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Gone with the wind: Valuing the visual impacts of wind turbines through house prices

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ABSTRACT

This study provides quantitative evidence on the local benefits and costs of wind farm developments in England and Wales, focussing on their visual environmental impacts. In the tradition of studies in environmental, public and urban economics, housing sales prices are used to reveal local preferences for views of wind farm developments. Estimation is based on quasi-experimental research designs that compare price changes occurring in places where wind farms become visible, with price changes in appropriate comparison groups. These groups include places close to wind farms that became visible in the past, or where they will become operational in the future and places close to wind farms sites but where the turbines are hidden by the terrain. All these comparisons suggest that wind farm visibility reduces local house prices, and the implied visual environmental costs are substantial.

Introduction

Renewable energy technology clearly provides potential global environmental benefits in terms of reduced CO_2 emissions and slower depletion of natural energy resources. However, like most power generation and transmission infrastructure, the plant, access services and transmission equipment associated with renewable electricity generation may involve environmental costs. This is particularly so in the case of wind turbine developments, where the sites that are optimal in terms of energy efficiency are typically in rural, coastal and wilderness locations that offer many natural environmental amenities. These natural amenities include the aesthetic appeal of landscape, outdoor recreational opportunities and the existence values of wilderness habitats. The visual impacts of these 'wind farms' may be especially important because they are often on high ground with extensive visibility. Although views on their aesthetic appeal are mixed, there is evidently considerable dislike for their visual impact on the landscape, with 23% of respondents in a poll of 1001 residents in Scotland in 2010 agreeing or strongly agreeing that wind farms "are, or would be, ugly and a blot on the landscape" (You Gov, 2010). It should be noted, however, that only 51% of respondents had actually seen a wind farm in real life. In addition to these potential impacts on landscape, residents local to operational wind turbines have reported health effects related to visual disturbance and noise (e.g. Bakker et al., 2012; Farbouda et al., 2013).

The UK, like other areas in Europe and parts of the US has seen a rapid expansion in the number of these wind turbine developments since the mid-1990s. Although these wind farms can offer various local community benefits, including shared

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ownership schemes, community payments and the rents to land owners, in the UK, and elsewhere in Europe, wind farm developments have faced significant opposition from local residents and other stakeholders with interests in environmental preservation. This opposition suggests that the environmental costs may be important. The issue is highly controversial, given that opinion polls and other surveys generally indicate majority support of around 70% for green energy, including wind farms, (e.g. results from the Eurobarometer survey in European Commission, 2006). This contradiction has led to accusations of 'nimbyism' (not in my backyard-ism), on the assumption that it is the same people opposing wind farm developments in practice as supporting them in principle. There is perhaps less of a contradiction when it is considered that the development of wind farms in rural locations potentially represents a transfer from residents in these communities and users of natural amenities (in the form of loss of amenities) to the majority of the population who are urban residents (in the form of energy). Other possible explanations for the tension between public support and private opposition to wind energy developments are discussed at length in Bell et al. (2005).

This paper provides quantitative evidence on the local benefits and costs of wind farm developments in England and Wales, focussing on the effects of wind turbine visibility, and the implied cost in terms of loss of visual landscape amenities. In the tradition of 'hedonic' studies in environmental, public and urban economics, housing sales prices are used to reveal local preferences for views of wind farms. This is feasible, because wind farms in England and Wales are often close to and visible from residential areas in rural, semi-rural and even urban locations, so the context provides a large sample of housing sales that are potentially affected (at the time of writing, around 1.8% of residential postcodes are within 4 km of operational or proposed wind farm developments). The study offers a significant advance over previous studies, which have mostly been based on relatively small samples of housing transactions and cross-sectional price comparisons. Estimation in this current work is based on quasi experimental, difference-in-difference based research designs that compare price changes occurring in postcodes where wind farms become visible, with postcodes in appropriate comparison groups. These groups include: places where wind farms became visible in the past, or where they will become visible in the future and places close to where wind farms became operational but where the turbines are hidden by the terrain. The postcode fixed effects design implies that the analysis is based on repeat sales of the same, or similar housing units within postcode groups (typically 17 houses grouped together). Kuminoff et al. (2010) provide a discussion of the advantages of quasi-experimental approaches of this type in the context of hedonic methods for environmental valuation.

The overall finding is that operational wind farm developments reduce prices in locations where the turbines are visible, relative to where they are not visible, and that the effects are causal. This price reduction is around 5–6% on average for housing with a visible wind farm within 2 km, falling to under 2% between 2 and 4 km, and to near zero between 8 and 14 km, which is at the limit of likely visibility. Evidence from comparisons with places close to wind farms, but where wind farms are less visible suggests that the price reductions are associated with turbine visibility. As might be expected, large visible wind farms have much bigger impacts that extend over a wider area.

The remainder of the paper is structured as follows. The next section discusses background policy issues and the existing literature on wind farm effects. The Data section outlines the data used for the analysis. The Estimation strategy section describes the empirical strategy and the Results section the results. The final section concludes.

Wind farm policy and the literature on their local effects

In England and Wales, many wind farms are developed, operated and owned by one of a number of major energy generation companies, such as RES, Scottish Power, EDF and E.ON, Ecotricity, Peel Energy, though some are developed as one-off enterprises. Currently, wind farms are potentially attractive businesses for developers and landowners because the electricity they generate is eligible for Renewables Obligation Certificates, which are issued by the sector regulator (Ofgem) and guarantee a price at premium above the market rate. This premium price is subsidised by a tariff on consumer energy bills. The owners of the land on which a wind farm is constructed and operational will charge a rent to the wind farm operator. Media reports suggest that this rent could amount to about £40,000 per annum per 3 MW turbine (Vidal, 2012).

The details of the procedures for on-shore wind farm developments in England and Wales have evolved over time, but the general arrangement is that applications, in common with applications for most other types of development, have to pass through local planning procedures. These procedures are administered by a Local Planning Authority, which is generally the administrative Local Authority, or a National Park Authority. Very small single wind turbines (below the scale covered by the current analysis) can sometimes be constructed at a home, farm or industrial sites within the scope of 'permitted development' that does not require planning permission. The planning process can take a number of years from the initial environmental scoping stage to operation, and involves several stages of planning application, environmental impact assessment, community consultation and appeals[1]. Once approved, construction is relatively quick. According to public information from the European Wind Energy Association[2], a 10 megawatt (MW) wind farm (3–4 turbines) can be constructed in 2 months, and a larger 50 MW wind farm in 6 months (the average size wind farm in this current study is around 18 MW). Large wind farms (over 50 MW) need approval by central government. Offshore wind farms are also subject to a different process and require approval by a central government body.

[1] For example, Peel Energy http://www.peelenergy.co.uk/ provides indicative project planning timelines for their proposed wind farm developments.
[2] http://www.ewea.org/wind-energy-basics/faq/ accessed February 2014.