

# MARKET INTEGRATION AND THE DEVELOPMENT OF WIND POWER COOPERATIVES IN DENMARK LESSONS LEARNED FOR GERMANY

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*Wind power cooperatives in Denmark have mitigated exposure to market risks through joint cooperative actions and cooperation with financially strong partners. They have been facilitated by specific regulatory measures. Meanwhile, Bürgerwindparks (citizen-owned wind farms) in Germany could face severe obstacles from increased market integration. Price risks are lower, but the risks and costs of marketing electricity could be higher compared to Denmark.*

## FINANCING AND CREATING ACCEPTANCE FOR THE ENERGY TRANSITION

The European Union (EU) and its Member States are in the midst of a transition from a fossil-based energy system to one based on renewable energy sources (RES). To achieve this transition, financial contributions from the private sector are required as well as social acceptance at local level, where RES projects are actually implemented and often face resistance from locals for various reasons [1], [2].

The participation of private citizens in the generation of electricity from RES (RES-E) in the form of citizen-led initiatives is a viable solution to these challenges. Citizen-led initiatives can be defined as regionally confined groups of regular citizens who jointly initiate, procure, operate and own at least 50 per cent of RES-E installations. Such initiatives are heterogeneous, they can vary in size, organisational form, technological focus, etc. Prominent examples include *citizen-owned wind power cooperatives* or *solar initiatives*. Comparative research has shown that a high degree of financial ownership and participation on the part of private citizens through citizen-led initiatives in wind power leads to a high degree of acceptance for projects at local level and is positively correlated with high deployment rates [3]. In short, citizen-led initiatives can facilitate the energy transition.

Fixed feed-in tariffs (FiT), understood as market-independent remuneration paid for every kilowatt hour (kWh) including purchase obligations, have proven to be the most effective support mechanism for incentivising RES-E deployment by different actors, especially small decentralised actors. However, according to the EU state aid guidelines, RES-E technologies like onshore wind have reached market maturity and should be exposed to market signals via feed-in premiums (FiPs)[4]. FiPs, understood as remuneration in the form of a bonus payment in addition to market prices for every kWh, are supposed to be more appropriate for integrating renewables into power markets because they usually expose producers to market signals like fluctuating wholesale market prices. However, it is not clear how small and financially weak citizen-led initiatives operating weather-dependent wind turbines will react to a stronger exposure

to market signals. This has triggered a debate among scholars and practitioners, which refers more to economic theory than empirical evidence. This paper contributes to filling this gap by analysing the case of wind power cooperatives in Denmark.

Denmark embarked on the market integration of wind power at the end of 2002, when almost 40 per cent of installed wind power capacity was owned by wind power cooperatives. So, my research was guided by the following question:

### **How did market integration of renewables influence the development of wind power cooperatives?**

Moreover, I argue that Denmark is a highly relevant case for Germany. *Bürgerwindparks* – the German counterparts of Danish wind power cooperatives – owned 20.4 per cent of total installed wind power capacity (6 301 MW) in 2012 [5]. However, a reform of the Renewable Energy Sources Act 2014 (EEG 2014) has obligated producers to react strongly to market signals. Thus, I also ask:

### **What can Germany learn from the Danish case?**

The analysis takes an institutional perspective to assess risks and risk allocation for potential investors, which are determined mainly by the type and design of support mechanisms for renewable energy and power market design. It has been suggested that increased market integration via feed-in premiums can create barriers for citizen-led initiatives because they lack the skills, human resources and financial liquidity to trade electricity on wholesale markets. Thus, they rely on intermediary parties to sell their electricity output and manage balancing responsibilities on their behalf. This might increase actual risks (unreliable and reduced revenue) as well as the perception of risk by citizens and banks, potentially preventing the initiation of citizen-led projects [6].

The results are based on a qualitative case study of Denmark. The main dataset consists of 12 semi-structured interviews with key actors (managers and members of cooperatives, intermediary actors, public actors, NGOs, financial sector representatives) in Denmark and an extensive analysis of different types of documents.

## DENMARK AS A PROTOTYPICAL CASE FOR MARKET

### INTEGRATION

Wind power cooperatives in Denmark are formally organised as general partnerships, where individual citizens invest jointly in the procurement of wind turbines to operate them and sell the electricity output. Cooperatives are democratically organised but financially weak, because they rely on members' equity and loan capital from banks for project financing. Typically, they focus on a single small and local project, but can also become involved in large projects like the Middelgrunden Wind Cooperative with more than 8 000 members who operate parts of a 40 MW wind farm. Cooperatives differ from most traditional actors in the energy sector because they are driven by a mix of material and non-material motivations (e.g. profit, environmental protection, local added value, etc.) and often accept lower rates of return.

The emergence of wind power cooperatives in the late 1970s was facilitated by several conditions: a traditional familiarity in Denmark with the cooperative model in different economic sectors, ownership regulations restricting wind turbine ownership to local citizens and enterprises until the end of the 1990s, and tax incentives. Most importantly, stable fixed FiTs from the late 1980s until 2002 kept the exposure to markets risks at almost zero and financing was available at low interest rates from banks.

In 2002 cooperatives owned slightly less than 40 per cent of the total installed 6 300 turbines and over 150 000 households owned shares in wind power cooperatives. The remaining turbines were owned by single owners (approx. 40 per cent) – mostly farmers and utilities (approx. 20 per cent)[7].

The framework conditions for wind power in Denmark changed drastically after 1999 and again after 2002. Ownership regulations were abandoned, turbine sizes increased due to technological development, spatial planning procedures became more complex, and competition for available sites for wind projects became fiercer when commercial actors entered the market.

After the election of a new liberal-conservative government with a strong neoliberal agenda, Denmark implemented a fixed FiP scheme in 2003. Producers received the Nord Pool<sup>1</sup> market price, a fixed maximum premium 1.3 cent/kWh for 20 years and an additional 0.3 cent/kWh to cover balancing costs. Moreover, all new producers had to market their electricity directly on the wholesale market and were fully exposed to imbalancing risks.<sup>2</sup>

In the period from 2003 to 2008 investment in new installations, especially by cooperatives, dropped to virtually zero, with the exception of some repowering and off-shore installations. The main reason was that the premium was too low to compensate for low Nord Pool wholesale prices, and price volatility was perceived as a big risk by ordinary citizens and thus “scared people to enter into the cooperative game” [8]. Consequently, no new cooperatives emerged until 2008. Indeed, many existing ones dissolved because low revenue streams made possible repair works and even operation hardly profitable at all. Meanwhile the government had set up attractive incentives for decommissioning and repowering old turbines, which were often owned by cooperatives. After receiving good offers, many cooperatives dissolved and sold off their turbines to commercial actors, who were virtually the only ones who could deal with the complexities of repowering.

### FAVOURABLE CONDITIONS FOR CIVIC PARTICIPATION

**Wind power cooperatives in Denmark have mitigated exposure to market risks through joint cooperative actions and cooperation with financially strong partners and they have been facilitated by specific regulatory measures.**

Firstly, wind power cooperatives and individual owners of wind turbines were able to react strategically to policy changes. Already in 1999 the Danish Wind Turbine Owners Association (DK Vind) founded an independent trading cooperative called Vindenergi Danmark (Vindenergi DK) based on a joint decision by private wind turbine owners and DK Vind during a general assembly meeting [8].<sup>3</sup> The original purpose of Vindenergi DK was to trade guarantees of origin for electricity from wind power, but

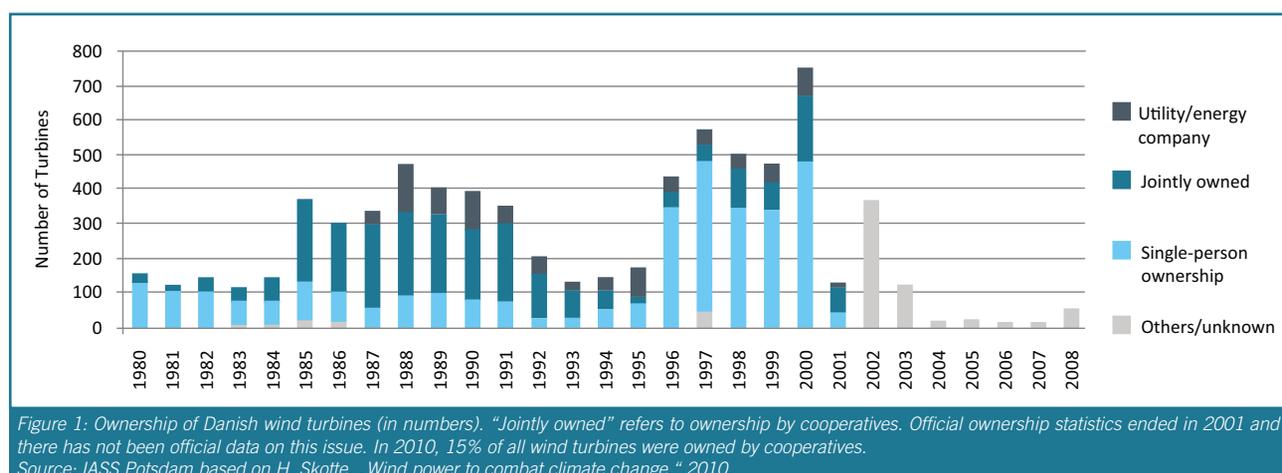


Figure 1: Ownership of Danish wind turbines (in numbers). “Jointly owned” refers to ownership by cooperatives. Official ownership statistics ended in 2001 and there has not been official data on this issue. In 2010, 15% of all wind turbines were owned by cooperatives. Source: IASS Potsdam based on H. Skotte. „Wind power to combat climate change,” 2010.

<sup>1</sup> Nord Pool is a common electricity spot market between Scandinavian and Baltic countries. Denmark joined the exchange in 2000.

<sup>2</sup> Imbalancing risks exist when generators need to provide load profiles before feeding power into the grid and must assume financial responsibility for any deviations between load profile forecasts and actual power production.

<sup>3</sup> DK Vind was founded in the late 1970s to represent the interests of private wind turbine owners through technical assistance, knowledge-sharing and political advocacy.

after 2003 the cooperative focused on purchasing and trading electricity at Nord Pool on behalf of wind power cooperatives and other private producers. To put it simply, private owners of the wind turbines organised in DK Vind pooled their resources to set up their own trader to take care of electricity sales to the market.

Vindenergi DK and the specific set-up as a member-owned trading cooperative mitigated real risks for existing cooperatives and facilitated the creation of new cooperatives because it also reduced risk perception. Vindenergi DK is organised as a non-profit cooperative owned exclusively by its members. A yearly dividend is paid to members and they maintain ownership as well as control and voting rights on a democratic basis. Moreover, Vindenergi DK reduced transaction costs and increased revenues from electricity sales for producers. This was possible due to a slim administrative body, extra incomes from the sale of guarantees of origin for electricity from wind power and economies of scale resulting from an increased wind project portfolio. In 2013, the cooperative traded over 2 500 MW of installed capacity, which corresponded to more than 50 per cent of total installed wind power capacity in Denmark [9]. Vindenergi DK's total market share was even as high as 70 per cent of installed onshore capacity in 2013. This is important because most cooperatives operate onshore turbines. Even though there are no exact figures, it is estimated that two thirds of all cooperatives trade with Vindenergi DK [8]. A major advantage of such a large portfolio is that balancing costs have been reduced substantially due to the wide geographical distribution of turbines.

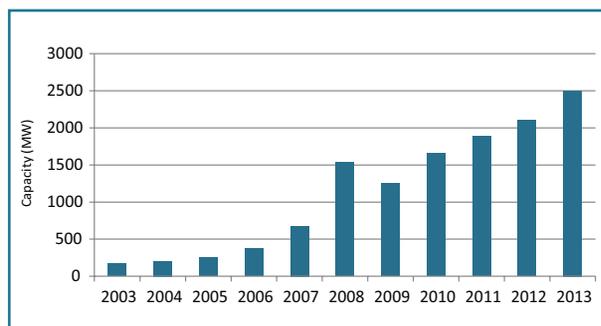


Figure 2: Installed capacity traded by Vindenergi DK in MW. Source: IASS Potsdam based on data retrieved from [www.vindenergi.dk](http://www.vindenergi.dk)

Secondly, the decreasing number of wind power cooperatives was connected to an increasing commercialisation of wind power and increasing resistance from citizens to wind projects [8]. To restore and maintain public acceptance, the Danish government enacted specific regulatory measures to ensure the participation of citizens in wind power projects: 1.) A local citizens' option to purchase wind turbine shares was implemented, thereby obligating developers of a new wind turbine to offer at least 20 per cent of the ownership to local citizens living within a radius of 4.5 km from the turbine; and 2.) A public guarantee to fund up to a maximum amount of €70 000 to support the financing of preliminary investigations, planning, etc. by local wind turbine cooperatives. If the project is implemented, the guarantee functions as a low-interest loan. If not, the maximum

amount does not have to be paid back. Both measures have arguably facilitated the creation of new cooperatives, but they are not undisputed. For example, the local citizens' option to purchase was dominated by professional investors in the first two years after it was introduced, as more than half of the projects implemented were not able to sell 20 per cent of shares and faced strong local resistance in planning process [10].

Thirdly, the nature of cooperative ownership has changed fundamentally. Wind power cooperatives that are initiated and solely owned by local citizens have become rare. As I have demonstrated, the higher total cost of modern wind turbines, increased market risk exposure, and the natural financial weakness of cooperatives in project development stages have created obstacles to the traditional model. However, these obstacles have often been overcome when local citizen groups have cooperated with financially strong partners like municipalities, utilities or private funds. Typically, a group of local people forms a cooperative to organise collaboration with such professional partners during the planning and construction phases of a wind project because it is more cost efficient and less risky for the cooperative. In some cases there is even a common board of all the partners during the planning and construction phases. After a project is implemented, ownership is usually split and neither party is involved financially or legally in the operation of the other party's turbines. The Hvidovre Wind Farm, where two turbines were erected in 2009 by DONG Energy and a local cooperative is a prominent example. After commissioning, ownership was split, with each partner owning and operating one turbine. Even though DONG offered to purchase and sell the cooperative's electricity output, Vindenergi DK was deliberately chosen as a trader by the members.

## COMPARING DENMARK AND GERMANY

Finally, the question remains how the Danish case can help to inform the German case of *Bürgerwindparks*. To arrive at an answer, we need to compare the risks in each country and evaluate the transferability of lessons learned in Denmark.

There are many similarities between the two countries, but also significant differences. Germany is experiencing a policy development similar to that in Denmark but with a delay of ten years. In the summer of 2014 Germany abandoned its fixed FiT regime. All new RES-E installations with a rated capacity above 500 kW are obligated to market their electricity on the German spot market and are remunerated by way of a sliding/ floating FiP. As in Denmark, an existing cooperative culture and low-risk investment conditions created by a FIT have allowed citizens to jointly invest in wind turbines. By contrast, however, the kind of ownership regulations for wind power that exist in Denmark have never existed in Germany. Therefore, the commercialisation of projects started earlier and is much more common. Many *Bürgerwindparks* have been developed in cooperation with professional project developers, who are in a better position to handle risks and complexity [11], [12].

**Bürgerwindparks in Germany might face severe obstacles from increased market integration. Price risks are lower, but the risks and costs of marketing electricity could be higher compared to Denmark.**

The main barriers to new wind power cooperatives in Denmark were excessively low and fixed premiums that meant that producers were fully exposed to price risks from unpredictable and fluctuating spot market prices. However, the present situation in Germany is different because the level of exposure to fluctuating market prices is lower under the German FiP scheme. In contrast to the Danish fixed FiP, the German sliding/floating premium design calculates remuneration to producers on the basis of monthly average spot market prices and a technology-specific reference price. So the premium is sliding because it makes up the difference between monthly average spot market prices and the reference value. Producers will only face high price risks if the party selling the electricity on the spot market is selling below the monthly average spot market price. In fact, the experience of an optional premium in existence since 2012 show that the opposite is true, as traders have regularly achieved prices higher than the monthly average, leading to higher revenues for producers [13]. Therefore, most wind power producers have become accustomed to using the premium model.

Yet, German *Bürgerwindparks* might face higher risks from market structures in electricity marketing. Since 2012 approximately 70 traders have emerged in Germany, covering the majority of existing wind turbines. In 2013 the five biggest traders traded 64 per cent of all wind power under the market premium scheme [14]. In contrast to Denmark, none of those companies has a specific focus on small-scale producers. So, given the present market structure, it is possible that those big players have considerably more market power than small *Bürgerwindparks* and will not protect the latter's interests in the same way that Vindenergi DK does [15]. Furthermore, large traders might give less favourable terms to *Bürgerwindparks* with small portfolios, because transaction costs are higher for small projects. These uncertainties might also increase the cost of capital for *Bürgerwindparks*, since banks will most likely calculate with higher risk premiums [16].

### **WHAT CAN GERMANY LEARN FROM DENMARK?**

So, how can Germany learn from the Danish case to preserve a high level of citizen participation in wind power? The Danish case suggests that increased market integration of wind power via fixed feed-in premiums increases price risks, transaction costs and risk perception. This creates an obstacle for small and financially weak citizen-led initiatives. Surprisingly, the case of Denmark also shows that cooperatives can survive and even thrive in high-risk environments under certain conditions, i.e. when cooperatives work together and pool their resources with financially strong partners when developing projects. The creation of the trading cooperative Vindenergi DK is a case in point for resource pooling, as it demonstrated how market risks are

mitigated when many small cooperatives jointly concentrate their activities and extend ownership beyond the generation of electricity to the marketing of electricity. This has mitigated risk exposure and improved the economic situation for individual cooperatives in a competitive environment. In Germany, there is limited potential to implement a nationwide central marketing model similar to Vindenergi DK due to established market structures. However, there might be some potential for *Bürgerwindparks* and other citizen-led initiatives to cooperate at regional level and in the direct supply of electricity to customers. We can already observe efforts to this end. To mention just one example: by the end of 2014, 24 citizen-led initiatives had joined a common initiative to market their output and supply customers directly [17].

As I have shown, in Denmark, specific regulatory measures have incentivised the creation of new cooperatives. The German government could consider following the Danish example and facilitate citizen-led initiatives by setting up state funds to finance the early project development phase. Another option would be to impose an obligation or create incentives for project developers to offer a specific share of ownership to local citizens. Such draft legislation based on the Danish example is currently being debated in the Federal State of Mecklenburg-Vorpommern. Yet, the Danish experience suggests that such a regulation needs to be designed carefully and involving locals in planning procedures is crucial to its success. Creating an option for local citizens to 'buy in' does not necessarily create acceptance. Besides, there might be other legal and political obstacles [18].

The overall conclusion of this paper is that citizen-led initiatives can survive and thrive in competitive environments under certain conditions. Future research could assess these conditions in different contexts in more cross-country comparisons. Germany is well advised to closely observe how things develop for its Nordic neighbour because both countries share some crucial similarities and there is much potential for mutual learning.

### **BACKGROUND AND ACKNOWLEDGEMENT**

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