelsø, Larsen and Sørensen 2003). *Pre-subscriptions* played an important role in financing the work of the cooperative before planning permissions actually had been obtained (Vikkelsø, Larsen and Sørensen 2003; Larsen 2007). 10,000 people joined the cooperative by buying 30,000 pre-subscriptions at a price of 7€ per piece. One pre-subscription meant the reservation of one share

(Vikkelsø, Larsen and Sørensen 2003). In this way the Middelgrunden Coop ensured coverage of the planning costs, and at the same time got an indication of the degree of (local) support for the project. During the first 10 years of production (2001 – 2011) the ten cooperatively owned turbines receive a fixed price for the produced electricity plus a fixed renewable energy premium during the first 5 years (Vikkelsø, Larsen and Sørensen 2003). Since the European market for green certificates has not started yet, a fixed price including a CO_2 subsidy was set. From 2007 to 2011 this price will be around 0.06€[21] (Middelgrundens Vindmøllelaug 2007).

Planning Process

The original plan to establish Middelgrunden was initiated by Jens Larsen, the project manager at the Copenhagen Environment and Energy Office (CEEO). CEEO has been around for about 25 years and one of its main goals is to promote sustainable development through concrete projects (Larsen 2007). One motivation behind Middelgrunden was to show that wind power can be a possible solution for Copenhagen as well as to make ordinary people understand what sustainability and wind power is (Larsen 2007).

In 1996 CE began investigating the feasibility of an offshore wind farm at Middelgrunden, which had been pointed out as a possible site for offshore wind power (Vikkelsø, Larsen and Sørensen 2003; Larsen 2007). Around the same time CEEO contacted the Danish Energy Authority (DEA) about the possibility to build an offshore wind farm at Middelgrunden because the offshore wind power plan, which was an agreement between the DEA and the power companies, would not take off at that time. Although Middelgrunden had been pointed out as a possible offshore wind power site, the DEA and other authorities originally rejected CEEO's proposal because local initiatives were not part of the existing plan (Larsen 2007).

After two years of discussions and negotiations CE and the Middelgrunden Coop, which was formed by CEEO and a group of local people, could sign a contract. Since the Municipality of Copenhagen owned CE, a close link to local politicians could be established (Larsen et al. 2005). SEAS Wind Energy Centre, which is part of the largest consumer owned utility[22] in Denmark, then did consulting work and project management. SEAS acted on behalf of CE and was assisted by SPOK Consult & EMU, an consultancy specialized in Energy and Environment (Vikkelsø, Larsen and Sørensen 2003; Larsen et al. 2005). The role of the Middelgrunden Coop was decisive, as it helped solving most of the organisational and practical problems (Larsen 2007). The organisation of Middelgrunden resembles the *coastal-offshore model* of co-ownership, as shown in Figure 5.2.

[21] This corresponds to 0,43 øre/kWh and was calculated using an exchange rate of 7.45 (Danmarks Nationalbank 2007). The CO_2 tax refund is 10 øre/kWh (0.013 €/kWh) and is paid since 2006, after the first 5 years (12,000 full-load hours) of production were over (Larsen et al. 2005, 4).
[22] SEAS-NVE.

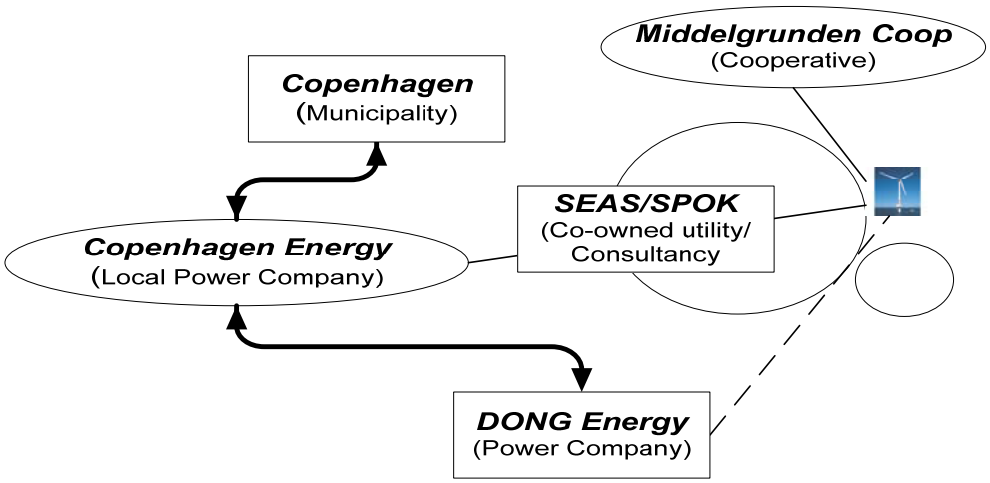

Figure 5.2 Organisation and ownership of Middelgrunden Offshore Wind Farm as illustrated in the coastal-offshore model. Based on Vikkelsø, Larsen and Sørensen (2003, 8-9).

Figure 5.2 illustrates that besides the main shareholders, being the Middelgrunden Coop and DONG Energy, two other actors, which were crucial to the implementation of the project, were involved in the set up. On the one hand CE was closely connected to the Municipality of Copenhagen, and thus there was the potential for a strong local anchorage of the project (Vikkelsø, Larsen and Sørensen 2003; Larsen et al. 2005). On the other hand, the co-owned SEAS represented the involvement of a local utility. The dashed line indicates that DONG Energy was not involved in setting up the project as such, but now owns the turbines.

The application for principal approval of the project was already sent in September 1996. After going through the public hearing process with 3 hearings in 1997, 1998 and 1999, the proposal was principally approved in May 1999 and received final permission from the DEA in December 1999 (Vikkelsø, Larsen and Sørensen 2003; Larsen et al. 2005). To allow optimal grants form the Renewable Energy Scheme it was necessary to receive this permission before the end of 1999 and also have all construction contracts signed (Vikkelsø, Larsen and Sørensen 2003). This allowed for only a very narrow timetable that made it necessary to involve all interested groups as early as possible to overcome planning barriers at an early stage of the project (Vikkelsø, Larsen and Sørensen 2003; Larsen 2007). The few objections during the public hearings were mainly related to the visual impact of the turbines. This issue could be resolved by reducing the number of turbines from 27 to 20 without decreasing the installed power of the whole farm (Vikkelsø, Larsen and Sørensen 2003). One group that remained in opposition to the project were local fishermen. An agreement about compensation during the period of construction could be made, which improved the acceptance among this group (Larsen 2007).

Among the initially objecting organisations was the Danish Nature Protection Agency, whose national committee's main reason to object was the interference with the initial plan of the DEA (Larsen 2007). The objection of the Danish Society for Nature Conservation is an example of how the cooperative from the beginning worked together with all the main actors involved and managed to overcome much of the initial resistance towards the project (Vikkelsø, Larsen and Sørensen 2003 5; Larsen 2007). The Danish Society for Nature Conservation revised its decision later on after a number of the local members in Copenhagen, who were in favour of the Middelgrunden project, publicly objected to the decision of the national committee. The reasons for this were on the one hand lobby work done by people, who were both members of the Danish Society for Nature Conservation and worked for CEEO, and on the other, involvement and information directed at the local committees of the Society (Larsen et al. 2005, 3; Larsen 2007).

Another example for how the Middelgrunden Coop actively managed to overcome concerns regarding the noise impact from the turbines is when a guided tour to an inland turbine was organised with people living close to the harbour area. This helped to convince people that there would not be any significant noise impacts from the turbines (Vikkelsø, Larsen and Sørensen 2003). While acceptance among the people in Copenhagen does not seem to be an issue any longer, seeing the turbines for the first time does not seem to create negative attitudes either. Results from a small survey among tourists in the Copenhagen harbour area, made by the Middelgrunden Coop, indicate that the majority has a positive attitude towards the turbines (Middelgrundens Vindmøllelaug 2007).

Lessons Learned

Being a pilot project in terms of technology and ownership, Middelgrunden offers valuable experiences on the *macro level* – apart from the abovementioned contribution to national energy goals. On the *meso level*, besides producing electricity for the Copenhagen area, the Middelgrunden ownership model helped to create a strong *network* among local people, the cooperative, the municipality and the utility. The experiences gained from the cooperation between these actors during and after the planning process may be useful for similar projects in the region. The possibility for people to financially participate in the project represents a benefit at the *micro level*. The issue of investment security was anticipated choosing regional set-up for the cooperative, and thereby enabling a larger number of people to buy shares. The examples above show how the perceived 'costs' at this level could be reduced (fewer turbines, low noise impact) and how *community acceptance* could be ensured (pre-subscription round).

The case of Middelgrunden illustrates the importance of local commitment in second phase wind power projects. In a large city, such as Copenhagen, it is necessary to ensure that all interests are considered in the planning process. This requires a large amount of information work and the creation

of an extensive local network. The Middelgrunden Coop played a decisive role in this regard, as it built up these necessary contacts, and considered all objections by affected actors before ultimate planning decisions were taken[23]. Issues raised by these actors were as much as possible incorporated into the planning process, because there was a clear desire for building local consensus. The whole process can therefore be described as the presentation of an idea, which through the planning process was formed into an actual product. This may be somewhat different from other planning processes, in which consumers often are presented with a design that can only be altered to a limited extent.

5.2 Samsø

Samsø is an island located between Jutland and Seeland. It has around 4,000 inhabitants living in several larger villages and in more dispersed farmhouses (Samsø Kommune. n.d.). Samsø Municipality is the only municipality on the island. Main sources of income on Samsø are agriculture and tourism. It can be expected that any regional development that benefits the local economy is welcome. Especially projects that improve the image of the island and attract visitors are desirable. Furthermore, due to the limited size of the community it is easier to provide information and to include a sufficient number of people in the planning. The case of Samsø is an interesting example for the restructuring of a whole energy system and the simultaneous application of several alternative energy sources. Besides inland and offshore wind power, among others also photovoltaic and district biomass heating systems were established on the island. Although it is beneficial to view all these developments as a whole, the focus in the following is on the wind power installations – in particular on the offshore wind farm, as it represents a new form of ownership. Reference to the whole system is again made in the last subchapter. Inland wind power is included in the discussion of the planning process because it emphasizes the decisive role of the Energy Company.

The Renewable Energy Island Project

In 1997 the DEA started the competition 'Renewable Energy Island', whose aim was to encourage island communities in Denmark to make proposals for an alternative energy supply on their island. Samsø sent in a proposal and won the award in late 1997. The proposal involved a 10-year plan to convert the energy system on the island to be based on 100% renewable energy sources[24]. By being the winner the island got the opportunity to be a national and international demonstration project. There was a need for demonstrating renewable technologies by that time, and islands represented rather transparent systems, where it was possible to measure incoming and outgoing energy flows (Hermansen 2007). Main restructurings were to be carried out in the heat, electricity and transportation sectors.

[23] During the process CEEO and the Middelgrunden Coop were in contact with 50,000 to 100,000 people (Vikkelsø, Larsen and Sørensen 2003).

[24] A detailed description of the initially planned activities on Samsø can be obtained from http://www.veo.dk/old/DK/default.htm.

Until today the island has managed to become 100% self-supplying with electricity, and around 70% of the heat is produced from renewable energy sources (Energiakademiet 2007; Hermansen 2007). Furthermore, all transport (including ferry transport) on the island is compensated by electricity produced form offshore wind (Hermansen 2007). Compared to the levels of 1997 it was possible to reduce CO_2 emissions by 140%. This was possible because the good connection to the main land allowed for the export of CO_2 quota (Hermansen 2007). Between 1993 and 2005 3 straw-fired district heating power plants and 1 solar/wood chip power plant have been built. In addition, several individual solutions, including solar heating, biomass heating and heat pumps have been installed in about 300 households (Energiakademiet 2007). The consumer-owned local utility NRGi, which is also responsible for electricity supply and transmission on Samsø, established one district heating plant. The second power plant is consumer-owned, and the third one is owned by a local business together with consumer representatives and representatives from the municipality (Energiakademiet 2007). In total, 11 windmills were installed in 2000 to cover the island's electricity production. All windmills have a capacity of 1 MW and are installed in two groups of 3 and one group of 5 turbines at three sites on Samsø. Farmers, who mainly are from Samø, own 9 of the turbines. The other two turbines are owned by local cooperatives (Energiakademiet 2007). A simplified illustration of the new energy installations on Samsø is shown in Figure 5.3.

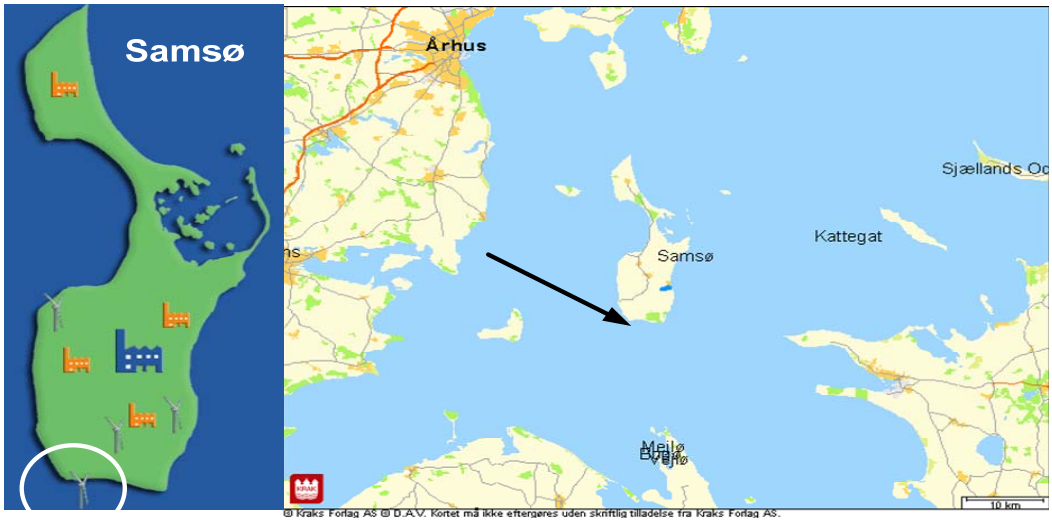

Figure 5.3 Overview of the energy facilities on Samsø. Power plant icons to the left indicate heating installations. Grey icons indicate windmills. The offshore wind farm is encircled. Retrieved from Samsø Energi- og Miljøkontor (n.d.) and Krak (2007).

Offshore Wind Power on Samsø

The offshore wind farm close to Samsø is discussed in more detail, because it represents a new form of ownership – the island model. As mentioned one main reason to install offshore windmills on Samsø was that there was no feasible, proven technology that could be used in transport on the island.

To fulfil the 10-years plan it was decided to install 10 offshore turbines with a total capacity of 23 MW instead (Energiakademiet 2007; Hermansen 2007). The turbines were installed in 2002 and each has a capacity of 2.3 MW; a maximum height of 103 m and total annual production is 77.5 GWh (Energiakademiet 2007).

The offshore wind farm is owned in three different ways, as illustrated in Figure 5.4. Samsø municipality owns five of the turbines. Individual, private investors own three turbines, and two turbines are cooperatively owned.

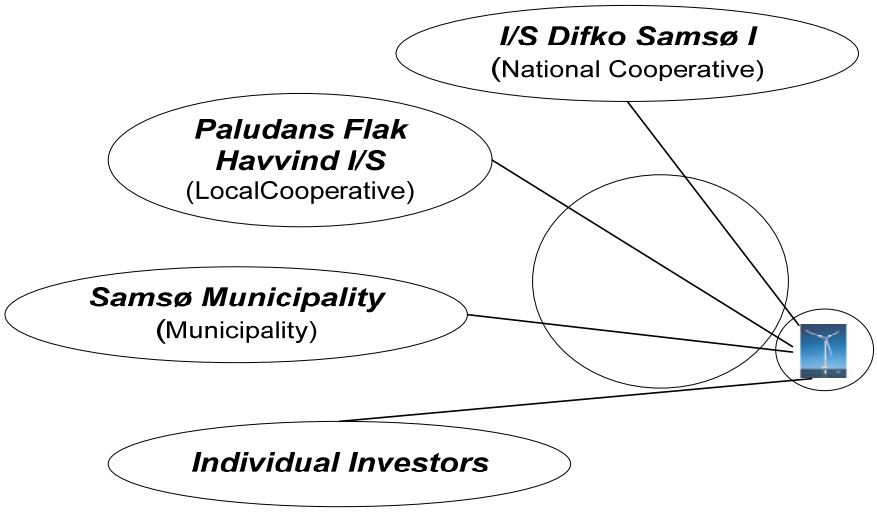

Figure 5.4 Ownership structure of the Samsø offshore wind farm as an example for the island model.

One of the turbines is owned by Paludans Flak Havvind I/S, a local cooperative, which has around 500 members. I/S Difko Samsø I is a national cooperative with 7,800 shares and around 1,000 members, and also owns one turbine (Energiakademiet 2007; Hermansen 2007; Difko. n.d.). Out of the three individually owned turbines one is owned by a group of local farmers (Energiakademiet 2007).

The investment costs for one offshore turbine were around 3.2 million €. For the municipality (Samsø Vedvarende Energi APS) this meant a rather risky investment of around 16 million €, or between 4,000€ and 5,000€ per inhabitant (Hermansen 2007). The investment decision was subject to a rather strong political discussion, and the final decision was taken with the condition to only use the income from the turbines to pay back the loan. Due to a surplus production of nearly 10% the local government could however be convinced to use some of the income to create a fund, from which other energy projects could be initiated. One of these is the Samsø Energy Academy, a knowledge and conference centre that informs about the projects on Samsø, as well as initiates new projects. In 2012, ten years after construction, the municipal bank loan will be paid back (Hermansen 2007). Today the electricity is sold to NRGi based on a ten-year contract. On top of this ‘market price’ the

Samsø turbines additionally receive 0.013€/kWh CO_2 tax refund (first 12,000 full load hours) and an extra tariff of around 2.3€/kWh (Moesgaard 2006, 19). The set up of this offshore ownership model actually proved to be favourable for the participating cooperatives, because they were able to receive the same tax reductions as well as contracts on service and grid connection as the other co-owners (Hermansen 2007).

Planning Process for Inland and Offshore Wind

The DEA, Samsø Municipality and the trade organisation on Samsø decided the overall set up of the renewable island project. All energy projects, including district heating, inland windmills and offshore windmills, on the island were coordinated by the Samsø Energy Company (Samsø Energiselskab), which was founded in 1998 and ended its activities in 2005. Its work is continued now through the Energy Academy (Energiakademiet 2007; Hermansen 2007). The Energy Company made the 10-year renewable energy plan, which was rather detailed and could be used as a guideline throughout the whole process. This plan was a helpful tool in showing people which steps came next. In this way public acceptance could be increased because the plan was based on the requirements of existing Danish energy policy (Hermansen 2007). Also cooperation with the regional authority in Aarhus could be ensured in the beginning, due to the fact that the plan had to be approved there. Although regional planning and siting requirements did apply to Samsø as well, this good cooperation made the erection of slightly higher turbines possible. Also for the regional authority Samsø had the character of a demonstration project, which could be used in later campaigns (Hermansen 2007). Along with the renewable energy plan the creation of a *common level of knowledge and understanding* through several public information meetings were crucial to achieving local acceptance. Like at Middelgrunden, this acceptance was 'measured' by offering the possibility of signing pre-contracts for the wind turbine cooperatives (Hermansen 2007).

To get initial approval for the plan by Samsø Municipality was not a problem, because although the mayor at that time was not particularly in favour of RE, the plan was promising in terms local development of the farming community. The erection of the inland turbines meant direct economic incentives for the farmers on the island, and they were rather positive towards having a turbine on their land. The Energy Company, however, assumed that having all turbines individually owned would create opposition. An agreement with the farmers was made that meant that the farmers would be able to have their own turbines, but at the same time also would provide their land for a couple of cooperatively owned turbines. '*We* [the Energy Company] *did this having in mind that this would create local acceptance and perception of financial fairness among the islanders'* (Hermansen 2007). It was not necessary to explain the well-known and accepted cooperative model, but to ensure individual interest in the project (Hermansen 2007). Due to the visual impact of the onshore turbines the possibility remained that some people rather wanted to invest in other RE technologies, such as

solar power. It was possible to combine these interests with the opportunity of raising the general awareness for the project by creating a second fund, into which farmers paid a certain share of their annual profit. This money could then be used to finance other projects like a rapeseed press or photovoltaic installations. The Environment and Energy Office on Samsø managed this fund (Hermansen 2007).

Financing the cooperatively owned inland turbines was facilitated by making an agreement with the local banks about the possibility of getting a loan without mortgage of around 400€, which was necessary to buy one share. Seven shares (around 2,800€), which represented the annual electricity consumption of an average household, was a popular amount to buy. The security for the bank was that it could keep the share and thus the income from the turbines, in case the loan could not be paid back (Hermansen 2007). The intention of the Energy Company behind this agreement *'was to make it possible for everyone to own a share in a wind turbine. The agreement with the local banks made this happen. So, we did all this with trying to maintain as much as democracy as possible – equal possibilities for everyone'* (Hermansen 2007).

With regard to the ownership structure of the wind turbines on Samsø both the Energy Company and the municipality were influential. The municipality did not want to invest in any of the onshore turbines because it did not want to interfere with the business of local investors. As described above, later on the municipality wanted to buy all 10 offshore turbines, but did not have the investment capacity and ended up buying five. The role of the Energy Company remained important with regard to how the ownership structure of the offshore wind turbines was set up. Here, it was made sure that everyone from the local community, who wanted, had the chance to be part of a cooperative first, before the project was announced nationally. The 'investment gap' was filled with a national cooperative and individual ownership. Furthermore, an agreement with NRGi, the local utility, could not be made because they did not want to be a 'minor' shareholder in the project (Hermansen 2007).

Lessons Learned

The case of Samsø demonstrates the benefits of having a plan that is publicly accessible and an organisation working in the interest of the local community. A clear benefit for the projects on Samsø was that people could see the vision behind the changes that were going on in their community, its relation to local development and the stepwise progress associated with it. The local community had an active role in planning and owning the developments on their island, and in this way developed support for such a large-scale change. On the one side the projects built on existing and locally accepted technology (i.e. district heating since 1993), and on the other, acceptance for newer technology (onshore wind power) was built, before it was applied on a large scale (offshore wind power). It seems that on Samsø there was much less political discussion regarding the establishment

of wind power than in the Middelgrunden project. The turbines were part of the overall plan for the island and this seems to have shortened the implementation time considerably.

The experiences from Samsø are valuable on the *macro level* because they are not only informative of a new form of wind power ownership, but also of the possibilities of converting a whole small-scale energy system in a sustainable way. The benefit for the municipality on the *meso level* is the aforementioned income related to offshore wind power and taxes. Overall, the combination of demonstration of alternative technologies with local development was crucial to maintain municipal support; and this support was needed, as the RE project affected several sites on the island. In th ecase of Samsø it was therefore possible for people to directly see the significance of single projects in relation to the final vision of the RE island. Financial benefits through cooperative ownership are also present on the *micro level*. An important new element that helped to increase local acceptance was the energy fund, which was created in relation to the inland turbines. This gave people the choice to invest in other alternative technologies, and thus have an indirect financial benefit as well.

5.3 Summary

As mentioned in Chapter 3 *network stability* and *community participation* may be closely related to project acceptance and success. The relevance of community participation and corresponding indicators are explained in the end of Chapter 3. Indicators for network stability are described in Appendix A, based on McLaren Loring (2007, 2651-2652). In Table 5.1 below it is illustrated how these indicators are represented in the Middelgrunden and Samsø projects. It can be concluded that indicators for community participation and network stability are well presented in both projects. In the case of Middelgrunden this may be due to the combination of actual project planning and turbine ownership in one actor – the Middelgrunden Coop. In the case of Samsø the main reason may be that the main project planner – the Energy Company – favoured cooperative ownership, and in that way combined planning and ownership through participatory planning.

	Middelgrunden	Samsø
Network stability		
Strong relationships among actors within the network	actors from CEEO have worked together in similar projects	Small island community, network naturally is strong; the municipality supported the Energy Company
Immutable mobiles (texts and documents)	Bylaws of the cooperative, newsletters	10-year renewable energy plan, bylaws of the cooperatives
Multiplicity (actors belonging to several networks)	Some Members of the Middelgrunden Coop were also members of the local Society for Nature Conservation; Close association between actors in the CEEO and the Middelgrunden Coop	Close association between the Energy Company, the Environment and Energy Office and the municipality
Critical actors	The presence of actors such as Jens Larsen (CEEO) was crucial throughout the whole project	comitted people in the Energy Company
Community participation		
Participants in planning process are representative for all potentially affected individuals	project was initiated by a group of local people; cooperation with the Municipality ensured close links to politicians; Actors, whose interests were not represented in the planning group, were contacted throughout the planning process	Manageable number of inhabitants made it possible to inform everybody
Barriers to involvement of local communities in the planning process have been minimised	possibility of participation through the cooperative; involvement of other actors was actively established	A number of open public meetings
Community members impact decisions about the project	During the public hearings between 1997 and 1999 people had the opportunity to raise questions and concerns; Downgrading from 27 to 20 turbines	Bank agreements regarding loans; agreements with local farmers regarding cooperatives
Community members have financial ownership in the project	Middelgrunden Coop offered 40,500 shares; 38% out of the shareholders are members of the local community	There are in total 3 local wind cooperatives
Project was initiated by a local individual or group	Members of CEEO and the Municipality, who initiated the project, were locals	The Energy Company was an organisation on Samsø
Community will have continued involvement in the project after construction	Homepage of Middelgrunden Coop informs about the production and condition of the turbines, and about the economy of the cooperative; cooperative is responsible for maintenance; It organises (public) trips to the turbines, annual meetings for the members and issues newsletters	Samsø applied for another 10 R&D turbines; the creation of the revenue fund from the inland turbines; the foundation of the Energy Academy as a knowledge centre for the RE energy island project; homepage of the Energy Agency

Table 5.1 Indicators for network stability and community particpation in the Middelgrunden and Samsø projects.

The cases also add some new aspects to the acceptance framework presented in Chapter 3. The experiences from Middelgrunden confirm that co-ownership and participation is crucial to obtain local acceptance for a project. Middelgrunden is special in a way that the local community is composed of a variety of interest groups. This means that in order to provide the possibility for participation for all affected actors, an extensive contacting and information work needed to first be carried out. Thus, in cases where there is a diversity of interest groups (such as in cities), *networking* may be closely associated with participation, and could be included in the acceptance framework.

Samsø offered the unique possibility for the local community to view individual projects as part of a development towards a clear future vision. It was not necessary to ask why a development exactly took place in one's own backyard because the purpose of this development within the larger context was obvious. Moreover, people actively took part in shaping these developments. The RE island project therefore was an opportunity for the farming community to learn about a new technology 'by doing'. Restructuring the whole energy system on Samsø also means that people not only learn about wind power, but also about many kinds of general issues related to energy supply. It is important here that the Energy Company as the main planning authority saw the need for local engagement. Another important characteristic of the project is that learning could take place through incremental innovations. District heating, for example, brought energy issues to the homes of people without tremendously impacting the landscape. Later on larger projects like the inland turbines could be carried out, based on the created awareness. *Learning* could therefore be another element to be added to the acceptance framework, especially when discussing the change of a whole system, or, other forms of RE technologies[25].

[25] These could be micro applications like PV and heat pumps or activities related to biomass and biogas, where people have a more direct contact with the technology, compared to wind power.

6. Conclusion

Local resistance towards wind power projects is one challenge to successful wind power deployment, and may increase if wind power is expanded to become a main element in future energy systems. It is therefore necessary to investigate what the reasons for people are to resist wind power projects in their community, and how such resistance can be anticipated. The purpose of this thesis therefore is to address this issue by answering the following research question:

Which factors influence the local acceptance of wind power, and how can new forms of ownership contribute to building up and maintaining this acceptance in Denmark?

The research was divided into a number of sub-questions, as shown in Table 6.1. Before discussing the most important findings of the research, it is made reference to how these (sub-)questions were answered in the study.

#	Question	Chapter
	(1) Which factors influence the local acceptance of wind power?	
1a	Which forms of public acceptance with regard to wind power do exist?	3
1b	What are the reasons for local opposition to wind power projects?	3
1c	Under which conditions does local acceptance of wind power projects evolve?	3
	(2) How can new forms of co-ownership contribute to building up and maintaining this acceptance in Denmark?	
2a	Which forms of ownership for wind power do exist in Denmark?	4
2b	What are the motivations of actors in these ownership forms?	4
2c	How can existing forms of ownership be combined to ensure local acceptance and planning success?	4
2d	How was local acceptance and planning success ensured in the cases of Middelgrunden and Samsø?	5

Table 6.1 Overview of Research questions and corresponding chapters.

Questions 1a and 1b are answered through the review of existing literature in Chapter 3. Recent research emphasizes the social construction of public wind power perceptions. It becomes evident in this regard that resistance towards wind power projects, as sometimes expressed in a selfish attitude (NIMBY), has actual reasons beyond pure selfishness. These reasons may be influenced by a variety of factors, including the planning process and ownership as the major ones. It is suggested that the 'gap' between social acceptance and local resistance can be filled by these two factors, by changing the pattern of cost and benefit distribution between different social levels. These relations are illustrated in the conceptual model, thus answering question 1c.

Question 2a is answered by taking a brief historical look at the ownership structure of wind power installations in Denmark, before analysing existing ownership models. When looking at the current system it becomes apparent that beyond the economic and technical challenges related to wind power deployment, also problems at the (municipal) planning level need to be considered. After the analysis of the motivations behind different existing forms of ownership related to question 2b, this finding is rather interesting because municipalities usually will profit from the income of wind turbines. Question 2c about how new forms of ownership can be combined to ensure local acceptance and project success, is addressed building on the discussion about the motivations of actors and the assumption that these actors have capacities suitable for different (geographical) contexts. It is suggested how new co-ownership models may be able to meet all of these requirements.

Two of these new co-ownership models and the associated planning process are investigated, thereby answering question 2d. It is shown, based on indicators from literature, that both projects involved high degrees of community participation and network stability, which are generally positively related to local acceptance. In answering question 2d reference is made to the conceptual model of community acceptance. In the next section the most interesting findings of the research are summarised. The results are discussed in relation to limitations of the research, and are then combined with suggestions for possible further research approaches in the field. This is done because the pilot character of this research made it possible to specify a number of concrete further research questions.

6.1 Results, Limitations and Further Research

Results: One main implication from the conceptual model is that local opposition towards wind power arises as the result of people perceiving an unfair distribution of costs and benefits related to the project. ’Costs’ may include impacts from turbine operation, a lack of involvement in plannning decisions and the allowancing of the financial benefits from electricity production to other actors (outside of the community). Consequently, ’benefits’ include participation in the financial income from electricity production (i.e. ownership) and participation in the planning process. Local acceptance is dynamic in a way that one project may be accepeted, while another one in the same community may be rejected, due its setup. There is a certain propbability in Denmark that given the the second phase of wind power, local accpetance might change negativley. What is important here is that it does not matter if perceptions of unfairness is actually qualified and/or justified, but that it is possible to positively change these perceptions by a number of measures. Depending on the context of the project these may range from ’simple’ information, over community participation to actual community ownership. While community ownership in theory may be most crucial to obtain local accpetance, the cases indicate that community ownership often is associated with community participation in case the planning authority is locally anchored. In fact, in the cases of Samsø and Middelgrunden local anchorage of the planning organisation was crucial, as this both guaranteed an

ownership structure likely to result in local acceptance, and also guaranteed a planning process that was participatory and thus also had a positive influence on local acceptance.

Limitations and Further Research: The results of the cases only allow for indications, and it is not possible to derive general statements about the link between planning and ownership from them. This is due to the reason that it was possible to discuss only two cases of new co-ownership forms, resulting in a limited set of data. Secondly, the cases did not primarily serve to test the conceptual model, but rather to add to its development. This means that the conceptual model needs to be tested with a more comprehensive set of data from several different cases in different contexts, in order to maybe quantitatively determine the importance of different factors in the model[26]. Such contexts could include other countries, landscapes, phases of national wind power deployment, other forms of RE technology[27] etc.. This is directly related to the assumptions with regard to the new forms of co-ownership. For instance regional development is related the cost/benefit structure in the conceptual model, and it needs to be investigated how important this factor is in different contexts.

Results: The cases demonstrate that second phase wind power development is possible within two of the new co-ownership models. On Samsø at was indeed local/regional development that motivated the municipality to support the developments on the island. The cases also indicated that in certain contexts new elements could be added to the conceptual model. Furthermore, as assumed for the discussion of the new co-ownership models, the nature of local acceptance tends to be different in different landscapes. The investigation of Middelgrunden shows that the type of local acceptance necessary to obtain planning permission stretches much further than in the case of Samsø. This means that in a city like Copenhagen the discussion about the wind power project may very much be influenced by general political standpoints towards wind power, that there is a larger variety of interests to consider, and that landscape issues (the image of the city) could be of much greater concern than in other models of the coastal-offshore type. Overall this has meant that in the case of Middelgrunden a relatively large number of 'local acceptors' needed to be present. This crucial task was fulfilled by the local planning authority (CEEO), which is closely associated with the Middelgrunden Coop. Thus, in this special coastal-offshore model network stability could be added to the conceptual model as a relevant planning element.

The case of Samsø illustrates that an aversion towards a specific wind power project in the community is not necessarily associated with an aversion towards renewable energy in general. Some people preferred to invest in other types of RE technologies instead of wind power. Again, the role of

[26] This could for instance also entail a study of recent cases of (local) resistance towards large-scale wind power projects in Denmark.
[27] Such technologies could include other large-scale, visible installations, such as biogas and biomass plants and PV parks. Local opposition may also be relevant in such projects (Upreti and van der Horst 2004).

the planning authority (the Energy Company) was crucial in this regard, as it helped creating a fund from which these other projects could be financed. These investment alternatives could be created because they served the ultimate purpose of converting the entire energy system on the island. The learning process that is initiated in the local community by such a planned system change, made an upgrading through incremental innovations, including inland and offshore wind turbines, possible. This indicates that learning is a valuable planning objective, especially where the contact between wind turbine and population is close or frequent, such as on islands. With regard to island ownership learning could therefore be added to the conceptual model. Based on the experiences on Samsø a model illustrating the relations between success criteria for wind power projects and ownership can be suggested. It is illustrated in Figure 6.2 and explained in the following.

- The type of ownership is one determinant of how much local people participate; i.e. a cooperative will first of all look for local members, and thus will inform as much as possible about the project. This may encourage more local people to invest in wind power through the cooperative, and thereby provide investment security.
- If regional development for an actor (e.g. municipality) is important, then the actor will invest (ownership and investment security) or encourage members of the local community to investment.
- Some actors (farmers) may see the chances of business development (regional development), and therefore invest (investment security), which will result in individual ownership (ownership)

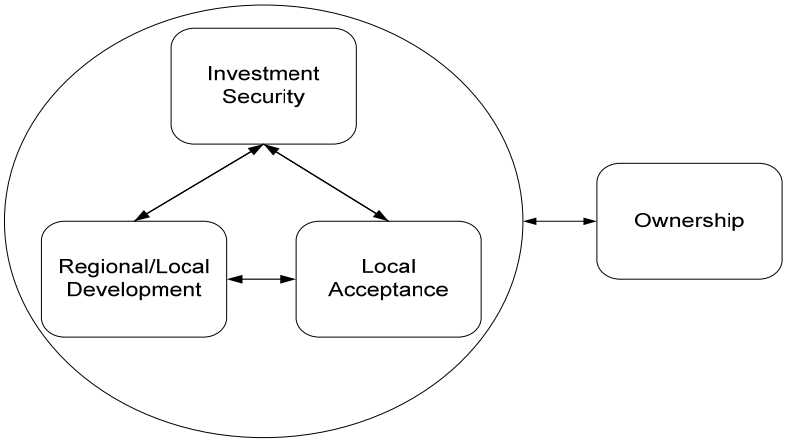

Figure 6.1 Relation of success criteria for wind power projects within the island model.

The case of Samsø also indicates that while some actors, such as cooperatives, have the will to invest in wind power, but sometimes lack the necessary financial capacity, other actors, such as utilities, may have the capacity, but not the will to be co-owners in wind farms. The local utility preferred to own the whole wind farm at Samsø instead of being part of a new co-ownership model.

Limitations and Further Research: The assumption that the importance of local acceptance is different in different geographical landscapes may be rather subjective. Also, the role of motivations of actors in different forms of ownership requires further empirical research. In this regard it has not been possible to entirely define the role of municipalities as both planning authorities, and representative authorities of a local community. It is for instance not totally clear what exactly has caused the planning delays in some cases. One would assume that taxes and income from electricity sale might encourage municipalities to further wind power siting. Are the planning problems related to setting different priorities in relation to the regional reforms? Or are they related to equivocal signals from decision makers (offshore plans, change of the financial incentive system etc.)? Or is it indeed local acceptance that pays a role here? All of these questions might be relevant. The financial capacity of municipalities in Denmark is another uncertain element here. Finally, there is a need to be aware of the interrelatedness between the main challenges in the second phase of Danish wind power development. Social acceptance (as reflected in or synonymous to economic acceptance) clearly is related to local acceptance. One main question in this regard is how a (financial) support system for wind power should look like to encourage the establishment of the new forms of co-ownership discussed in this study?

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Appendix A – Indicators for Network Stability

The following description is adopted from McLaren Loring (2007, 2651-2652), who uses network theories, previously developed in innovation research, and applies them to the field of technology deployment. The assumption is that concepts regarding the formation of networks and the relationships between actors *'can just as easily be applied to networks surrounding the planning of a wind energy project as they can* [be applied to] *the innovation of, for instance, an electric vehicle'* (McLAren Loring 2007, 2652). The level of network stability for supporters and opponents is indicated by the presence of four main indicators:

- *Strong relationships among actors within the network*: This indicator is evident when actors agree on their roles and goals and when they actively participate and interact with others in the network. Strong relationships also tend to form between actors, who have known each other for a long time, worked together before or were good friends prior to the involvement in the respective project. It is assumed that the more strong relationships the network displays, the higher is the stability of the network.
- *Immutable mobiles (significant texts and documents)*: Texts and documents within a network indicate a degree of organisation within that network since they take effort, coordination and time to produce. Strategic texts that contain clear goals define the purpose of the network, and show that the network is able to communicate throughout the network. Other examples that demonstrate commitment and motivation include letters to planning authorities and (public) information material. Together these things indicate a higher level of stability of the network.
- *Multiplicity*: Multiplicity is the degree to which a network has actors that have a range of identities; i.e. belong to more than one network. Actors may make use of one network to support their efforts in another. Examples may be lawyers, planners, engineers and people who are engaged in NGO's. They can use their experiences and skills to support a wind power project, and may also be able to use other resources (meeting rooms etc. from that network). In this way multiplicity adds to the stability of the network.
- *Critical actors*: These actors play a major role within the network. They are generally seen as people without whom a network could not have formed or survived. Important properties of these actors may be that they dedicate a lot of time to the project, bring in special skills or knowledge or motivate others through their particular conviction about the project. Critical actors add to the stability of the network, especially if they introduce multiplicity to that network.

Appendix B – Interview Transcript

Date: March 27, 2007

Place: Copenhagen

Participants: Anne-Grete Holmsgaard (SF, Member of Parliament), Karl Sperling (AAU)

1) *In your opinion, what are the main reasons for the current stop in the establishment of new wind power capacity in Denmark?*

One of main reasons was the plan of the government, elected in 2001, to cancel the plans for new offshore wind farms. All of the three farms that were originally planned were cancelled. On land back in 1999, we had this agreement of the green certificate market. On a European scale Denmark was sort of alone with this system, and we all figured that this could probably not be realised in a good way. So, we tried to negotiate a new agreement before 2001, but that never took place. We figured that a green certificate market would only work in an international or European market, so we wanted to negotiate about the possibilities, i.e. switching back to the feed-in system. But after 2001 this negotiation never started. The government was just against it – their agenda was to have a lowest possible electricity price. During the years that followed nothing much actually happened, except of one agreement to take down older, smaller windmills, and replace them by better ones. Around 1,500 windmills were replaced through this scheme. This reduced the number of mills and slightly increased capacity. We didn't agree on anything until spring 2004. This involved an agreement where the government needed the opposition to change the ownership structure of the transmission system – this was in the interest of everybody. It shifted from private ownership to state-owned, non-profit ownership. The deal was that the opposition demanded the construction of at least two new offshore wind farms having the same capacity (~400 MW) as the three that were originally planned. We demanded further windmills on land as well, together with more biogas and R&D money. The package included the Skrotningsordning, where you could get a certificate for an old wind turbine (<450 kW) corresponding to a certain amount of money and running time, which you could use to build new wind turbines. Almost no new wind turbines were built, however. The main reason for that is because the sites have not been found. This was the task of the Ministry of Environment, but they haven't been able to determine new sites for land-based turbines.

2) *Who was supposed to invest in new wind turbines according to the Skrotningsordning?*

Everybody could, but experience shows that mainly developers have bought up existing turbines. No, co-operatives have been established, because there was no such requirement included in the deal. Now, the developers complain about that there no sites available.

3) *Besides issues of nature protection and visual impacts, what are other reasons for the difficulties to find appropriate sites?*

Well, it is as you say: nature protection and visual impact that are determining. Another requirement are appropriate distances to neighbours and buildings etc.. There are rules for all of that, including Environmental Impact Assessment (EIA), and local, structural plans. The local plans were set up at the same time we had the reform of the municipalities. And we said that if you do that at the same time as changing the local structure, the municipalities would not be very active and cooperative. So we asked for a national directive designating specific areas reserved for wind turbines. The government didn't want this, and we have been discussing this with them since 2004.

4) *Would you say that there was a remarkable increase in resistance of local people as well?*

In a very few cases there was a very strong resistance. One case is Kyngby, for example. Energi E2 wanted to put up 2 windmills very close to the original power plant. The proposal was to take down around 20 older windmills instead, but there was a very strong resistance to this. I think that part of this resistance was due to 'not in my backyard' (NIMBY) attitude. Some people might be a bit scared now because of the larger dimensions of the new turbines. The developers are also not very good in explaining to the public what the new turbines involve – that are actually needed for the country.

5) *Do you mean that there is a lack of information?*

Yes, I think that there is a considerable lack of information. Both from the developers' side and the side of the Wind Industry Association. But the biggest should come from the government to inform the authorities and the public much better. The developers are of course concerned about the economy, first of all, so they don't really think about distributing information.

6) *Could there currently also be an increase in local resistance due to people's perception of unfairness – they don't have any financial benefits from the current development?*

I think it can be part of it. I would divide it into several groups of local resistance. First, there is a very small group who is very concentrated on the NIMBY attitude. Another, more mixed group consists of people who are either concerned about the rural landscape (church towers etc.), or are generally against wind power. But the biggest group are the ones who just don't say anything. Actually, most of the wind capacity being built during the last ten years didn't involve (local) co-ownership. It was mostly bigger and smaller electricity utilities. This goes together with the market liberalisation, with the merging of a very few energy companies. Danes are generally rather sceptical towards big companies like that.

I would favour a return of the co-ownership model – I mean basically it is allowed to established co-ops today. I think that most people just think that it would be too difficult to organise projects involving these large wind turbines.

7) *I heard that this is also related to the uncertainty of the market prices. So, people can get no guarantee for their investments.*

Yes, it involves a rather big uncertainty, because part of deal was also the limit for the market price for wind power (36 øre/kWh). We discussed about this within the opposition – should we stay in the agreement or not?

8) *Was the original plan before 2001 to start with the green certificate market right away?*

Yes. And then we would say that we would raise the percentage of renewables (RE), and fining people if they didn't reach this quota. After having seen what happened on the British market, I am not so positive towards the green certificate market anymore. It works when you are still far away from the quota, but when you are approaching it the development simply stops. People are insecure concerning the conditions, under which they make their investments.

I think it is much better to have a tender model or a feed-in system.

9) *What would a tender model look like?*

I am more and more in favour of the tender model. There are several reasons for it. First, I don't want to get cheated again with some kind of feed-in tariff, where no windmills are really built. Now, if the state was responsible for the tender, you could be surer about getting the windmills. The other reason is that you can define a tender model in a way that a certain amount of power has to be owned by the public – local authorities or co-ops.

The tender will include a negotiated price – just another kind of feed-tariff in a way. So you guarantee a certain amount of money for a certain amount of production. A disadvantage could be that you cannot be sure that the system is optimised – because wind resources are unevenly distributed. The Wind Owner's Association have actually come to support a tender system.

Under the feed-in system you could support co-op development by making the tariff depending on the amount of co-ownership. But you cannot be sure that you will get the mills. If we had the majority we would be sure, because we could design a very favourable feed-in tariff.

10) I mean it kind of worked in the years after 1992.

Yes, but it also got rather expensive. You have to balance it – definitely, you have to give subsidies (tariff, climate bonus etc.), but it shouldn't be too big. We have differentiated according to a certain amount of running hours (fuldlasttimer). This creates more freedom for choosing your site.

11) So, if understand correctly, you would 'reserve' a certain amount of tenders for co-ops and exclude private investors from the bidding?

I think it would be very difficult to do that. It involves big arrangements and investments to get new turbines these days – you have to be rather professional. The question is, if you could be sure that there are enough co-ops who could actually handle such big installations and investments. I am not quite convinced about that.

But you could for instance say that there should be a 50% co-ownership. I know that some private investors might react very negative to this, but if it is part of the deal, then they have to find these local investors.

12) How would you actually ensure a co-ownership of 50%?

Well, it should be a condition of the tender: both local co-operatives and local authorities should be included in the investments.

13) Do you think that would be in correspondence with the European process of market liberalisation?

Yes, I cannot see any problems with it. You can also imagine that a co-operative would want to manage the tender. I think their problem would be to get some security [investment guarantee] for their investments. That is very difficult to get if you are not a business already. You need the cooperation of the banks as well – you shouldn't be forced to pay higher mortgages.

14) In general, why do you think the co-ownership is needed in Denmark?

We need the involvement of local people because this was the backbone of the success of wind power in Denmark. Of course there will be some problems when you have larger mills, because the resistance will be bigger. There are two sides to this: first, we need more local engagement in RE. We need a message like: "Yes, we want renewables". The other side is, that when you are local you are more engaged in finding a site for the windmill because it is sort of your own project. It is not just some strangers who get into the area with a development project.

15) I would even say that the lack of local involvement is one of the reasons why there currently is a stop in development.

I don't think it is right that this is a reason. Talking about the previous government, which we supported: they actually stopped the regional planning with regard to wind power. This is seldom said in the debate. Their planning guidelines for the 'amter' (the previous regions) did not contain anything regarding the finding of locations for windmills. The whole planning went into the offshore direction. So, the regional authorities had actually dropped the planning of windmills until they got a different message in the spring and summer of 2004. They had to plan knowing that the organisational structure would change after 1.5 years. This of course, was perceived as unnecessary workload by the regional authorities. They asked themselves, why they should do it. And this was the main reason for the stop in development. There could be economic reasons as well (price uncertainty). But it is hard to determine the one or the other reason as a main reason. A developer would of course say that it is the price limit. I say, that it clearly is the lack of appropriate sites for onshore windmills.

16) Would it in that case be easier to support co-owned offshore turbines because there are many more sites available than onshore?

Yes I am not saying that there shouldn't be a co-ownership for offshore wind farms, but the important thing is to have on the land because that is where the people actually live. It is a bit hard to find the local authority when you have offshore turbines. The new wind atlas is not finished yet – there is only an old one with potential sites. They are not on small islands. They are mainly along the west coast of Denmark and around Samsø (and some other sites). When you have them around an island it is very obvious to have a co-ownership. I know of another company who wanted to win the tender for Horns Rev 2, but couldn't get a bank guarantee. Probably, it is going to be a bit more difficult offshore, because the big energy companies will say that it will make it more troublesome and expensive for them. But what they could do is to say; well we build it and sell part of it as public shares. If you want you can do it. We need people to be involved in the development.

17) How and when will the green certificate market start?

It will not start. At least not during the next couple of years – it has been postponed a couple of times.

18) So, what do current political discussions focus on?

Nothing really has happened during the last six years. It has been tough discussion all the time. Now, the government seems to be willing to negotiate with the opposition about having more RE. But they haven't made a real proposal. The energy strategy for 2025 is not ambitious enough. There are some targets in it, but no information about how it will be done – no means. Compared to the strategy from 2005, the newest one from 2007 doesn't contain the statement, to leave the development of RE to the market, anymore. The targets are only a little bit higher than the ones we have already.

19) How long does the Skrotningsordning run?

Until the end of 2009. I am sure that something is going to be decided before that because the government is very keen on taking this to the national agenda before the next elections. So, there will be negotiations, but their internal disagreement is very apparent. The DF actually has a veto right on the PSO, which is used to finance the feed-in tariff. I don't see any other way of financing it. In principle, could use the national budget for it, but there is a tax stop on that – so where would you find the money.

20) Have there been made any law drafts?

No, absolutely nothing.

21) How would a concrete policy agenda, that has the promotion of RE and local involvement as goals, look like?

I would make a political agreement saying that in 2008 we have to tender out a certain amount of RE. Included in this would be a demand for a certain amount of local ownership. But it should be local, not national co-ownership (distant co-ownership).

22) But who would go out to the municipalities and local people and inform them about their possibilities?

When you take part in that tender you could either organise yourself as a co-operative, and do the bidding, or in case of an energy company they would have to organise the local involvement.

23) Why do you think that the large energy companies do not invest more into wind power? I often hear that it is because of the sunk costs they have in the fossil fuel power plants.

Well, if you are not part of the Skrotningsordning you don't have any motivation to invest into wind power, because the price simply is too low. If this would be the price for coal or gas, they wouldn't invest either. In a situation with a lack of power the interest would maybe be bigger. (surplus capacity) so, the only investments are the two offshore farms, and those are tenders.

Actually we didn't think about including co-ownership into the offshore tenders in 2004. This was a mistake, but we were under hard pressure from the government – we were almost desperate. We sat down and made a list of the things we wanted – more RE capacity, basically. Co-ownership was simply not on our agenda at that time. And nobody told us about it. Not even the green organisations.

24) But as I understand Svend Auken, he basically believes that the time of the co-operatives is over.

I think today he would find it attractive to have co-ownership. But it will involve big investments – it might be a bit too risky to make the whole development depend on co-ownership. You need the organisational capacity to do such large-scale projects – like Middelgrunden, Samsø and Ærø have managed. Those are successful examples, but can we be sure that we have such substantial organisations all over the country? I am not sure about that, but there will probably enough people who would love to be co-owners.

25) What do you think were the main reasons, put forward by the current government, to oppose any new regulation on more RE capacity?

Money. The argument was to decrease the electricity price as being a very important factor for industrial development. The electricity prices actually rose already before the government changed. This was partly because we removed the feed-in tariff from the state's budget. The price is rising because of many reasons: partly because of the quota system, partly because of the long term investments that don't allow you to flexibly change your capacity.

Appendix C – Interview Transcript

Date: April 22, 2007

Place: Aarhus

Participants: Asbjørn Bjerre (Director of Danish Wind Turbine Owners' Association), Karl Sperling (AAU)

1) *For how long have you been working with DVF?*

Since it started – that means since 1978.

2) *What are the fields that you are working with?*

It mostly is politics and organisational issues, not so much the technical and economic side.

3) *In your opinion, what are the main reason for the current situation of a 'slow-down' in Danish wind power development?*

In terms of capacity there was a rather fast development in the middle and end of the nineties. In 1999/2000 we had around 7,000 turbines on land in Denmark. Some politicians thought that this was too much, and the development had to be slowed down. They did different things. They began to talk about offshore turbines, and better planning and siting of turbines in the landscape – with regard to the neighbours and so on. Also the economy was changed. There had been introduced the feed-in tariff system in the beginning of the 90's, and until the end of the 90's this resulted in a very good economy for wind turbines (ca. 60 oere/kWh). Already in 1991 we suggested that the price should be adjusted annually according to what the actual price per kWh was. But it was not changed. So by around 1998 there had been built too many turbines at the good sites like in Northern Jutland. Here, around Aarhus it was still ok, but the politicians thought that some people were earning too much money on the turbines.

That altogether meant that there was a sudden stop. It would have been cleverer to reduce the subsidies more gradually. Another fact was the European movement towards liberalisation of the energy sector by that time – especially with regard to electricity. The Danish government wanted a new payment system with some kind of certificate. There was the wish to have competition between RE technologies both nationally and internationally. In the end of the 90's almost all the parties decided that there should be a liberalisation in Denmark. This meant that there suddenly was a high uncertainty with regard to wind power investments.

It also had consequences for ownership. Up until 1990 we had a system that did not allow you to own more than one wind turbine, and it should be located on your own land. And when you participated in a co-operative you were only allowed to a certain amount of shares – about the size of the electricity

use of your household. These shares should be part of wind turbines that were located in your neighbourhood or community. These regulations were in opposition to the philosophy of a liberalised market system. So, this law was changed. In the years following, only very few turbines were erected. These were for the most part big investments undertaken by people, who could benefit from the tax deductions and were therefore interested in making an investment. No turbines were sold to local people. The developments almost stopped 6/7 years ago. 2002 was the last year where a number of turbines were erected. It was the last year of the old replacement regulation (udskiftningsordning). In connection to this law 1,500 turbines were taken down. The new law of 2004 doesn't work that well.

The question of payment is a little complicated. The original plans in the law of 1999 for full market liberalisation were never carried out. There were different systems in other European countries (e.g. German tariff system), and the Commission decided to wait a couple of years to see how the different systems work, before they would make a decision about the future. It is obvious that the German and former Danish system is better for investors giving them much higher investment securities. This means that a common European certificate market lies in the far future.

The Danish government had to find something else. It was decided that the price for wind power should be composed of the market price and a 10 oere subsidy for the environment. [This is not the 2004 replacement agreement. It is not limited in time]. It is very probable that the parliament is going to decide something else this summer. But I am not sure about how that will end.

4) *Are there already ongoing discussions?*

On January 19, this year, the government presented a new energy plan. One part of this plan is to look at how the payment for wind turbines in the futures should look like. The tender model for turbines on land has been proposed. So there would be a certain amount of MW to be built every year, and investors would be found through tenders. But that hasn't been decided yet – it is an ongoing discussion.

5) *To your knowledge, which types of ownership currently do exist in Denmark?*

We have been thinking about how we could find some new forms of ownership. There is a need for involvement not only of the investors but also of the population living close to the big turbines. Today it is much more difficult to get political approval for wind turbines – not only because they are bigger but also because we don't have local ambassadors, who establish a relation to the local politicians. So, they are asking us for a useful model. We have tried several things.

First of all, we suggested that the model used before is still ok. There is no reason why we shouldn't use it. Because of the size of the turbines now you can (need to) have more families as owners. This can be a problem in a small village, for instance. So one should change the tax regulation, and there are two suggestions for this. Currently, you are allowed to earn 3,000 DKK tax-free with a wind turbine. This amount should be higher.

The other one is a little bit difficult to explain. There should be an agreement that makes it possible for business people to include the investment in a wind turbine into the rest of their investments – as some kind of business investment. So a local businessman could invest in a turbine with the money from his business. This would create the possibility for some people to by more shares, for example worth a couple of hundred thousand DKK. (afskrivning)

We also looked at the new parks that DONG Energy is going to built in the North Sea and at Roedsand, and asked them if we could find a model where people in Denmark could have the possibility to invest in these turbines as well. It is not going to be a co-operative type of ownership (interesse-selskab), but we are sure that we can find some kind of other model for this type of offshore investments.

6) What this model look like?

We are discussing with the ministry of finances if it is possible to use the same tax system as for turbines on land. Then you would be able to make an interesse-selskab. But then the co-operative has to own the whole turbine itself. Offshore the risk is higher, and we would like to spread the investment over maybe 50 turbines. So the co-op would own only a part of each of the 50 turbines. So, problems with the turbines would be backed-up by all investors, not just by the small ones. So, instead of private people owning a certain number of turbines, it could be cleverer if they owned, let's say, 10% or 20% of the whole wind farm. We are talking to DONG about because they are the only ones having the concession to build offshore. But we are also talking to people from Vattenfall regarding the possibility of local investments.

In Sweden Vattenfall pays some kind of compensation to the local community around their turbines. This is money can be used for cultural or social purposes in the community. We do not favour this model very much. Siting big wind turbines so close to neighbourhoods should be regulated by environmental laws (noise levels and so on).

We are also trying to talk to private project developers. We think it could be a good idea to ask them to at least try to sell one or more turbines to the local people, when they are planning a new group of turbines. In one or two cases they have agreed on doing so.

7) *How do these developers get the permission to build the turbines?*

For the time being, they make use of the skrotningsordning. That's the only way right now to get a permission to erect new turbines. They also try to find suitable sites themselves by asking and talking to local people. They make agreements with farmers to have the right to build a turbine on their land some time in the future. So, when there are better conditions in the future, they are the first ones who have the right to build.

8) *I heard that some places private developers began to by up old turbines and tried to replace them with bigger ones. Has this, to your knowledge, resulted in cases of local resistance?*

It is not a big problem right now, but I think it might be a bigger problem in the future. In these cases many of the neighbours don't know that the owners have changed. They have lived with the turbines for a couple of years, and my not have noticed this. The problem will come when the turbines are taken down, and new ones are to build, and the people will find out that someone far away owns them.

9) *With the skrotningsordning do you expect that there will be an increase in replacement of turbines in the near future?*

Of course we will have new turbines because they cannot last forever. In 2002 we had the last big group been taken down. Before 2025 basically all turbines will have been replaced. But it is not possible to replace them just where they are because bigger turbines have other requirements regarding distance to neighbours and so on. It also depends on the decisions of the local politicians and the Skov- og Naturstyrelsen.

10) *Does this mean that the whole pattern of turbines in the landscape will totally change?*

Yes. We calculated that we could of a share of 50% in electricity production supplied by around 1,500 turbines, with 1/3 of them being offshore. So, compared to the 5,000 turbines that we have today, it will be much fewer. [maybe also a new generation of very small domestic turbines]

11) *What are the main differences between ownership forms today and in the past?*

There are only very few turbines sold in Denmark today – mostly to firms and individual persons. They can make best use of the tax effects when they invest 20 or 30 million DKK in a turbine. Very few owners own the new turbines. Energy companies also own some. But there haven't been so many sites to erect them. I think we will find a system where parts of the population will be interested in

investing again, together with the energy companies and maybe the communities, like on Samsoe. The municipalities have to task to site the turbines already – so they might as well own them.

12) *If I understand you correctly, one of the future options could be to have more of a mixed type of ownership?*

Yes. But still we need the support of the developers and energy companies, because the investments are just too big for a neighbourhood. So, some kind of joint venture is needed.

13) *What would be the differences between these new models for different types of installations (on land, coastal, offshore)?*

On land the limit should be a height of 150m. Offshore there are of course no limits. In terms of capacity the biggest turbines for the next 15 to 20 years would be 3.6 (Siemens) to 4.5 MW (Vestas) on land.

14) *What would be the consequences for ownership? Bigger installations meaning more private capital required?*

I don't think that capital is the problem. In the future wind electricity will be cheaper than coal or gas based electricity. It won't be so difficult to get the money for investments. The wish to have public or local investors is based purely on political reasons.

15) *What do you think about the new plan of the government?*

A couple of years ago we already suggested to have of share of 50% electricity production from wind. So that is fine for us. Some people in the opposition (S) suggested 80%, which certainly would be possible. But then we would need to invest into the stability of the infrastructure (grid, connection between production and consumption). That is the most important job for our organisation right now. I mean we need the market to function better, and better regulations to make use of the fluctuating production.

Now we say that it should at least be 50% because the European goal of 20% is a much bigger job for most other countries than for us. If you want to fulfil this goal in Europe, you need to have market that functions much better than today. It should be an open market. Private companies shouldn't own the grid.

16) *In general, what are you recommendations for a future policy model to support wind power?*

First of all, we should have a fixed goal for wind – not only for renewable energy in general. So, a clear political decision is the most important thing. These goals should cover a long period of time, because investments in the energy sector are long-term investments. You need to make political agreements about the security of such investments with the energy companies, to convince them.

Besides the goals, you then need to design the appropriate regulatory framework to make these ideas happen in practice.

17) How would these regulations look like – still some kind of feed-in tariff system?

Basically, the electricity price for one type of electricity should reflect the real costs of its production. This means that also the external costs should be part of the price. The CO2 quota system goes in this direction. The idea is that the CO2 costs should be added to the market price, so that fossil fuel electricity would cost more. It is not working very well, but it should go in this direction.

That would be enough. We wouldn't need any kind of extra subsidy for wind power – it would be cheaper than fossil electricity. But when you do that the price for one kWh would increase a lot and the Danish industry would get problems in competing internationally. So this should at least be a European system. Although we are discussing about the necessity of further subsidies for wind, I think we need this financial support until we this fair market price system.

The other quite different type of system is the feed-in system and the tender system. In these systems we don't pay for what the electricity really costs, but how much it costs to produce it, which is entirely different. If you have a specific goal of maybe 2000 more MW in the next 10 years, and you want that as cheap as possible, then you can use the tender system. The market only is used to find the cheapest investor – there is almost no connection to a liberalised market. So the new goal of the government contradicts their former policy, where they said that it should be the market that decides how much renewable energy we get by which technology.

18) In your opinion, why is public involvement in ownership of wind turbines needed?

I have two reasons. It is not because it is necessary to get investment capital, because that can easily be acquired somewhere else. But right now, we need local acceptance for the siting of wind turbines. That is one thing. You should feel an ownership of the turbine – people should look at it and should be able to say: "this mine, I earn money with it."

The more political argument is that it brings the need to produce electricity close to you. People will feel more responsible for energy production and the environment. In the long run this is the most important argument. It has been very important in Denmark since the first oil crisis. People got practically involved in energy politics. Today we still have 43,000 owners (families) as our members, who own share in a turbine. It had been 150,000 families once. 80% of the Danish owners are our members. So, around 50,000 families are still involved in Denmark. In general, this means a lot for the political interest in energy in Denmark. These people have been following the political debate very closely.

During the last couple of years public opinion polls have shown the high public support for wind energy. I think the experience with wind turbines has been very good for the political climate with regard to RE in Denmark. Wind turbines in the landscape encourage local discussions about energy and pollution. The practical knowledge about it has been important. This is also one of the reasons why I think it is important to involve more than just a few investors in the future – because we simply get closer to people.

19) *Some people might argue that the large increase in capacity during the middle of the 90's was due to the feed-in tariff law of 1992 and the possibility of distant ownership. Could local participation and ownership be seen in the years before be seen as a stepping stone towards this development – I mean that without local acceptance there wouldn't have been the possibility for e.g. distant ownership?*

Well, I think that we would have had this increase in capacity anyway, because many local people were interested in investing in wind power. But for a developer it is just easier to sell to a single person, instead of asking a few hundred local families if they want to participate. It was some kind of 'sellers market' – more people wanted to buy turbines, than there were to sell.

20) *People could argue that public or local ownership is not really needed because most of the new turbines are going to be built offshore anyway?*

It is so much more expensive to build offshore. A couple of years ago politicians said that the future of wind power is on the sea. They don't do that anymore. In the 2007 strategy of the current government only 1/3 of the future capacity is going to be built offshore (~4,000 MW on land and ~2,000 MW offshore in 2025).

21) *Can you tell me more about the agreement with DONG Energy?*

It is nothing concrete yet. We are working on concrete land and offshore models. We are going public now because of the coming negotiations between the political parties, to tell them that we are working

on that and assume to get some results as well. The message should be that local involvement is important. DONG has in interest in saying that they agree with us on that issue. Our interest was to get DONG to make a binding agreement with us – a commitment like that when building new wind parks, they would at least sell one of the turbines to local people. We also suggested making a law regarding this.

Appendix D – Interview Transcript

Date: March 26, 2007

Place: Ballen, Samsø

Participants: Søren Hermansen (Manager Energy Academy), Karl Sperling (AAU)

1) *How did the energy system on Samsø look like before you applied for the Renewable Islands Project?*

It was kind of a traditional support system with a grid connection to the main land. All electricity sources came from sources at Jutland. The heating was mainly based on oil, some electricity, and some biomass (wood stoves etc.). There was one district heating system based on straw in the largest town on Samsø. Some farms have had straw furnaces for quite a long time. It has been quite popular in Denmark since about 20-30 years.

2) *Who were the main actors and responsible persons in the system before?*

The set up of the island project was partly decided by the DEA and partly by the local municipality in cooperation with the trade organisation on Samsø. There were not many people who knew about this project. This engineer from Plan Energi (in Skørping) saw this island competition project issued by the DEA, and thought it would be a good idea for business and employment on Samsø. The mayor and the chairman of the trade organisation thought that this was a good idea – not because of the renewable energy potential, but because of the business potential.

3) *When did the competition finally start?*

The competition was announced in 1997, and we sent in the proposal in September 1997. The winner of the title 'Danish Renewable Energy Island' was announced in October 1997. The proposal was a 10-year plan for the conversion of the energy system to 100% of Renewable Energy (RE). In the beginning it was just the title – no money in it. Later on we got support to establish the Energisel-skabet.

4) *Has the goal of the 10-year plan been achieved?*

Well, some of it has been achieved. Transportation, as everywhere, is still one of the weak points. We cannot solve it right now because we have to rely on proven technology. With a lot of subsidies we could buy electric cars for everybody, and charge them by wind power. But that it is not possible right now. Currently, we compensate the energy use of transport sector by the offshore wind power production – we produce the same amount of energy offshore, as we use for transportation. When the technology is ready we can buy our own electricity instead of selling it to the grid at a small price. We expect to be on market terms 10 years after the start of the project. When the consumption is low

during night times, we might be able to charge batteries – that would enable us to buy electricity at a low price and sell at high prices. But that's for the future – right now we sell everything. Right no we compensate for the CO2 emissions of fossil fuel produced electricity. We actually have reduced our total CO2 emissions by 140% compared to the levels in 1997. That's because of our good connection to the main land – we could export our CO2 quota.

5) *In what way did national and local policies influence the set up of the system on Samsø?*

On a national level we had a very strong Energy- and Environment Department/Ministry. They were very much in favour of projects like this. There was a very good support scheme to change from oil furnaces to, for instance, wood pellets, solar panels and heat pumps. This specific initiative was launched because I think the government at that time felt that the transition to RE systems went too slowly, and asked themselves what the main obstacles were. One idea back then was to overcome barriers by showing that the technology is working through demonstration projects. Choosing an island would make the whole process more transparent because you could measure everything imported and exported. It was also backed up by NGO's – in general there was a very positive political atmosphere. It was possible to transfer that onto the local policy because the mayor at that time (from the conservative party) was not particularly in favour of RE, but in favour of local development of the farming community. Both could be well combined through the island project – it met the local need for development. The prices on farm products were declining at that time, and it was not possible to make these processes more efficient.

6) *How did the project influence the local economy?*

It was difficult to see in the beginning. We went to the people, especially the ones living in older houses, and advised them to switch from their oil furnaces to wood furnaces, for instance. Due to the increasing oil prices it was possible to save up to 2/3 of the energy costs. This money could be invested again in insulation of the houses – new windows etc.. This modernisation process created a lot of jobs for local carpenters and so on. This refurbishment of houses created a lot of investment potential, which was also recognized by the local banks. We set up a scheme that could show how much you could save by switching to wood pellets. This could be shown to the banks. So, we involved the local banks, had meetings with them and presented these things to get their approval on guaranteed loans for the local people. So, this concerned the initial investments.

When were planning the erection of wind turbines, the farmers were very positive to it because they saw the direct incomes related to it, and wanted to have the turbines on their land. We made an agreement with the farmers about the possibility for having these new turbines on their land owned by a co-op. We did this having in mind that this would create local acceptance and perception of

financial fairness among the islanders. (Individual farmers could easily get bank loans because of the feed-in tariff, which was guaranteed for 10 years). Then we made agreements with the local banks that would make it possible for individuals to get a loan to buy a share in the co-op (~ 3000 DKK in 1999) without a mortgage. We estimated that about 7 shares (~ 21,000 DKK) would represent the annual electricity consumption of an average household. So, to buy 7 shares was quite popular. If people couldn't pay the money, the contract for the shares would stay with the bank, and the income from the turbines would directly go to the bank to pay back the loan. That was a reasonable agreement for the local banks.

Our intention was to make it possible for everyone to own a share in a wind turbine. The agreement with the local banks made this happen. So, we did all this with trying to maintain as much as democracy as possible – equal possibilities for everyone.

7) *What exactly happens with the profits of the wind turbines now – both as an individual owner and a co-op?*

Some people didn't like wind turbines in the landscape. They wanted to have solar technology instead or something else. So, for individual owners we made another agreement to raise the general understanding for the project. A fund was created, into which the farmers paid a certain amount of the profit every year. The Energy and Environment Office on Samsø managed the fund. The incoming amount of money wasn't too high since each wind turbine produced only around 6,000 DKK during the first 5 years. Anyway, the profit of the wind turbines approximately corresponds to what the farmers previously earned in farming ('Energy Farming'). This fund was used to give subsidies to other projects – a rapeseed press or PV installations for instance. This is one of the very few arrangements of this type in Denmark.

The major share of the profits was used to pay back the loans. The farmers used it to improve their farms. The municipality bought 5 of the 10 offshore turbines. The decision to take part was subject of a strong political discussion. It was a rather risky investment (ca. 120 Mio. DKK → ~ 30,000 to 40,000 DKK per inhabitant). Finally they agreed to invest, but the profit had to be used to only pay back the loan as quickly as possible. With the help of an accountant I could convince the local government to put the profit of the surplus consumption into another fund to be able to keep up the development. Surplus consumption turned out to be 10% beyond the amount they had decided to pay back. 3 Mio. DKK from this fund could then be used to initiate the building of the Energiakademiet. The loan will be paid back in 2012 (10-years pay back time, started in 2002).

8) *How did you come up with the decision to have a certain number of wind turbines privately owned, and others owned by co-ops?*

The 11 1 MW onshore turbines came first. As I said we had a lot of investors who wanted to buy one turbine, which was just like the development in the rest of Denmark at that time. We didn't consider this to be a favourable development. We saw that this would create a lot of opposition, and wanted make it possible for everyone to buy a share. So the agreement was that we would help the farmers to get permission to erect the turbines, and they in turn would make room for co-ops. To estimate how many co-ops we would get we held a lot of public meetings and started to sign pre-contracts. People started to sign up, and we pushed the process by advertising and so on. During that period we sold about the 2 co-op turbines (~450 shares, around 10% of the population). Then there was no interest anymore – the market was filled. Later on we found out that more people would have liked to own a share, but had hesitated. But we had to finalise the contracts and build the turbines before the end of 1999, because the feed-in tariff was being reduced every year. At that time the municipality didn't want to buy onshore turbines because they didn't want to compete with private investors. After 2000 we immediately started planning the offshore turbines, and then the municipality wanted to own all the 10 turbines. But the investment was too huge, and they could only own 5 of them. We could only sell one local co-op turbine. One turbine was owned by a national co-op. Around 500 people own the Samsø offshore turbine. The national turbine is owned by about 1,000 people. The other 3 turbines are owned by small investor groups – the smallest being two persons. One turbine costs about 24 million DKK.

9) *What about the utilities – didn't they show any interest?*

Well, they didn't show so much interest in the co-op model. They preferred to own the whole wind park. We also tried to do a similar system to the one at Middelgrunden, but the utilities couldn't agree on being a 'minor' shareholder. The utility is called NRGI – they are also some kind of co-op, membership-owned with a large group of representatives. They are our electricity supplier. [The government as part of the feed-in law establishes the grid connection]. We have 10-year contract with NRGI to buy our electricity – a requirement by the law.

10) *Can you tell me more about the initial resistance in the towns of Besser and Kolby?*

I don't know what caused it. The system worked in a way that we tried to engage people in each town, and sort of create a local movement. So, we initiated the process through information meetings, and later on a local working group ran it. We based these meeting on specific calculations and proposals for the specific areas. In some areas people wanted to cooperate in others they wouldn't. In Besser and Kolby we couldn't get the positive attitude of the majority of the inhabitants. It was the specific case of district heating, and we needed the support of 60% of the population, or wait. Now, people would maybe be more willing but there is no subsidy anymore. Nowadays, we have to be very

sure of the support of the villagers, and in some villages the people are rather old and don't want to make these kind of investments anymore.

11) What was the maximum amount of shares that an individual could own in a co-op?

I think in the 1999 project the maximum amount was 30 shares. The law of 1999 said that you could only own shares in wind turbines in your municipality. That means that you had to have an electricity meter registered in that municipality – it was ok to live somewhere else. The same law set this limit of 30 shares per person – corresponding to about 90,000 to 100,000 DKK. That was changed later on when we built the offshore turbines – anyone in Denmark could buy as many shares as wanted. What we tried to do with the offshore turbines was to limit the knowledge about them to the local population first, to ensure that everyone from here would get the chance to buy a share.

12) Could you please summarise again the main challenges and problems in setting up today's system?

The crucial issue was information – you cannot inform too much about the plans. That's the problem with the utility companies today: they don't inform, they just make offers. We are the consumers and they are the producers. We tried to reverse that by saying that if you consume something, you should be part of the production – just like the co-op model. This model is well known and accepted in Denmark. So we didn't have to explain that too much, but rather how we can ensure the individual interest in the project. You cannot just come up with a business plan – you have to build capacity among the locals, and explain a lot. You have to openly inform people about the project, in order for them to able to make a decision. It should be a democratic process.

13) Were there any major planning or political obstacles?

Well, the planning was basically determined by the 10-year plan for the RE island. The team at the Energiselskabet made this plan; it was very detailed. We could use this plan as guideline throughout the whole process. We could also use this plan as a public tool to show people what the next steps were. It was a very helpful tool. We had to make minor adaptations though. Some of the things were just too sophisticated.

14) Do you think that these information campaigns helped prevent resistance of the local people?

Yes, because it wasn't just random things we came up with, but real contents of the plan. And the plan itself built on Danish energy policy at that time. The national scheme, for instance, required cutting down on electric heating – that's what we did. Today we ask ourselves, why did we do that, and at the same time installed new electric capacity. Instead, we could have kept some of the electric

heating to balance out the energy production. But that was not on the political agenda at that time. So, I think it was a good idea that we nevertheless stuck to the plan.

15) What are the main challenges right now?

We still have to do more about transportation. But because there is no proven renewable technology for transportation we have to wait. Instead of waiting for technology development we have decided to be a little bit ahead of it. Regarding wind energy I think we have done enough. We had a proposal for another 10 wind turbines because the government proposed demonstration projects in research and test areas. With the Energy Academy we have the proper facilities to have some researchers here to study these areas – not so much because we need the electricity, but because we would like to be part of the research and development of new technology; beyond the RE island project.

We still need to cover 25% of the heating by RE. We need to reach houses, which are too far away from the district heating system – with mainly old people living in them.

16) How did and does that cooperation with the regional authorities look like?

Up until now they have been the regional planning authority. When we came up with the local plan, we had to send to them to get approval for it. The cooperation with them has been very good – they were very supportive with respect to this island project. We actually were allowed to erect a little bit higher turbines. But still, all the regional planning and siting requirements did also apply to us. [nature reserve in the north, avoided this area – turbines had to be placed in the south] Three out of five of our proposed sites actually got approval from the region. They used Samsø as an example in their campaigns later on.

17) Coming back to the term 'proven technology': how do you define it in the context of Samsø?

At Risø they tested and approved different types of turbines. So we wanted the series that were approved by them. The same with biomass technology, which was being tested at the Technological institute in Aarhus.

18) How does the system in 20 years look like?

I hope that will have a more complex system where we can balance energy production and consumption. You could for example use the electricity produced during the night (low consumption) to power appliances like refrigerators during daytime. More electric (local) cars, based on Lithium batteries. In combination with the rapeseeds – we should produce the oil here, instead of exporting seeds, and importing oil. Transportation will be taken care of in the next 10 years. The national interest will increase in general, and Samsø will not look as sophisticated anymore. There will be

more demonstration projects all over Denmark. Samsø was valuable as a demonstration project – from bigger projects can take point of departure.

19) What will happen to the wind turbines after the end of their lifetime?

We will probably have another 10 offshore – the onshore ones will be taken away after 10 years time. It will be easier to build even larger turbines offshore instead.

20) Regarding the wind turbines is there anything you could have done better or could do better now?

I think we could have had a better public ownership model. The island project was carried out right in the transition from an almost 100% national co-op model to more privately owned turbines after 1995. It was kind of a disaster for the co-ops, because it suddenly became a profitable business to sell rights on a co-op site to private investors. After the first generation of turbines, in many cases not all of the members of a co-op could agree on upgrading to a bigger turbine. In many cases people were quite old, so they decided to rather sell their shares. They could sell the sites at very good prices. A lot of good co-ops were closed down because of that. We came in the middle of that process. So, I would have liked all of our turbines to be publicly owned, with a public income.

21) How would you have done that?

Maybe like with the offshore turbines – we managed to have 3 to 4 different ownership models there. This was approved by the tax office: you can have these different set ups, but at the same time have the same service contracts, and grid connection. Normally, the set up is very strict – it wouldn't be possible to get the same tax reductions as a co-op. But in our model everybody gets the same tax reductions.

22) Where are these taxation conditions specified?

In the tax law. If you own one turbine you can register this turbine as a small business – selling electricity to the utilities, to the grid. Then you can deduce the taxes from your investment, i.e. the bank loan for the turbine. That means that all the income from the turbine that is used to pay back the loan will be tax-free. After that you have to pay the full tax – about 50% of the income. However, in a co-op you have to pay a certain amount of tax every year, according to your income. It is a fixed percentage for one share throughout the payback time – you cannot change that. So in this system most people are more interested in getting the tax reductions than being part of the co-op. Some farmers actually have included a turbine into their daily business. This reduces the overall mortgage on the turbine. Then you can take a big bank loan and be sure of the payback. It is some kind of speculation, and somehow undermines the good idea of the co-op. That was not the intention of the feed-in law. The intention was to generate as much RE as possible – the intention of the tax law was

to stimulate business development. So people mainly saw the tax reduction potential of the wind turbines.

23) Talking about the situation when the market will be fully liberalised, how do you see the situation of the Samsø wind turbines?

We talked about creating a Samsø Production Company. All the turbines would go together and sell the electricity in one pool. So, pooling green energy could be an idea. The Wind Turbine Association has made a pool already. Right now the feed-in law is not in favour of wind power because there is a limit for what you can get for wind power. There shouldn't be a limit on a liberal market.

24) How will the wind turbine business on Samsø be doing?

There is a potential of being better of, but I think that it would be more or less will be the same. You might expect a lower income, but also lower costs. It depends very much on regulation. There is this climate meeting here in 2009, and we should come up with some good ideas. We can see now that the opposition is increasing their efforts.

25) Which recommendations would you give to e.g. other islands that wanted to do similar projects?

We were lucky to be part of the national scheme for a while (4 years). So we had a very good head start. For an island it is rather easy to calculate the absolute amount of fuel that is consumed, and to estimate the potentials of replacing it by other means. If you can, you should start planning, because it will create local employment and by this a higher tax income for the municipality – labour is taxed quite heavily. So, it has other benefits apart from the environmental ones. You shouldn't come up with sophisticated plans, but look at the daily routines, and see if there are alternatives to it. And that can already save a lot of money – e.g. just changing the heating or cooling system will reduce the main energy consumption.

26) Does that also refer to requirement to preferably proven technology?

If you want the people to understand how it works and to accept the change, then you have to create a common level of knowledge and understanding. To reach that you shouldn't start with sophisticated technologies such as H2 or methanol/ethanol. First, the things that can be implemented directly without many changes should be applied. The drivers are local businesses – plumbers, for instance. They should be able to see this business potential as a part of their own development. It will be easier for a business that already sells heating systems, to upgrade to solar systems than to H2, for instance. The first district heating system, for instance, was planned by NRGI, and they hired local entrepreneurs to all the fieldwork. The locals learned from that, and only locals managed the building of the next district heating system.

27) Do you know of other, similar projects that are being planned right now?

I know that on Ærø they are planning to build 3 more turbines.

The utilities can offer production prices, which are so low that nobody can compete with them. They can do that because they have the market. Afterwards, they can add on the difference on the electricity price. This creates a dependency, because we don't argue about the price, since we are dependent on getting the electricity from the utilities. It is some kind of state-guaranteed monopoly. I heard that DONG won the tender for Rødsand, offering a price of around 49 øre/kWh. It is impossible to come up with such a low price because, for instance, the steel prices are so high that it is very expensive to buy the wind turbines now. So, the price should be binding, otherwise there has to be another bidding round. I am sure that the price in the contract has only been guaranteed for a certain period.

28) Which policy recommendations can you give to support RE, wind energy in particular, on liberal markets?

It should be a combination of private and co-op ownership again. There should be better conditions for the co-ops, and maybe more market-like conditions for the private investors- so it can be comparable with other investments. Cutting down on the feed-in tariff was too radical in Denmark – it stopped the development. So I would prefer a more differentiated feed-in tariff where you have an advantage of being in a co-op. Then you would also avoid local resistance towards the big turbines of the utilities.

29) How should co-ops behave then on the liberal market?

In our experience the payback is not fantastic. But it still gives the same revenues as if you had the money in a bank.

Appendix E – Interview Transcript

Date: March 28, 2007

Place: Copenhagen

Participants: Jens Larsen (Copenhagen Environment and Energy Office), Karl Sperling (AAU)

1) *Who initiated the whole Middelgrunden project?*

I did. I started this working group, which is similar to the management of Middelgrunden now.

2) *What were the initial intentions for starting this project?*

To show that it was a possible solution for Copenhagen, and to make it understandable for ordinary people what sustainability and wind power is. We (KMEK/CEEO) have been here for about 25 years, and one of our main goals is to promote sustainable development through concrete projects like this one. We have kind of a consulting role in these projects, involving the public in Copenhagen.

3) *I wasn't really sure about the year the whole project started – was it in 1993 or 1996?*

Well, I think you might this information in all the relevant literature.

4) *In what way did national policy influence the project in the beginning?*

100% I would say. At that time there was a plan between the Energy Agency (DEA) and the electricity companies for offshore wind farms in Denmark, but it couldn't take off. Nothing really happened, and it took a very long time. So, we intervened and said that we would like to build offshore. The DEA didn't like it because it wasn't part of the original plan. As a local initiative we were confronted with a lot of scepticism by the authorities. Middelgrunden was pointed out as a possible area, but they didn't really expect anything to be built there. The whole feed-in tariff system didn't include offshore wind power, because – as the lawyers would say – there hadn't been built any offshore installations before. So everything was political. Even the Danish Nature Protection Agency objected the project, saying that the main reason was that we weren't part of the plan. And they are a big interest organisation – so that was big problem for us.

But then we went to the local groups of Nature Protection here in Copenhagen, and they liked the idea. So we got it on their agenda for the annual assembly, and they voted about our project – and we won. There was a famous professor outside of the assembly place with signs saying 'Yes, Middelgrunden'. Some Members of KMEK were also members of Nature Protection and did some lobby work there. So, we made them change their mind, and they sent another letter to the Environmental Minister, in which they stated that they supported the project.

5) *When was that?*

During the official hearing process. That is very important – it is the main difference between local projects and the electricity companies' projects. This is a co-op project (50-50), but we solved all the organisational and practical problems. The problem is that almost nobody either understands or admits this – not even the politicians and utilities themselves.

There are around 100 international delegations coming to visit us each year, we are part Al Gore's book, and even New York is planning a project similar to ours. But especially in Denmark the understanding is rather low. The politicians who started the whole wind power development more than 20 years ago aren't there anymore. The other basic problem is that the feed-in system currently is too weak. So, it is very difficult to start projects. Right at the time we were planning this project, there was this whole discussion about abolishing the feed-in system. So it was very uncertain for us. Local politicians and the energy spokesman for DF were very much against the project, because they thought it wasn't economic and a waste of public money. The Conservatives in the municipalities adjacent to the area also tried to stop it. So, the main reasons were economy and the visual impact of the turbines.

I spoke with the spokesman of the liberal party (Venstre) at that time (before they were in government), and he said that this is not economic. He mentioned other projects with better wind resources and lower costs – for example at Ærø. That is correct if we had our turbines on land, but compared to the big offshore farms we were cheaper in installation and grid connection. So, nobody really understands the economic background for offshore wind. You can, for instance, not get the production price for Horns Rev. It is also impossible to get information about the service and maintenance costs, because it is part of private company. The government wanted to have two big offshore farms, and their logic was that it then was the best to have private companies manage the projects. I don't think that this is correct – but it nearly killed our project.

6) *So, these political considerations were the main challenges you were facing in the beginning?*

And the visual impact. Two people objected the project because of that.

7) *Did you have any initial funding for the project?*

Yes. The first money came form the green fund. We got 100,000 DKK for an information campaign about the project. We used this money to apply for more money – first we got money for environmental research, and public funding for the energy agency. The parliament basically supported it, and just wanted to see if we were able to manage the project.

8) *When did you get all this funding – after or during the political discussions?*

We cheated the system by applying for environmental research – for the EIA report, and not for the project itself. The energy agency should then use this report to organise public hearing. We used this process to anticipate many of the problems. We tried to find solutions for the problems, raised by the authorities, in advance.

9) *And the rest of the investment costs came form the local people then?*

Yes. We sort of had a pre-payment around – just a symbolic fee to show that we had the support of the members. But it was a problem that we didn't have more money.

10) *Was that the guarantee to take a bank loan then?*

No, co-ops are not allowed to take loans. Or at least someone had to able to back it up. And of course no one wants to back up a 5 Mio. DKK loan if the project doesn't get realised. That is the biggest problem for local co-ops compared to the utilities – they have the capital, we don't.

11) *But where did the rest of the money come from?*

That was the public money – for the environmental research.

12) *Which effects did the project have for local economy?*

Nearly all the entrepreneurs for the foundations and some of the ships were locals. But that is not very difficult to achieve in a big city such as Copenhagen. Siemens – the turbine supplier, does the maintenance. The boat we use is local.

13) *In your opinion, what was the motivation for around 8,000 people to take part in the co-op?*

Money and environment. For the women, the environment is the main reason and then money, for the men it is the other way around.

14) *Did you make any surveys concerning these issues?*

For two of our other projects we made an investigation among the people. It isn't very scientific – but this is due to a lack of finances again.

15) *Are there applicants who want to have a share project now?*

Yes, we have a waiting list with around 200 people on it. All the shares (40,500) are distributed, so you have to wait until somebody wants to sell.

16) *Were there any examples of significant local resistance – anti-wind movements and so on?*

No anti-wind movements but other cases of significant resistance. During the public hearing process we had I think 26 statements by different groups with 4 objecting the project. There were also a lot of articles in the newspapers, of which some were negative. But I guess this is very similar to other wind projects in Denmark and the world. We tried to get in contact with the affected groups – talk to the fishermen, for instance. We couldn't change their attitude, but get higher acceptance just because somebody talked to them. We negotiated and made a compensation agreement for the construction period with them. So, with this strategy we got in contact with a lot of groups and reduced the problems. Again, this is one distinctive feature of our project. A utility or developer cannot do that to such an extent. You can say that it is like getting into the civil society and getting a grip of it.

17) *In general, how would evaluate the local resistance?*

The same as everywhere else. And what is that – a scientific question to find out. We didn't have the anti-wind lobbyists that you can find some places, with homepages and so on. The wind turbine neighbours association didn't react here because there were no direct neighbours.

18) *What are the current challenges for the Middelgrunden co-operative?*

The issue with the transformers. There are several court cases.

19) *When are the existing turbines going to be replaced?*

25 years is the time that we got the windmill site free of charge. We have the option of building new turbines. The problem is that the foundation is designed for 2 MW turbines.

20) *Which recommendations would you give to people wanting to start up similar projects – maybe outside of big cities?*

You need guts, money, spirit, technical skills and political understanding. I am afraid that something like this might not happen anywhere else in the world. In one of the Bürgerwindparks at the west coast maybe…they only miss the grid connection. It is very complex. Nobody really knows and understands the conflicts that happen inside when you do such a project. Even the opposition in Denmark doesn't have these insights, and might be therefore that they think it is better to leave these processes to the utilities. There are too few people in Denmark right now supporting the co-op model, like it was 20 years ago. These projects are too big for local people if they don't get the support and the money for it.

21) *Besides the feed-in tariff that you mentioned, are there other policy recommendations that you would give to support co-ops?*

I just made a paper for the parliament. The man who made this agreement with DONG is a member of the management at Middelgrunden.

Right I am considering a project at Avedøre. Dong bought the whole wind farm 3 years ago, and we have the option to build bigger wind turbines there. I am trying to start it up again. Dong right now doesn't want to cooperate with us regarding this project, because of a court case we are having against them. (Dong shall be hold responsible in the transformer case, because the established the grid connection) The idea for this new project was to make it 50-50 again, in cooperation with the utility – with half the shares being public. My problem is a lack of finances again. The other is that Dong probably wants to build this farm themselves, because they own the existing turbines already.

22) Why hasn't Dong started this project yet?

Probably because they aren't quite aware of the possibility. They have a pool of possible projects, and this one is probably not the best.

23) Where do you get your funds from now?

We get it from the PSO for the Energitjenesten. It was a political decision to reserve 25 Mio. DKK for energy saving projects – we got the biggest share of 15 million DKK.