Energy Policy 86 (2015) 506–519

Contents lists available at ScienceDirect

Energy Policy

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

Gone with the wind? The impact of wind turbines on tourism demand

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HIGHLIGHTS

- Comprehensive quantitative empirical study on wind turbines and tourism demand.
- Consideration of wind turbines in vacation municipalities and in their geographic surroundings.
- Novel data set on wind turbines and touristic demand in all German municipalities.
- Application of spatial panel analysis in the context of tourism research.
- Evidence for a negative relationship between wind turbines and tourism demand.

ARTICLE INFO

Article history:
Received 1 April 2015
Received in revised form
2 August 2015
Accepted 3 August 2015

Keywords:
Wind turbines
Tourism
Germany
Externality
Spatial panel regression

ABSTRACT

While wind energy production is relatively free from environmental externalities such as air pollution, it is frequently considered to negatively impact landscapes' visual aesthetic values, thereby inducing negative effects on tourism demand. Existing evidence for Germany indeed points towards a negative relationship between tourism demand and wind turbine construction. However, the existing studies primarily rely on interview data and simple bivariate statistics. In contrast, we make use of secondary statistics on tourism and wind turbine locations at the level of German municipalities. Using spatial panel regression techniques, we confirm a negative relation between wind turbines around municipalities and tourism demand for municipalities not located near the coast. In the latter regions, the relation between wind turbines and tourism demand is more complex.

1. Introduction

The quest for green energy has led to a massive growth of renewable energy production all over the world. As different sorts of renewable resources are employed, green energy production also varies with respect to its embeddedness into landscapes. For instance, solar panels are frequently hidden on roofs and biogas production facilities are relatively well fitted in agricultural landscapes. In contrast, wind turbines are clearly visible and have a very distinctive design. Moreover, they produce a range of light and visual emissions. For instance, in Germany, wind turbines are required to be equipped with a light signal identifying them as obstacle for flight activities when exceeding 100 m of height, which they frequently exceed (BlmSchG, 2013). When wind turbines are installed in large parks, blinking red signals become clearly visible at night time. In addition, they are characterized by a very particular visual appearance. "[*W*]*hile modern technologies can more or less successfully mitigate other environmental impacts, such as noise and danger to bird populations* […], *this is not the case with the visual impact*" (Molnarova et al., 2012, p. 269).

The visual impact of wind turbines on landscapes increasingly matters due to the growing importance of visual consumption and the role of aesthetic judgement of landscapes (Urry, 1992). Not surprisingly, the visual dimension is therefore among the most important predictors of a tourist destination image (MacKay and Fesenmaier, 1997). The growing importance of the aesthetic judgement of landscapes relates to the emergence of the "*romantic tourist gaze*" (Urry, 1990) in general and "green tourism" in particular. Green tourism emphasizes "*small scaleness, local control, modest developments using local labour, buildings in 'traditional' style, the emphasis on personal contact with visitors, the eating of local produce, encouraging the understanding of the area's ecology and heritage, and the setting of limits to the growth of such developments as to avoid a tourist mono-industry*" (Urry, 1992, p. 1213).

Wind turbines may conflict with such a view, as they commit a "*technological landscape guilt*" (Thayer, 1990, p. 2) inasmuch as they are inappropriate and do not fit in traditional close-to-nature

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http://dx.doi.org/10.1016/j.enpol.2015.08.005
0301-4215/

landscapes (Thayer, 1990; Hoppe-Klipper and Steinhäuser, 2002). In particular close-to-nature or natural forms and configurations are perceived as enriching landscapes while the technical design of wind turbines and their non-natural materials may attract negative attention (Peters et al., 2009). Moreover, wind turbines may be perceived as being historically inappropriate, which contradicts the desire for consistency between the natural (original) and artificial environment. Urry (1992) argued that today's tourists are likely to associate rural landscapes with historical periods. The technological, modern, and planned appearance of wind turbines may therefore strongly conflict with tourists' expectations of historic rural surroundings. This conflict remains even when viewing modern wind turbines as advanced versions of historic wind mills: Pasqualetti et al. (2002) pointed out that current wind turbines "*are only distant cousins to the familiar windmills of the Netherlands with which many are comfortable*" (p. 8).

1.1. Wind turbines and landscapes' attractiveness

There exists substantial research evaluating the impact of wind turbines on landscape appearance. While many studies find a generally negative impact, they also identify significant heterogeneity in individuals' assessment of wind turbine impact on landscapes (Landry et al., 2012; Gee, 2010; Molnarova et al., 2012; Jobert et al., 2007). Among others, this heterogeneity concerns individuals' general attitude towards technology and renewable energies (Bayerl, 2005; Molnarova et al., 2012). Differences also seem to exist between local residents and visitors/tourists, although the literature has not yet unanimously clarified which of the two groups is less repelled by wind turbines (Devlin, 2005; Frantál and Kunc, 2011; Megerle, 2013). Generally, wind turbines do not seem to be plagued by the not-in-my-backyard (NIMBY) behavior. For instance, Wolsink (2000) and Devine-Wright (2005) did not find evidence for pronounced NIMBY behavior, as they do not observe that people reject wind turbine installation close to their homes while favoring the general enlargement of wind power utilization. In contrast, visitors and tourists in search for recreation prefer untamed and less artificial landscapes (Devlin, 2005; Hoppe-Klipper and Steinhäuser, 2002).

In addition to individuals' characteristics, the type of landscape where wind turbines are installed matters as well. Molnarova et al. (2012) reported that the surveyed individuals were particularly sensitive concerning the placement of wind turbines in "*landscapes of high aesthetic quality*" (Molnarova et al., 2012, p. 269). In contrast, when placed in rather unattractive landscapes wind turbines are perceived as less problematic. Place attachment also plays a role because negative visual effects of wind turbines are reported to be magnified when individuals attach strong identity values to locations (Strazzera et al., 2012). When installed in large parks, wind turbines also induce stronger negative effects on landscape attractiveness than when positioned in an isolated manner (Devine-Wright, 2005). The magnitude of negative effects is moreover increased with larger numbers of daily encounters, at least up to a level of five encounters (Ladenburg and Dahlgaard, 2012).

1.2. Wind turbines and tourism

The clear prediction of the negative impact of wind turbines on landscape attractiveness makes it plausible to also expect a negative relation between wind turbines and the success of places in attracting tourists. Interestingly, the empirical picture of the matter is less clear. For off-shore wind turbines, Landry et al. (2012), Gee (2010), and Lilley et al. (2010) reported only a weakly negative effect on landscape attractiveness as perceived by tourists. For instance, Lilley et al. (2010) found that just about one-quarter of the surveyed tourists considered choosing another beach if offshore wind turbines were installed less than 10 km away from the coast. This share diminishes significantly with increasing distances between turbines and the coast. On the basis of a quantitative empirical estimation using GIS techniques, Riddington et al. (2010) estimate a weakly negative relation between wind farms and tourist expenditure for Scotland. Eltham et al. (2008) reported that two studies conducted for Wales and Scotland (NFO System Three, 2002, 2003) found "*contradictory responses; a proportion of visitors reported that a wind farm would put them off visiting a location while others suggested a wind farm could actually be used as a tourist destination to bring more visitors into an area*" (Eltham et al., 2008, p. 24). Another survey by MORI Scotland similarly reveals no adverse effects of wind turbines on tourism (MORI Scotland, 2002). Frantál and Kunc (2011) surveyed tourists in the Czech Republic, and their results clearly show that wind turbines "*are less disturbing than other industrial or infrastructural constructions*" (Frantál and Kunc, 2011, p. 514). While the attractiveness of landscapes is highly important to tourists, only a very small share (6%) oppose the presence of wind turbines in places they visit. Interestingly, wind turbines may actually serve as points of interest at times, as almost 66% of the surveyed individuals are found to be interested in visiting wind turbines when information centers are available as well.

1.3. Empirical evidence for Germany

The present paper focuses on Germany, which is a very interesting case for studying the effect of wind turbines on tourism. The exploitation of wind energy has seen rapid growth in many countries. However, few countries have experienced growth of renewable energy production like Germany. Since the 1990s the construction of onshore wind turbines rose from 1.652 in 1993 to 24.458 in 2014 (EnergyMap.info, 2014). This led to an increase in wind energy's share in total energy production from close to nothing to almost 8% in 2013 (BDEW, 2014). Alongside the similarly rapid expansion of biogas and photovoltaic energy production, this growth substantially helped to increase sustainable energy production in Germany, which in 2014 amounted to about 24% of total energy production (BDEW, 2014). Hence, the German density of wind turbines is matched by few other countries in the world and it is continuously growing.

Despite the relevance of the tourism and wind energy industry for many German regions, few studies empirically analyze the relation between tourism and wind turbines for this country. The following briefly presents the four most prominent studies:

SOKO Institut (2009) : Among the first studies dealing with this issue for Germany is the "*Studien für Windkraft und Tourismus*" (*studies on wind energy and tourism*). These surveys have been conducted between the years 2003 and 2009 by Henry Puhe. About 2000 individuals over the age of 14 were interviewed. About 10% of these people found that wind turbines negatively interfere with the appearance of landscapes. About 15%, moreover, indicate that they will avoid places with wind turbines for future vacations.

Institut für Regionalmanagement (2012) (*IFR*): On behalf of the nature park "*Naturpark Nordeifel*", the institute surveyed almost 1400 park visitors with respect to their opinions about wind turbines in the year 2012. Similar to SOKO Institut (2009), about 12% found wind turbines to negatively impact the visual appearance of landscapes. However, in this case, only 6% stated that they will avoid regions with wind turbines when choosing their destination in the future.

CenTouris (2012) : The Center for Market-Oriented Tourism Research at the University of Passau (CenTouris) conducted an online survey in 2012. In total, 977 survey individuals (aged