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Optimizing the Local Embedding of Renewable Energy Plants*

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Abstract: In this article we ask about the factors that promote acceptance of local renewable energy plants and about the specific role nature conservation plays in the concert of other acceptance factors. We explored to what extent trade-offs between climate protection, nature and species protection, protection of local residents and local value creation can be realigned. The article provides an overview of the key acceptance factors identified and derives a set of trust and acceptance building measures. It has a specific focus on wind energy.

Our findings suggest that nature conservation rationales have definitively a role to play as a local acceptance factor, but other acceptance factors are closely linked or more important. Particularly, economic factors, the attitudes towards the energy transition, trust in key actors and planning and development processes were identified as key preconditions for local acceptance.

Key Words: Renewable Energy Plants, Wind Energy, Acceptance Factors, Local and Regional Acceptance, Climate Protection, Nature Conservation, Trust

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I. Introduction

1. Setting the Scene – Renewable Energy Goals in the EU and Germany

In December 2018, the revised Renewable Energy Directive 2018/2001/EU (RED II) entered into force. It aims at keeping the EU a global leader in renewables and to meet its GHG emissions reduction commitments under the Paris Agreement. The RED II establishes a new binding renewable energy target for the EU for 2030 of at least 32%, with a clause for a possible upwards revision by 2023. In order to achieve the overall binding EU target, the Member states have to develop National Energy and Climate Plans (NECPs) by 31 December 2019.

In Germany, the share of renewables in final energy consumption across all sectors reached 16.6 percent in 2018 (UBA, 2019). In 2018, the share of renewables in gross electricity consumption reached 37.8 percent. Germany aims to cover 60 percent of final energy consumption and 80 percent of its electricity consumption from renewables by 2050. The government has goals for phasing out nuclear by 2022 and simultaneously decarbonising the economy by reducing GHG emissions by 80 to 95 percent of 1990 levels by 2050. A commission recently recommended to phase out coal by 2038. The implementation of local energy projects, in particular wind energy, plays a key role in this transformation.

2. Social Acceptance of Renewables as a Pre-Requisite for a Successful Energy Transition

Social acceptance of wind energy has become a subject of contested debates due to the visual impact on landscapes, noise annoyance (including infrasound), perceived health risks, local environmental disruption, risks for local fauna and flora, potentially negative impact on recreation and tourism, potential land and real property value loss, but also due to perceived procedural or distributional injustice and poor public involvement and participation (Petrova 2016). Wind turbines, ground-mounted photovoltaic systems or biogas plants require space and have an impact on habitats and landscapes. Thus, questions of nature and environmental compatibility are increasingly being put forward as arguments against the expansion of renewables.

In cities as well as in rural areas and across all educational, income and age groups, the population supports the overall goals of the energy transition and favours the expansion of RES. While solar energy on rooftops is widely accepted, conflicts increase when it comes to the construction of ground-mounted systems (solar parks), onshore and partly offshore wind turbines or biogas plants. Particularly, where wind turbines are planned, concerns about the visual impact, acoustic emissions including infrasound, nature and species conservation as well as other local resident interests are expressed (FA Wind, 2019). When asked about the conditions under which renewable energy plants (RE systems) are accepted, there are no easy answers. However, for the success of the energy transition, it is of pivotal importance that the further expansion of renewable energies is accepted and supported by the population.

3. The Interdisciplinary Research Project AcceptEE

The aim of the research project AcceptEE (see footnote 1) was to analyse whether an environmentally sound expansion of RES can lead to a higher level of local acceptance of renewable energy projects. We analysed the specific role of landscape as well as nature and species conservation rationales in the concert of other local acceptance factors. Furthermore we asked how trade-offs between climate protection, nature conservation, protection of local residents and local value creation can be re-aligned?.

To answer these questions, the research team employed a combination of qualitative and quantitative research methods. In a first step, municipal and regional political leaders, representatives from regional planning and permitting authorities, nature conservation authorities, land owners, project developers, plant operators, citizen action groups opposing wind energy and nature and environmental protection associations have been interviewed in three different locations with installed capacities of wind, ground-mounted PV and biogas plants. In a second step, personal interviews and an online survey addressing local residents in the host communities have been carried out. In total, responses from 158 residents were collected. The quantitative analysis was mainly performed by the Institute of Psychology in Halle. It comprised bivariate and multivariate analyses.

4. Purpose, Concepts and Structure of the Paper

Referring to the broadly acknowledged framework developed by Wüstenhagen et al. (2007) who differentiate between three dimensions of social acceptance, in this paper we mainly concentrate on

community (or local) acceptance of renewable energy projects.[1] The paper has a special, but not exclusive focus on wind energy and is structured as follows: Section 2 presents an overview of those acceptance factors which, based on the surveys of local residents and the quantitative analysis, were identified as key. Section 3 leads us to the question how wind farms and other renewable energy plants can be optimised in such a way that they are accepted as widely as possible by the local population. It has a special focus on trust and acceptance building measures. The findings are mainly based on qualitative research methods (desk research, expert interviews).

II. What influences Local Acceptance of Renewable Energy Plants?

This section provides an overview of key acceptance factors identified in the research project AcceptEE:

1. Social Norms

As social beings, people in almost all spheres of life use social norms (the opinions and behaviour of others) as a source of information and for orientation in their search for their own point of view. This is also the case when it comes to renewable energy projects: the more positive the local opinion is estimated by local

1) Socio-political acceptance is defined as the general degree of support for technologies and policies, whereas market acceptance relates to the meso level, involving both consumers and investors and also includes an intra-firm dimension (Wüstenhagen et al., 2007, p.2685).

residents, the higher the level of acceptance. Residents, however, tend to underestimate the local acceptance in their community. One of the reasons for this is that opponents are usually more active and more visible because they are concerned about public attention. Hence, protests against specific plants do not necessarily reflect the prevailing local opinion. Although the correlation of this factor with the local acceptance of the plants turned out to be weaker compared to the other acceptance factors, it was a constant size (Hübner et al., 2019).

2. Environmental Compatibility: Human, Nature and Landscape Protection

Our research suggests that nature and species protection play a significant role as acceptance factors, but economic factors, attitudes towards the energy transition and trust are even more important in influencing local acceptance (Hübner et al., 2019). Referring to the influence of wind power plants on humans, sound (noise) including infrasound plays a key role. In our study, cases of annoying noise from wind turbines were reported. However, most residents in our surveys perceive their living environment or health hardly as impaired (ibid.). Irritations are triggered through the visibility of the installations, the rotating blades and the navigation lights (in the night). In particular on mountain ridges or in sensitive landscape types, wind turbines have a great influence on the perception of the landscape scenery. Other related factors include a possible reduction of the recreational function or the loss of the "sense of home".

Habitat disturbances or collisions can result from the land-use changes associated with the construction of the plants as well as from

their operation. In particular, the danger of birds and bats colliding with wind turbines is a matter of major concern. In Germany, questions of nature and species protection are addressed within the process of wind energy zoning in spatial planning and in the approval procedure. If negative effects for objects of protection are expected, compensatory measures are prescribed. Nevertheless, in the three regions surveyed, respondents estimate the consideration of nature and landscape protection aspects as rather critical. Interestingly, most of the respondents did neither know the expert opinions drawn up, nor the compensatory measures implemented to offset intrusions of nature and landscape. This means that in practice more is done in terms of nature and species protection than the local residents perceive.

Nature conservation as an acceptance factor is rather difficult to grasp, because trade-offs between energy production based on renewables in order to mitigate climate change and the protection of nature, biodiversity and landscape are almost inevitable. A low impact on biodiversity and the landscape seems to be crucial for community acceptance.

3. Economic Factors and Perceived Distribution of Costs and Benefits

The findings of the quantitative research indicate that the economic benefits of wind energy projects is the most important acceptance factor. This factor includes regional and local added value creation, local economic development and welfare effects. Municipalities hosting RES projects can benefit from local trade tax payments and compensatory measures and payments for the intrusion of nature and

landscape. Many developers offer further compensations, in-kind benefits or support the development of non-profit civic associations or foundations. There are also examples of developers offering other benefits including special electricity tariffs to the communities.

However, a critical acceptance factor is the distribution of costs and benefits. If only few actors benefit (land owners, investors), while many others have to bear the risks and negative impacts, local acceptance is likely to be low. Envy between different actors is a recurring phenomenon that also generates opposition. Local RES projects are more likely to be accepted if investors contribute to local welfare creation and the Common Good and if these contributions are perceived by the local people. Therefore, as many residents and local actors as possible should benefit economically from the installation of RES facilities. Community (co-)ownership and citizen energy companies are examples of direct financial participation, foundations or civic associations which disburse a certain percentage of the operating company's revenues for social or charity purposes are examples of indirect financial participation of local communities.

In addition to a fair cost-benefit distribution between the beneficiaries and those affected by the projects, a fair spatial distribution of renewable energy plants should also be considered as an acceptance factor. The aspect of "interregional distributional fairness" became particularly clear in the expert interviews in the region of Dithmarschen with one of the highest wind turbine densities in Germany. Interviewees pointed out, that the region has fulfilled its contribution to the energy transition and that "the limits of what is tolerable have been reached".

4. Plausibility, Stringency and Coherence of the Energy Transition

Both our qualitative and the quantitative results from our expert interviews and surveys with local residents reveal that the overall attitude towards the energy transition, the perceived plausibility and coherence of energy policy goals, strategies and measures at the various political and administrative levels had a relatively high impact on the local acceptance of renewable energy plants. The more local residents consider the energy system transformation and its implementation to be meaningful and consistent, the more likely they are to accept RES projects. This is also in line with other research findings (Eichenauer, 2016; Eichenauer, 2018; Devine-Wright et al., 2017). Many surveys including the recent Social Sustainability Barometer on the Energy Transition (Setton, 2019) indicate, that the vast majority of the population in Germany supports the energy transition and the expansion of RES. The actual implementation of the energy transition, however, is viewed more critically by the population. In particular, cost and equity issues play an important role, but also the perceived lack of coordination of the overall process.

5. Trust in Key Players

Trust in the procedures and in the responsible key actors, such as investors, project planners and employees of the authorities, is closely linked to the acceptance of local RES facilities. Those who consider the actors and institutions not trustworthy will have little confidence in the procedures and decision-making processes. Trust in the actors is strongly linked to personal qualities such as honesty, credibility, reputation, competence, fairness and orientation towards the Common

Good. If the actors cannot fulfil the respective expectations, the trust placed in them is rather low. Low trust in actors and institutions also influences trust in decision-making processes and procedures.

Land securing practices by project developers are often non-transparent. Often developers have acquired land or concluded option agreements with the landowners before the local authorities and decision-makers are informed. In many cases, information "flows behind closed doors", local authorities are left with the role of observers. In the worst case, municipal decision-makers learn about a project only once the developer applies for approval. Aggressive or non-transparent land securing practices reduce the credibility and trustworthiness of investors and planners. Bias, role and interest conflicts of political-administrative decision-makers can also have a negative impact on their credibility and trustworthiness and the local acceptance of renewable energy expansion (Reusswig et al., 2016; Eichenauer, 2016).

Ⅲ. How to Improve Trust?

1. Building Trust through Community and Citizen Energy Projects

Acceptance research shows that renewable energy communities and community ownership of renewable energy projects can be a main driver of community acceptance (cf. Jobert et al., 2007; Ruggiero et al., 2014; Warren and McFadyen, 2010; Zoellner et al., 2008; McLaren Loring, 2007; Sonnberger and Ruddat, 2017; Liebe et al., 2017; Wirth, 2014). At present, almost half of Germany's electricity generation capacity benefitting from the financial support provided via the

Renewable Energies Act (EEG) (except for offshore wind) is in the hands of small private investors. These actors include farmers, landowners, individuals and private households, energy cooperatives, civil law partnerships, limited liability companies or limited partnerships. These diverse forms of citizen energy (*Bürgerenergie*) are an important driver for the dynamics of the energy transition. Moreover, citizen energy encourages more diverse acceptance and support for renewables and thus increases the stability of the German renewable energy sector (Bündnis Bürgerenergie, 2014; Debor, 2014; Müller and Holstenkamp, 2015; Ott and Wieg, 2014).

Community wind farms are widespread in several regions in Germany like e.g. in North Friesland where 90% of wind farms are in community ownership (Windcomm, 2012). Many of the wind farms were developed by bottom up grassroots initiatives. Minimum shares are usually low to enable as many residents as possible to benefit as limited partners or shareholders. Usually, persons living in the immediate vicinity of the wind farm enjoy privileged treatment. Often, the municipalities are involved as initiators/shareholders. These projects have become a cultural asset within the community. In many cases the community wind farms are accompanied by complementary benefit sharing measures including in-kind benefits, community foundations/trusts etc.

In East Germany (former GDR) local or community ownership of wind energy plants is less developed. In Thuringia, 80% of all wind turbines are owned by investors from outside Thuringia. There are only few community/citizen owned wind farms or wind energy co-operatives. This is at least partly related to different land ownership structures which emerged after the privatisation of

formerly state-owned agricultural and forestry areas in Eastern Germany (Gotchev, 2016). Often, the actual owners of the land are not local farmers, residents or communities. Municipalities only own a small fraction of land. For this reason, opportunities to develop citizen/community wind farms are constrained. Local/regional value creation from wind turbines has therefore been limited so far.

A key rationale of many community energy actors is to control and shape local or regional energy supply and to generate local added value. A study conducted by the Institute of Decentralized Energy Technologies showed that a wind farm developed by regional actors with the participation of municipal partners strengthens regional added value almost eight times as much as one built by external developers (Institut dezentrale Energietechnologien, 2016).

Active financial participation of citizens – as shareholders or lenders – can provide an opportunity for profitable investments. Forms of passive financial participation include special electricity tariffs, provision of in-kind benefits, payments for the compensation of landscape intrusion, contracting of local firms for construction works, or land lease payments for land owners and bonus payments for local residents. Municipalities hosting the wind farms benefit from local business tax revenues.

Citizen energy is not only characterised by its potential to create added value, but also by a high degree of identification of citizens with the energy supply in their own municipality or region. This is because most of the electricity generated by citizens' power plants is produced regionally and close to consumption (Zuber, 2014). Furthermore, due to their proximity, initiators of community and citizen led initiatives and co-operatives often enjoy a relatively high

level of trust, an important pre-requisite of acceptance. Hence, supporting the development of community energy companies can definitively help to promote acceptance.

While in western and partly northern European countries the number of community energy projects has steadily increased over time, in most eastern and southern European countries community energy is still underdeveloped. This is related to a lack of enabling policy frameworks. New European legislation in the RES sector provides a framework which might spur the development of community energy. In its Clean Energy Package, the European Union acknowledged that renewable energy communities – such as co-operatives – have a major role to play in Europe's energy transition.

Article 22 of the RED II obliges Member States to assess barriers to renewable energy communities (REC), as well as the potential for REC in their territories. Member States are obliged to provide enabling frameworks that can ensure that there are no unjustified regulatory barriers to community energy, that distribution system operators cooperate with energy communities, that participation is accessible to all consumers, and that regulatory and capacity-building support is provided to public authorities in enabling and setting up REC. Member States will also need to ensure that they take the specificities of REC into account when designing support schemes.

2. Improving Trust in Energy Policy

Our study showed that the overall attitude towards the energy transition on the one hand, and economic factors on the other one, had the strongest influence on local acceptance. A spatial distribution

of energy plants which is perceived as unfair, an energy policy coordination perceived as inconsistent, or wind turbines, that have to be temporarily shut down due to grid congestions lead to discontent and annoyance. The more positively the implementation of the energy system transformation is assessed, the higher is the acceptance of local renewable plants. Hence, local communities have to be better informed about the meaningfulness of renewable energy production, its socio-economic benefits and societal values. Embedding the expansion of RES locally in integrated regional or municipal energy or climate protection concepts which are developed bottom-up in a participatory process together with local communities can help to promote acceptance and reconcile renewable energy expansion and nature conservation. The goals and achievements of the energy transition as a whole and the municipal contribution should be actively communicated at all administrative levels. Energy and climate protection concepts can become part of the local identity. Examples of this in Germany are the numerous "100% renewable energy regions" or "bio-energy villages". However, local actors and residents often do not know whether regional energy concepts exist and by whom or on what basis they were developed. For this reason, local energy and climate protection concepts should be developed in a participative manner and should be communicated to the public.

3. Improving Trust in Project Developers

Our research suggests that credibility and trustworthiness of the project initiators, developers and operators is of high relevance for community acceptance. If local actors are not trusted, opposition becomes more likely. External investors and project planners can

contribute to a smooth implementation of the projects through credibility, professionalism, open communication, public engagement and financial compensations for the local communities.

Particularly in regions where external developers dominate the market complementary benefit sharing mechanisms can turn out essential to ensure distributional justice and hence acceptance. This includes a fair distribution of benefits among developers, the host communities, landowners and local residents or foundations. It is essential to implement concepts that generate added value for the region. For instance, developers may contract local businesses or dedicate a certain percentage of their revenues to social or environmental projects (via foundations or civic associations).

Project developers can help to increase credibility and trustworthiness in many ways. They can voluntarily commit themselves to procedural participation and/or financial participation of local communities. Land procurement practices should be transparent and fair in order to avoid that land owners do not feel getting played off one against each other. The development of land lease pool models can help to reduce mistrust and envy among different types of land owners. Local decision-makers should be informed at an early stage of the planning process.

Developers can voluntarily opt to carry out an Environmental Impact Assessment, which automatically includes a formal participation of the public. Trust and acceptance building can also be enhanced if developers take over responsibility for local welfare and the Common Good including requirements of nature and species protection. Voluntary sustainability reporting (e.g. the publication of a Common Good Balance Sheet) also might help to increase trust.

Public actors can increase trust and acceptance by developing

voluntary quality labels for fair wind energy. Such labels can be effective, provided the issuing body is credible, the level of ambition is sufficiently high and control and sanctioning mechanisms are in place. In this context, studies in the field of product certification show that environmental and consumer associations or non-governmental organisations in particular are perceived as independent and trustworthy, whereas companies and private institutes are met with scepticism (Speck, 2018; Friedel and Spindler, 2016).

4. Improving Trust in Planning Pocedures

The early provision of clear, transparent, and credible information is a key prerequisite for opinion-forming processes among the population. Local citizens and decision-makers wish to get informed about the planned sites, the investment costs and profits, the costs and benefits for the local community, the impact on people and the environment and opportunities for participation. Visualization methods can support planning processes and make information easier to grasp.

In Germany, the formal participation possibilities in the authorization process are rather limited. Only where the number of wind turbines reaches 20 or more, or where an environmental pre-assessment leads to the conclusion that an EIA needs to be carried out, a formal participation process is obligatory. This means that many projects are implemented without any formal public consultation. Therefore, informal dialogue and public engagement formats are of pivotal importance. However, dialogue and participation should not only be left to the commitment of the developers and operating companies, but additionally supported by local governments and authorities.

Well-designed, informal participation formats and processes can

help to increase the perceived fairness and justice in the planning process and thus increase the chances of trust and acceptance. Initiators of participation processes should offer dialogues at an early stage and at the same time inform about the actual possibilities of participation and influence. In addition, the citizens want to know how the results will flow into the further planning process. Creating an open participation culture can help to build acceptance – but participation alone does not necessarily lead to more acceptance.

Usually, expert appraisals for nature and species protection are commissioned and paid for by the project planners. Nature conservation organizations, but also wind energy opponents often criticize that due to this specific constellation, the experts conducting those appraisals are inherently biased and lack credibility. They sometimes also criticize the poor quality of those appraisals. The certification of experts could counteract any resentment. However, objective standards are difficult to set. It was also suggested that expert appraisals should be commissioned and paid by the permitting authorities. A third option is that the involved parties (developers, authorities, environmental organizations) jointly select the experts (Hübner et al., 2019).

5. The Role of Advisory and Intermediary Organizations for Building Trust

Studies illustrate that mayors can play a pivotal role in transitions to 100% RES (particularly in small municipalities) through building support, brokering deals, communicating visions, and ensuring implementation of projects (Busch and McCormick, 2014). Mayors can take over important integration and mediation functions in the event

of conflicting views. Particularly in small rural municipalities, however, mayors and local councillors work on a voluntary or honorary basis. They tend to be overloaded by complex planning and approval procedures. Here, professional, neutral, intermediary advisory and support organizations can help to create a more open, constructive communication culture, to organize dialogues, and reconcile between different interest groups. They can support local authorities to act on a level playing field with developers. National and international research on the social acceptance of renewable energies emphasize the role of enabling intermediaries as a critical factor in determining the success and degree of social support for wind energy (Huber and Horbaty, 2010; National Economic and Social Council, 2014; Devine-Wright, 2012; Devine-Wright et al., 2017).

The example of the wind energy service centre in Thuringia in Germany, which was set up in 2015 as a structural unit of the Thuringian Energy and GreenTech Agency (ThEGA), illustrates the function of intermediary actors in promoting acceptance: the centre acts as an information hub and advisory body and plays a mediating role between the four central groups of actors – project developers, municipalities, citizens, and land owners. The service centre offers free and neutral information, provides consulting and support measures for municipalities, citizens and project planners. This includes site visits, citizen consultation hours, legal advice for municipalities, support for regional dialogue events, as well as assistance in conflicts.

In addition, the service centre awards the label "Fair Wind Energy" to project developers and planners if they voluntarily comply with five guidelines for fair wind energy. Accordingly, project planners have to meet certain minimum requirements with regard to transparent

handling of information, the participation of interest groups, fair participation of the citizens, municipalities and companies concerned and the involvement of local banks and energy suppliers. The guidelines also address nature conservation aspects. The label is intended to enable a positive differentiation with regard to the credible implementation of procedural participation rights and financial participation, as well as the strengthening of local value creation. The service unit monitors compliance with the label on an annual basis.

The activities of the service centre in Thuringia helped to overcome informational asymmetries and create a level playing field between developers and municipal decision-makers (Di Nucci and Krug, 2018). It has become almost impossible for project developers to do business in Thuringia without having the label for fair wind energy (Notroff, 2017). Findings of the European research project WinWind suggest that the label increases transparency and trust (Themann et al., 2019), key pre-requisites for social acceptance. In addition, it helps to build up additional network structures and exchange between stakeholders. The label provides clear orientation for other initiatives and has a standard-setting function.

Ⅳ. Conclusions

Our quantitative research results derived from personal interviews and an online survey suggest that nature and species protection play a significant role as acceptance factors, but economic factors, the attitudes towards the energy transition and trust in actors and processes are likely even more important in influencing local acceptance.

Plants built in a way that is compatible with nature and landscape are more widely accepted.

Respondents estimated the consideration of nature and landscape protection aspects as rather critical despite comparatively strict permitting requirements and need of comprehensive expert assessments. Only few residents are aware of what is already being done to take nature conservation concerns into account in the planning and permitting process. Most of the respondents did neither know the expert opinions drawn up, nor the compensatory measures implemented to offset intrusions of nature and landscape. This means that in practice more is done in terms of nature and species protection than the local residents perceive. The nature conservation requirements should therefore be comprehensively and effectively communicated. This applies both to the investigations carried out and to the measures taken to avoid, reduce and compensate for impairments.

Several studies suggest that proximity and local embeddedness of key actors, project planners and shareholders can have a positive effect on local acceptance (Jobert et al., 2007; Enevoldsen and Sovacool, 2016). However, our research concludes that the crucial factor is personal trust in the people involved. Conversely, our findings suggest, that external developers and investors can contribute to an almost conflict-free implementation of projects through their credibility, professional appearance, open communication, engagement of local communities and financial compensations.

Besides economic factors, the overall attitude towards the energy transition had a significant influence on the local acceptance of renewable energy plants. Promoting a) participatory local energy concepts and b) community energy projects can be a particularly

promising strategies to enhance acceptance. The recently revised Renewable Energy Directive has the potential to spur the development of renewable energy communities across Europe.

The paper provided a brief overview of policies and measures helping to build trust and hence acceptance. Factors that contribute to this include transparent decision-making and planning processes, a fair distribution of costs and benefits, and keeping generated revenues in the region. Because trade-offs between climate protection through wind energy on the one hand and nature and landscape protection on the other hand are always necessary, it is of particular importance to optimise transparency, participation and trust in actors and the development processes.

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