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Willingness to accept local wind energy development: Does the compensation mechanism matter?

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HIGHLIGHTS

- Local resistance to wind development depends on the compensation mechanism.
- Households prefer public compensation to private compensation.
- This result may be explained by under-provision of local public goods.

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ABSTRACT

Wind power development projects often include compensation for the affected communities, but little is known about the efficacy of the alternative compensation mechanisms. This study addresses this question by examining the relative potential of private and public compensation. We conduct a Choice Experiment (CE) that investigates household preferences of compensation for the local siting of a hypothetical wind park. Households chose among different alternatives, where each alternative was characterized by three varying attributes: the number of turbines, the level of private compensation, and the level of public compensation. Results indicate the wind park imposes welfare losses to local residents and non-local recreational users, with about 35% of these losses corresponding to non-use values. Findings show that households prefer public compensation to private compensation, with household's willingness to accept being lower with public compensation than private compensation. This finding suggests that estimates of local resistance to wind development depends on the compensation mechanism.

1. Introduction

Wind energy has emerged as an important renewable energy source in recent years: Wind energy generation experienced a five-fold increase worldwide in the period 2005–2012 and currently contributes to about 2% of global electricity supply. In the European Union, 11.4% of electricity consumption was covered by wind energy in 2015 (EWEA, 2014a). Estimates indicate that in 2020 this figure will reach 12.8–17% (EWEA, 2014b). Analyses of greenhouse gases (GHG) concentration stabilization scenarios show that this figure ought to rise to between 13% and 25% by 2050 (Fischedick, 2011; IPCC, AR5). If the world is going to approach the ambitious temperature targets inscribed in the Paris agreement (UNFCCC, 2015), global emissions need to be reduced by between 70% and 95% by 2050 (IPCC, 2014). This will require a substantial increase in the deployment of renewable energy.

Despite fast deployment during the last decade, wind energy faces important challenges (Wiser et al., 2011). First, while production costs have decreased considerably in recent years, more substantial and predictable climate and renewable energy policies are required to spur investment in many regions of the world. Second, the variability and unpredictability of the wind resource, and its localized nature, poses important grid integration challenges. Third, issues related to social acceptance and local opposition continue to impede plans for expanded deployment. This article is concerned with this third challenge.

Whereas there is widespread public support for increasing renewable energy supply generally, and wind power more specifically, wind farm projects are often met with local resistance (e.g. Devlin, 2005 and Wiser et al., 2011). The development of wind

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power presents a clear conflict between the dispersed societal benefits and the concentrated local costs, and while the general benefits may dominate the local costs, wind development plans are often overturned because of local opposition. Wind farming has well-documented impacts on local communities, including degradation of scenic vistas and landscapes, noise, shadow flickering, as well as impacts on birds, and on other wildlife and ecosystems (Wiser et al., 2011). As wind development continues, it will increasingly encroach upon where people live, thus making local opposition an even greater challenge than it is today.

Environmental valuation studies have attempted to measure the external costs associated with wind development projects. This literature comprises hedonic pricing (e.g. Heintzelman and Tuttle (2012) and Jensen et al. (2014)) and stated preference studies (e.g. Aravena et al. (2014) and Landry et al. (2012)). As discussed in detail in Section 2, the bulk of these valuation studies report local welfare losses due to wind farm development. The derived estimates provide guidance to decision-makers on the local costs of siting decisions and social benefits of wind projects. They also indicate the appropriate level of compensation that developers may provide local residents to offset for the local impacts of a wind project, although navigating the ethical considerations of compensating local residents can be a challenge (Cass et al. (2010)).

Existing environmental valuation studies have a strong focus on the household's tradeoff between the negative impacts of wind farming and private compensation measures. While useful for several purposes, such an approach fails to address some relevant considerations. In particular, compensation to local communities does not have to be limited to individual payments. In some instances, the provision of a local public good can be a viable form of reparation to local communities—e.g., see Cass et al. (2010) and Cowell et al. (2011). Though given little attention in the literature, economic theory provides a rational for such compensation. In fact, public goods and local public goods are often under-supplied due to coordination problems and institutional failures, and it should be unsurprising that some individuals prefer this form of settlement. Compensation in this case occurs at two different levels: first, it corrects an institutional failure that prevents a local public good from being provided and, second, like private compensation, it increases overall welfare.

By implementing a stated preference approach in a local community in western Norway, this study aims to contribute to the understanding of households' tradeoffs between wind farming impacts and private versus public compensation. The paper proceeds as follows. Section 2 presents a discussion of the literature on local impacts of wind energy and the role of compensation to local communities. Section 3 introduces the particularities of our case study and the CE. Section 4 presents the econometric model. Section 5 presents results and Section 6 concludes.

2. Literature review

This section starts by reviewing the economics literature on the effects of wind farming in local communities. The studies include applications of the hedonic price method and stated preference methods. We also review some studies in the geography and environmental planning literatures that provide insights on the relationships between wind farming and local communities, and the role of public compensation as means for easing local opposition.

The literature on the effects of wind farming on property values is relatively recent and scattered. Using a large sample of property transactions, Heintzelman and Tuttle (2012) study the impact of wind facilities on property values in northern New York State in the United States (US). The authors report that proximity to a wind farm consistently reduces property values in two out of the three counties analyzed. The effects in these two counties were large and declined with distance. For a wind farm located 0.5 miles away, the property value is, on average, 8.8–15.8% lower. When the wind farm is located 3 miles away, the negative impact on property values is estimated to be 2–8%. The authors conclude that existing mechanisms, such as easement payments to individual owners, may have properly compensated those who allowed wind farm development on their properties but are unlikely to account for the harm caused to those living in the vicinity.[2] Using detailed data from Denmark on property values and wind turbine location, Jensen et al. (2014) estimate that visual impacts reduce property values by up to 3%, while noise reduces property values by 3–7%.[3] In a similar study using transactions data from Wales and England, Gibbons (2015) finds that wind farm visibility, on average, reduces property values by nearly 6% within 2 km, less than 2% between 2 and 4 km, and less than 1% from 14 km. In a recent study using data from Rhode Island (US), Lang (2014) found no effect of wind turbines on housing prices, though this study only considered single-turbine sites.

Krueger et al. (2011) implement a CE to estimate the costs to the residents of Delaware (US) caused by the eventual deployment of an already planned offshore wind farm. It was found that a near-the-shore development would cause considerable welfare costs to residents, especially those living close to the coastline. Landry et al. (2012) on the other hand implemented a CE experiment in North Carolina (US) and found the effects of coastal wind farming on local recreational visitation to be relatively small. Consistent with Krueger et al. (2011) two CE studies using data from nation-wide surveys in Chile (Aravena et al., 2014) and in Sweden (Ek and Persson, 2014), indicate that individuals prefer offshore, rather than onshore wind energy developments. Álvarez-Farizo and Hanley (2002) and Bergmann et al. (2006) implement CEs in Spain and Scotland and report that wind farm impacts on flora and fauna as well as on wildlife induced considerable welfare losses. A Swedish study that conducts a CE considers earmarking of the revenues for conservation measures (Ek and Persson, 2014). However, the study was targeted to the general public. As we have argued, opposition is most relevant at the community level where the negative impacts of development are salient and where development plans may be halted.[4]

A number of studies outside the environmental valuation literature and within a more qualitative tradition have emphasized that local compensation for negative impacts of wind energy may be private or public. Examples of private compensation are lump-sum payments and share of profits to property owners, and reduced power tariffs to local inhabitants. Cowell et al. (2011)

[2] Hoen et al. (2014) use a large sample of property transactions from nine States across the US and report no effects of wind farming on property values. The authors point out that a proportion of the data used in Heintzelman and Tuttle (2012) come from the period between the announcement of the wind farm and its construction and this ought to be given consideration when interpreting their estimations. Gibbons (2014) questions the conclusions reported in Hoen et al. (2014) the data set included very few transactions in the areas near wind farms.

[3] Sims and Dent (2007) use post-construction data on 919 house sales in three communities in UK and report significant price effects in one of the three communities. In an unpublished study Sunak and Madlener (2012) use data from two communities in Germany and 1405 sales and re-sales and report a reduction in property values within the range 21.5–29.7% for those properties located within 1 km from the wind farm.

[4] Hanley and Nevin (1999) and Bergmann et al. (2008) have considered welfare impacts of job creation in the wind farm construction processes. A number of studies indicate that local opposition and negative attitudes towards wind farming decreased over the operation life of the facilities (e.g. Devine-Wright, 2005). It should be noted, however, that negotiations between communities and developers are over deployment plans, prior to construction when local opposition may be highest and this is likely to have an effect on demanded compensation levels.