



Public acceptance of renewable energies: Results from case studies in Germany

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ABSTRACT

This article addresses the public acceptance of certain renewable energies (grid-connected larger PV ground-installed systems, biomass plants and wind turbines) from a socio-scientific perspective. Using an environmental–psychological approach to investigate the social factors relevant to the formation of public acceptance towards renewable energies in four different regions, recommendations for the further implementation of renewable energy systems were to be derived. The present study has been conducted in a multi-modal research design combining a standardised questionnaire and qualitative interviews and focused on the residents' views and perceptions. Especially within the quantitative analyses, the results indicate that economic consideration of the respective renewable energy system, understood as a positive cost–benefit calculation made by the individual, is the strongest predictor for a reported acceptance. Furthermore, the importance of landscape evaluation and a strong connection between procedural justice criteria, such as transparency, early and accurate information as well as possibilities to participate during the planning and installation process, and a reported public acceptance became evident. Qualitative data were analysed in reference to the grounded theory and showed the relevance of the operating company's commitment on the local level, participation of the general public and the choice of the location for the plant were among the relevant aspects for acceptance in the implementation process.

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1. Introduction

Regarding the CO₂ reduction goals set by international politics, an increasing usage of renewable energies and a necessary shift of our existing energy systems towards sustainability have been discussed widely. In Germany, power generation via renewable energies has been strongly supported by the German government during the last few years. As a result, the number of renewable energy systems in power generation has risen rapidly. For reaching the goals in CO₂ reduction, an even higher degree of utilisation is required. So far, this topic has mostly been assessed from a technical point of view. Consequently, discussions focused on questions such as the reliability of energy supply or the challenges of grid integration.

Besides technical, legal and economic questions, however, broad public acceptance and a corresponding transfer of consciousness into every-day life are essential for reaching the reduction goals. Therefore, the present approach aims at investi-

gating the social processes connected with renewable energies. Despite the fact that representative public opinion polls show considerable support for sustainable energy policies as well as for a growing percentage of renewable energies in power generation on an abstract level, many residents on the local level feel severely limited in their quality of life by renewable technology systems installed nearby, i.e., for instance, by undesired changes of the landscape, by noise or by transport issues. In addition, risks for nature such as potential birdstrikes are perceived critically. In addition to these rather obvious aspects, contextual framework issues such as rising energy costs due to the mandated inclusion of increasingly larger percentages of renewable energies within the energy supply, the handling of administrative zoning, planning and licensing procedures as well as the provision of early and accurate information in specific implementation processes might influence how people think of renewable energy plants.

Taken together, these points emphasise the importance of knowing the social factors relevant to the formation of public acceptance towards renewable energies. In the same vein, it is necessary to investigate the corresponding processes on the

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individual level. Nevertheless, there has been little socio-scientific research concerning social aspects of renewable energies so far. Detailed knowledge about these processes, however, would create the possibility to give recommendations on the basis of empirical data regarding selected measures for the implementation of socially accepted renewable energy systems.

The present contribution exemplifies this approach by analysing the social aspects underlying implementation processes regarding grid-connected photovoltaic (PV) solar, biomass and wind power plants.

2. Theoretical background

Within the environmental psychological approach, the presented research follows a holistic understanding of environment. This study's definition of environment therefore includes the whole scope of possible dimensions, such as natural, technical, social and virtual. As a consequence, humans and their environments are not studied separately but as an integrated whole.

As regards renewable energies, some conflicting issues are already well-known and part of general public discourse. Some, such as changes of landscape, are even central topics of mass media reports. Due to their considerable (visual) range, it is in particular large PV systems or wind turbines that can cause significant changes to the surrounding landscape; for biomass it is the crop used and the grow patterns. This change relates to a number of different dimensions: in terms of spatial and material criteria, if characteristic features of flora and fauna are concerned, moreover, similar considerations apply to physiognomic characteristics of landscape as an extract of earth's surface as well as to the constructed conditions and meanings originating from the residents' individual perceptions. All these characteristics are viewed holistically rather than isolated from each other. In this context, it is important to stress that the process of perception and evaluation of landscapes is active, subjective and transforming (Ittelson et al., 1977). This subjective and individual perception and evaluation process always depends on previous experience and knowledge. Furthermore, it is embedded in societal construction processes as influenced by the actual state of the mental system (Strohmeier, 1999). Many studies report on fundamental preferences of natural and untouched landscapes (Kaplan and Kaplan, 1989; Ulrich, 1993), which are attributed with fostering recovery and promoting health (Ulrich, 1986). It is assumed that landscape perception helps to fulfil fundamental needs (Hartig et al., 2003; Schweizer-Ries, 2006). Therefore, one can suppose that an energy system established in already industrially affected landscapes is perceived as less interfering than an energy system constructed in previously untouched landscapes.

Another aspect is not to look on the respective characteristics of the technology, but on the overarching process level in terms of a conflict or negotiation process. In principle, the term conflict describes a perceived incompatibility of interests between two or more conflict parties (Rubin et al., 1994). There are a lot of different possible conflict types and dimensions, and they may be material or immaterial in nature. More specifically, in the case of renewable energy systems, there are several potential conflicts and conflict parties, e.g., residents, operating companies, environmental activists with different interests and motives. The procedural justice theory states that conflict progression and estimation are strongly influenced by the presence or absence of fair behavior by the conflicting parties (Tyler and Folger, 1980). Leventhal (1980) postulates six essential criteria which have to be satisfied to give a process procedural justice. These criteria are the equal treatment of persons and situations (*consistency*), the absence of self-interest (*bias-suppression*), full and correct

information (*accuracy*), the possibility to retract decisions (*correctability*), the involvement of all parties into the decision-making process (*representativeness*) as well as the adherence to elementary moral and ethical values (*ethicality*).

Consequently, if a successful and non-conflicting process is desired, these procedural justice criteria have to be taken into account in planning and system construction processes (Zoellner et al., 2005).

The changes of the landscape and perceived fairness of the planning process are only examples of influencing factors to the acceptance of renewable energy technologies, others might as well exist, e.g., risk perception, environmental consciousness, economical impacts, etc.

3. Method

Research in environmental psychology follows the principals of transdisciplinarity, multi-methodology and application-orientedness in order to address the complexity of the phenomena under investigation (Bell et al., 2001). Therefore, a multi-methodological approach is used to study the present subject. According to Bortz and Döring (1995), qualitative methods are to be used when (1) verbal data are to be interpreted and the subject under study has been poorly investigated so far, or when (2) the specific individual perspective of the research subjects is focussed upon. In addition, the described project aspires to actively involve the investigated individuals as opposed to view them as research objects only. It is planned, therefore, to reflect and discuss the project results in order to facilitate renewable energy processes in the communities.

3.1. Description of the investigated regions

All in all, four different regions have been researched. Two regions were compared concerning the social aspects of the implementation processes of PV ground-installed systems. In one of the communities, a PV system was installed (A), while in the other community (B) several hindrances prevented the installation of the planned PV ground-installed system. Region A is situated in a former mining area in East Germany, with all the ecological, economic and social impacts of this industrial background. Region B is situated in South-West Germany. Both communities consist of aggregations of several smaller communities.

As regards both wind energy (C) and biomass (D), one region was surveyed in each case. Region C is located in West-Germany and home to numerous wind turbines. Region D is situated in North-East-Germany, a rural area where many farmers changed their cultivation practices from food plants to energy plants. While many biomass plants are already operating, there is also still considerable protest among residents.

Furthermore, by the end of the research project, eight regions will be studied which gives the possibility to make comparative considerations between the regions and the respective energy technologies in more detail.

3.2. Qualitative methodology

The qualitative study consists of two phases. In the first phase, qualitative interviews have been conducted with members of local authorities, operating companies of PV ground-installed systems, nature protection organizations, and members of citizens' initiatives. This phase aims at understanding the wide range of social parameters that determine renewable energy

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