Energy Research & Social Science 13 (2016) 84–93

Contents lists available at ScienceDirect

Energy Research & Social Science

journal homepage: www.elsevier.com/locate/erss

Original research article

# Community perceptions of renewable energies in Portugal: Impacts on environment, landscape and local development

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ARTICLE INFO

*Article history:*
Received 30 March 2015
Received in revised form 21 October 2015
Accepted 9 December 2015
Available online 23 December 2015

*Keywords:*
Wind energy
Solar energy
Environmental impact
Socioeconomic impact

ABSTRACT

This article aims to contribute to the debate on energy transitions in Europe, by focusing on community perceptions in a southern European country marked by a significant development of renewable energy in recent years, Portugal. Three main dimensions of community perceptions of the impact, both positive and negative, of renewables are addressed: environmental, landscape and socioeconomic. The article is based on case studies of communities living in the vicinities of three wind farms and a solar power plant. The results show that not only community perceptions are heterogeneous but also that, in order to better understand the factors for social acceptance, it is crucial to examine perceptions not just at the planning stage but also once the energy infrastructures are constructed and functioning.



## 1. Introduction

Most of the social sciences literature on renewable energy and communities is still very much focused on the factors of acceptance and resistance and on participation and engagement during the planning stages. Far fewer articles address what happens in communities once wind farms, solar power plants and other energy infrastructures are built and start operating. Although several studies mention that social acceptance tends to grow after construction [1–4], few explore this change in detail and fewer still delve on the impact of renewable energy infrastructures in local communities.

Understanding how communities living in close proximity to these structures envisage renewable energy, its benefits and drawbacks, can generate relevant input for adjusting planning procedures, devising incentive schemes, avoiding negative impacts, ensuring environmental and social justice. And, since the most favorable locations are in many countries just about exhausted, especially in the case of wind farms, further development will require the siting of facilities in areas where they will have a higher impact, thus resistance is expected to grow.

This article aims to address that knowledge gap, by exploring the perceptions of communities living in the vicinity of wind farms and solar power plants, namely, the social and economic advantages and disadvantages, the environmental and health risks, the transformations in landscape and land use, the impact on local development, highlighting the tensions and conflicts, as well as the negotiations and compromises achieved between local stakeholders. Three main dimensions will be explored: environmental and health effects, landscape and place attachment, and socioeconomic impacts.

The article is based on three case studies of wind farms and a solar power plant in Portugal. Renewable energy infrastructures have become a dominant feature in most of the rural landscape in this country: with close to 250 wind farms (totaling over 2500 turbines), a third of the municipalities have at least one within their territory; this figure rises to close to half in the hilly northern and central regions (but increasingly reaching the southern areas as well) [5]. Therefore, many villages and small cities are directly affected, even if only in visual terms, by wind energy production. Photovoltaic solar power plants are less numerous (only 44 above 250 kW) and mainly located in municipalities in the south of the country [5] (Fig. 1).

We have argued elsewhere [6] that Portugal (and Spain) shows a distinctive pattern from northern Europe in terms of the factors for success in energy transition. The growth in renewable energy has

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http://dx.doi.org/10.1016/j.erss.2015.12.007
2214-6296/


1 Wind farm of Alvaiazere (WFA)

2 Wind farm of Serra da Freita (WFSF)

3 Wind farm of Terras Altas de Fafe (WFTAF)

4 Solar power plant of Amareleja (SPPA)

**Fig. 1.** Location of the case studies.(1)Wind farm of Alvaiazere (WFA). (2) Wind farm of Serra da Freita (WFSF). (3)Wind farm of Terras Altas de Fafe (WFTAF). (4) Solar power plant of Amareleja (SPPA).

been the result of very favorable policies (based on feed-in tariffs and public tenders for renewable energy connections to the grid) that have spurred the interest of large electric companies, whereas other factors considered relevant in other countries, notably community participation in decision-making and even ownership of infrastructures, are entirely absent. Direct benefits for municipal authorities (2.5% of the annual revenue of wind farms) and centralized planning practices have led to fairly low levels of controversy and a very high rate of project approval. Thus, perceptions of communities in Portugal may differ from their counterparts' in Europe and other places, but we will endeavor throughout the article to draw comparisons with international literature whenever possible.

## 2. Framework

Community responses to renewable energy facilities have been relatively well studied within the social sciences over recent years, particularly regarding the factors and processes underlying local acceptance and/or opposition, as well as the main impacts and benefits for local communities [3,7–12]. However, the great majority of studies focuses on responses before construction and not after the facilities have been running for a few years, when the impacts, positive and negative, become more visible and local expectations are met or not.

Within this literature, the most frequently studied issues concern the relationship between social perceptions of impacts and the degree of acceptance from local stakeholders [3,10–12], as well as the perceptions of negative impacts on environment, local landscapes and tourism [6,13–16]. In what regards solar energy, studies also cover issues related to space organization [17] and the occupation of agricultural land by large solar power plants [18–20].

Environmental impacts tend to dominate expert debates around the siting of energy facilities [15,21–23]. The mortality rates of birds, bats, and other wildlife due to the construction and operation of wind farms and solar power plants is a major concern for environmental organizations and a justification often mobilized for rejecting planning applications or setting up mitigation measures. Conversely, renewable energies play a crucial role in preventing climate change, a fundamental goal for most ENGOs, which leads to what has been called 'green on green' controversies [2,24,25]. However, there are few studies on how local communities envisage these environmental considerations and whether they play a role in promoting the acceptance/rejection of renewable energy infrastructures [26,27].

Health concerns are another frequent topic in the literature concerning the acceptance of renewable energy facilities. Noise and vibration from turbines and electromagnetic radiation from high voltage power lines are feared to cause health risks, a common complaint expressed by local communities when faced with wind farm projects in several countries [4,28–32]. There is an abundance of references in literature (e.g., volume 31, issue 4 and 5 of the journal *Bulletin of Science, Technology & Society*) showing that this matter is far from settled and scientific controversy remains.

Commonly defined in the scholarly literature as a twofold phenomenon, including both, and simultaneously, a territory and an image [33,34], landscape is also a core topic in the public debate about energy transition worldwide (e.g., [2,35]). Nowadays, though this is not always the case (e.g., [36]), there is a widespread opinion that renewable energy generation technologies in general and wind developments in particular stand in conflict with landscape preservation and values (e.g., [37]), particularly in rural areas (e.g., [24,38,39]).