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Local non-market quality of life dynamics in new wind farms communities

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HIGHLIGHTS

- Rural counties with wind farms have lower property tax rates than neighbor counties.
- Wind farm counties have lower student–teacher ratios.
- Ambient air pollution levels are higher near fossil fuel fired power plants.

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ABSTRACT

The environmental benefits from generating electricity using renewable power are well known. Both wind farms and large scale solar installations require significant amounts of land to generate such power. Private land holders gain from leasing and selling land to renewable power generators but how are nearby neighbors and county residents affected? This study uses data from West Texas and documents that wind farm county's residents have gained from recent place based investments in wind farms. County property tax rates have fallen and public school quality has improved in those counties where wind farms have been built. Based on the local fiscal data, local school quality data and local ambient air pollution data, renewable power is a “better neighbor” than conventional fossil fuel fired power plants.

1. Introduction

In 2010, coal was the fuel source for generating roughly 45% of total electricity production in the United States.[1] This fossil fuel creates a large amount of greenhouse gas emissions. Environmental and economic analyses have estimated the social costs generated by local air pollution and GHG emissions from burning coal (Zhou et al., 2006, Muller et al., 2011). Muller et al. (2011) estimate that coal fired power plants are responsible for 25% of total U.S industrial pollution damage or $53 billion dollars of environmental damage each year. In recent years, the United States has reduced its reliance on coal power plants and has increased its electricity generation based on natural gas and renewable power generation. This transition offers substantial environmental benefits. Ongoing research has examined the technical feasibility of such a transition (Delucchi and Jacobson, 2011, Jacobson and Delucchi, 2011).

Many states have adopted ambitious renewable power standards to nudge electric utilities to purchase more renewable power (Delmas and Montes-Sancho, 2011). To meet these policy mandates requires allocating large amounts of land to renewable power generation. Land owners are profiting from selling or leasing their land to renewable power generators.

But, there are concerns about several possible negative local externalities associated with the growth of power generation through wind and solar. Ecologists have sought to limit the growth of large scale solar and wind farms in the Mojave Desert because of concern about invading the habitat for desert tortoise.[2] In the case of wind turbines, an active conservation biology research agenda examines how bird and bat populations are affected by the turbines.[3]

Some local communities in areas featuring wind potential and solar generation potential are concerned about the perceived local quality of life impacts related to noise, infrasound vibrations, shadow flickering and esthetic impacts. In the Cape Cod area, the environmentalist Kennedy family has opposed the Cape Wind project on the Nantucket Sound.

This paper studies how local quality of life is affected by major investments in wind farms. A detailed case study of communities located in West Texas is presented. Texas has been the leading

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[1] http://www.eia.gov/electricity/

[2] http://www.nytimes.com/2009/12/22/business/energy-environment/22solar.html?pagewanted=all

[3] http://www.magazine.tcu.edu/Magazine/Article.aspx?ArticleId=469

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state installing wind turbines. Between 2005 and 2010, in the counties of Coke, Nolan, Sterling and Taylor, at least 2842 MW of wind generation capacity was built. This represents 6.5% of the nation's total installed wind capacity as of 2011. This investment creates the opportunity to study how large place based investments shape local communities.

Using data on local demographics, school quality, and county tax revenues in areas where wind farms have and have not been built, evidence is presented showing that few people actually live within a close range of the turbines. At the county level, several fiscal benefits from introducing wind farms are documented. County property tax rates have declined and public school quality has increased.

This paper also studies the community demographics for populations living close to power plants in the United States. Fossil fuel fired power plants locate in higher population density areas and are associated with elevated local pollution levels. In contrast, renewable power plants locate in less densely populated areas and produce zero local pollution. Thus, renewable power offers positive local fiscal spillovers without the local and global pollution associated with conventional power generation.

2. Research methods

This paper's empirical work has two pieces. First, it presents a detailed case study of local quality of life dynamics in West Texas areas where there has been a major investment in wind turbines. Several data sets are used to examine demographic dynamics, property tax rates and school quality dynamics in the vicinity of the new turbines. The second part of this study uses national level data to present new evidence documenting which demographic groups tend to live close to different types of power plants. This is an important environmental justice issue because coal fired power plants produce an array of localized environmental challenges (Davis, 2011). Together, these results present new evidence on local quality of life in wind farm communities versus quality of life in communities that are home to fossil fuel fired power plants.

By exploring both the local demographic exposure, and public finance impacts of introducing new wind turbines on local communities, this paper builds on a recent literature examining the localized consequences of such investments. To quantify how local communities have been affected by the introduction of wind farms, researchers have measured job growth predictions, survey respondents' perceptions, and local real estate price dynamics.

Slattery et al. (2011) use the NREL JEDI model to predict how wind farms of a certain size in terms of total power generation will generate construction jobs and ongoing maintenance jobs. They estimate that the West Texas investment in turbines created 680 construction jobs. An open question concerns who obtains these jobs? Is it unemployed incumbents or new migrants to the area. A regional science research line started by Bartik (1991) has argued that the bulk of new jobs created by a place based investment go to in-migrants rather than the incumbent unemployed or those who are out of the workforce. Migrants are more likely to gain jobs that require specific human capital and skills that the locals are unlikely to have.

A second research agenda has investigated nearby resident perceptions of the costs and benefits of the new investment based on stated answers to a survey (Brannstrom et al., 2011). Their empirical work relies on surveying key factors including landowners with wind turbines, elected and civil service government officials, and prominent local business and community leaders. They found that the perceived overall decline in the economic fortunes of the area encouraged respondents to support wind power.

A third methodology for studying the impact of local wind farms is to examine real estate prices in an immediate vicinity of the turbines. Hoen et al. (2009) use data pooled across thirteen major wind farms in states ranging from New York, Pennsylvania, Illinois to Oregon and conclude that there is little evidence across thirteen major wind farms that proximity to these turbines is a "disamenity". The formal statistical test underlying this claim is that in a regression featuring the log sales price of a home as the dependent variable that all else equal proximity to a wind farm is not associated with a lower sales price.[4] In contrast, in a comprehensive study of U.S new fossil fuel plants, Davis (2011) finds that nearby real estate prices fall when such high polluting plants open.[5]

3. West Texas wind farms and data sources

At the end of 2011, six of the nation's ten largest wind farms were in Texas.[6] The largest buildup of wind farms took place in West Texas in Coke, Nolan, Sterling and Taylor counties. Between 2005 and 2010, the NextEra Company built roughly 1800 MW of power generation in four different Texas counties. These counties include Coke, Nolan, Sterling and Taylor.[7] Socio-economic outcomes in these counties will be compared to Texas as a whole and quality of life measures will also be compared to five other adjacent counties; Fisher, Glasscock, Howard, Jones and Mitchell.[8] While wind farms have been built in these counties, the total wind generation capacity is much smaller than for Coke, Nolan, Sterling and Taylor.[9]

Together the nine counties listed above cover 3% of Texas' land area and are home to 1% of the state's population. Based on year 2000 Census of Population and Housing data, Texas is 73% White, 11.9% black and 32% Hispanic. The racial composition for these nine counties is 82% white, 7% black and 23% Hispanic. Across these nine counties, 17% of the adult population has a college degree while for Texas as a whole 23% of adults have a college degree.

To study the impact of new wind farms on community demographic change requires detailed information on where the wind farms are located and where people live. The Federal Aviation Administration provides GIS maps of the locations of all wind turbines by county.[10] From the FAA maps, the wind farms'

[4] Since Texas is a non-disclosure state, data providers are unable to sell sales price data for individual residential Texas transactions.

[5] Davis (2011) provides a comprehensive set of environmental impacts posed by fossil fuel power plants including visual disamenities, local noise pollution, and local emissions of low levels of uranium, thorium, and other radioactive elements as well as mercury, and other heavy metals. These power plants co-locate landfills near them and this can contribute to local air pollution and even enter the drinking water supply.

[6] The six in Texas include; Roscoe Wind Farm (782 MW), Horse Hollow (736 MW), Capricorn Ridge (663 MW), Sweetwater (585 MW), Buffalo Gap (523 MW) and Panther Creek (458 MW) see http://governor.state.tx.us/files/ecodev/Renewable_Energy.pdf.

[7] Other wind developers such as AES Wind generation have also built turbines in Nolan and Taylor. For example, the Roscoe Wind Farm is a very large wind farm built in Nolan, Texas (see http://stateimpact.npr.org/texas/tag/texas-wind-power/). Taylor County is the home of the city of Abilene. In some of the empirical tables below, Taylor County will be included in the econometric results but it will not be included it in the set of "wind farm" counties.

[8] In Coke and Sterling Counties, 812 MW of total capacity was built between the last quarter of 2006 and the first quarter of 2008 and 124 MW of total capacity was built in Glasscock and Howard between the 1st quarter of 2006 and the 2nd quarter of 2007 (see page 6 of Slattery et al. (2008)). In Nolan and Taylor Counties, over 1370 MW of wind capacity was built between 2005 and 2007.

[9] See http://www.awea.org/learnabout/publications/factsheets/upload/3Q-12-Texas.pdf.

[10] https://oeaaa.faa.gov/oeaaa/external/gisTools/gisAction.jsp?action=showWtBuildOutToolForm