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Wind Farms in North America

Author
Hoen, Ben

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Ernest Orlando Lawrence
Berkeley National Laboratory

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Ben Hoen

Environmental Energy Technologies Division

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DISCLAIMER

Chapter 11: Wind farms in North America

1 Introduction

For the last decade, the United States has increasing relied on wind energy to combat both depleting oil and coal reserves and to mitigate the effects of climate change through a reduction in CO_2 production. Consequently, wind power development has expanded dramatically in recent years (GWEC, 2010) and that expansion is expected to continue (GWEC, 2008; Wiser and Hand, 2010). The U.S. Department of Energy, for example, published a report that analysed the feasibility of meeting 20% of U.S. electricity demand with wind energy by 2030, which equates to approximately 300,000 MW (US DOE, 2008). Currently the U.S. generating capacity from installed wind farms is approximately 40 GW up from approximately 4 GW in 2000 (Wiser and Bolinger, 2011). To achieve a 20% wind electricity target in the United States of 300 GW, about 3,000 new wind facilities would need to be sited, permitted, and constructed.

Not only is the number of wind farms sited in the U.S. increasing and will continue to increase, but the size and number of turbines in each development is increasing too. In 1998-1999 turbines averaged 180 feet (55 meters) in height at the hub, with blades of almost 165 feet (50 meters), in 2010 land based turbines averaged approximately 295 feet (90 meters) with 278 foot (85 meter) blades. Similarly, in 1998-1999 the average project consisted of 28 turbines; in 2010 this average had risen to 40 turbines after peaking at 60 turbines in 2007 (Wiser and Bolinger, 2011). Industry expectations for siting in areas with lower overall wind speeds (where larger rotor diameters will allow for increased power output, all else being equal) is expected to further increase the scaling.

Though surveys show that public acceptance in the U.S. is high in general for wind energy (e.g., Firestone and Kempton, 2006), a variety of local concerns exist that can impact the length and outcome of the siting and permitting process. One such concern is related to the views of and proximity to wind facilities, which, in turn, might impact surrounding property values. To that end, surveys of local communities considering wind facilities have frequently found that adverse impacts on aesthetics and property values are in the top tier of concerns relative to other matters such as impacts on wildlife habitat and mortality, radar and communications systems, ground transportation, and historic and cultural resources (e.g., Firestone and Kempton, 2006).

A number of studies have investigated this link – between proximity and views of turbines and property values – and will be reviewed in the next section. Following that will be a summary of a recent research effort conducted in the U.S. around multiple wind facilities in the U.S. This research stands as the most comprehensive effort to investigate possible sale price effects from wind facilities to date. Finally, concluding remarks about what can be drawn from U.S. research as a whole will be offered.

2 Previous Research

Turning to the literature that has investigated the potential property value effects from U.S. wind facilities directly, it deserves note that few studies have been academically peer-reviewed and published; in some cases, the work has been performed for a party on one side or the other of the permitting process (e.g., the wind developer or an opposition group). Nonetheless, at a minimum, a brief review of this existing literature will set the stage for and motivate the later discussion of the methods and results of the present work. The literature summarised below, and shown in Table 11.1, is based around the three potential areas of stigma associated with wind farm development in the USA. These are:

Scenic Vista Stigma: A concern that a home may be devalued because of the view of a wind energy facility, and the potential impact of that view on an otherwise scenic vista.

Area Stigma: A concern that the general area surrounding a wind energy facility will appear more developed, which may adversely affect home values in the local community regardless of whether any individual home has a view of the wind turbines.

Nuisance Stigma: A concern that factors that may occur in close proximity to wind turbines, such as sound and shadow flicker, will have a unique adverse influence on home values.

Only one U.S. study has investigated Scenic Vista Stigma directly. Hoen (2006) used a hedonic model to analyse 280 residential transactions occurring near a wind facility in Madison County, NY. Each one of the homes were visited and a scoring method was used – as a proxy for visual impact - that took into account the number of turbines and the amount of each turbine that was visible from the home. He found no evidence that views of turbines significantly affected prices in that area.

A variety of authors have investigated Area and Nuisance Stigmas. Poletti (2005, 2007) used a *t*-Test to investigate Nuisance and Area Stigma by comparing the mean sales prices of 187 and 256 homes in Illinois and Wisconsin, respectively, located near wind facilities (target group) to those further away (control group).[1] He split these target and control groups into respective smaller and more-homogenous sub-groups, such as large and small tracts, with and without homes (i.e., land that's either developed or not), finding no statistical evidence that homes near the wind facilities sold for different prices than those farther away. Sterzinger et al. (2003) analysed roughly 24,000 residential transactions, which were divided between those within five miles (8km) of a wind facility and those outside of five miles (8km) in an effort to assess Area Stigma. They compared residential appreciation rates over time, and found no apparent difference between those homes within and outside of five miles (8km) from a wind facility, but the statistical significance of this comparison was not reported.

Other authors have used smaller samples of residential transactions and a variety of simple statistical techniques, without reporting statistical significance, and have found a lack of evidence of effects from Nuisance Stigma (Jerabek, 2001, 2002; Beck, 2004) and Area Stigma (DeLacy, 2005; Goldman, 2006). These results, however, are somewhat contrary to what one appraiser has found. In his investigation of Nuisance Stigma around a wind facility in Lee County, IL, McCann (2008) found that two homes nearby a wind facility had lengthy selling periods that, he believes, also adversely affected transaction prices. Additionally, Kielisch (2009) investigated Nuisance Stigma by comparing twelve

[1] The 2007 study used the data contained in the 2005 study in combination with new data consisting of transactions that occurred in the interim period.

transactions of undeveloped land near two wind facilities in Wisconsin (Blue Sky Green Field and Forward) to undeveloped land transactions farther away. He found that land tracts near the wind facilities sold for dramatically lower prices per acre (4046 sq. metres) than the comparable group, but the statistical significance of the comparison was not reported.

More recently, a number of high quality research efforts have been conducted, which use conventional methods, large datasets, and either are or expect to be published in peer-reviewed journals. Laposa and Mueller (2010) investigated Area Stigma prior to construction using an announcement of a proposed Texas wind farm (that was never built) and was unable to uncover evidence of such an effect. Hinman (2010), on the other hand, in her extremely rigorous master's thesis, investigated 3,851 sales near a two-phase wind project in Illinois finding a significant pre-operation Area Stigma, but no evidence for a post-construction Area Stigma. Similarly, Heintzelman and Tuttle (2011), analysed 11,331 transactions in three counties in upstate New York, finding no significant relationship between distance from the nearest turbine and selling price for homes in one county, where they had a large number of sales post-construction. Alternatively, in the other two counties, where virtually all of their sales occurred prior to construction, they found in some models a significant relationship between price and distance, indicating, potentially, that an Area Stigma exists prior to construction in those counties. Though, importantly, in separate models, the relationship between distance and price was not present or was inconsistent.

The difference between pre and post-operation effects might be attributable, at least in part, to the fear of the unknown. For instance, Wolsink (1989) found that public attitudes toward wind power, on average, are at their lowest for local residents during the wind project planning stage, but return almost to pre-announcement levels after the facilities are built. This result is echoed by Palmer (1997), whose post-construction surveys found higher levels of approval than in those surveys conducted pre-construction. Others, however, have found that perceptions do not always improve, attributing the lack of improvement to the perceived "success" or lack therefore of the project, with strong disapproval forming if turbines sit idle (Thayer and Freeman, 1987).

In addition to these revealed preference studies, a number of stated preference surveys (e.g., contingent valuation) and general opinion surveys have investigated the existence of potential effects. A survey of local residents, conducted after the wind facilities were erected, found no evidence of Area Stigma (Goldman, 2006). Similarly, some surveys of real estate experts conducted after facility construction have found no evidence of Area or Nuisance Stigmas (Grover, 2002; Goldman, 2006). These results, however, are contrary to the expectations for Area, Scenic Vista, and Nuisance Stigma effects predicted by local residents (Haughton et al., 2004; Firestone et al., 2007) and real estate experts (Haughton et al., 2004; Kielisch, 2009) prior to construction found in other locations. These predicted effects echo the pre and post-construction effects discussed above.

When this U.S. literature is looked at as a whole, it appears clear that, prior to operation, wind projects are predicted to negatively impact residential property values, and in some studies have been found to do so. However, post-construction surveys have shown that public support returns to more normal levels and that any evidence of widespread, sizeable, and statistically significant negative impacts to property values have largely failed to materialise.

A potentially more important issue is that many of the existing U.S. research efforts, excluding those conducted since 2010, leave much to be desired. First, many of the studies have relied only on surveys of homeowners or real estate professionals, rather than trying to quantify impacts based on market data (e.g., Haughton et al., 2004; Goldman, 2006). Second, a number of the studies that used market data conducted rather simplified analyses of those data, potentially not controlling for the many drivers (e.g., size and/or condition of the home, and lot size) of residential sales prices (e.g., Sterzinger et al., 2003). Third, when analysed, there has been some emphasis on area stigma, and none of the studies has simultaneously investigated all three possible stigmas listed above. Fourth, only one of the studies (Hoen, 2006) conducted field visits to the homes to assess the quality of the scenic vista from the home, and the degree to which the wind facility might impact that scenic vista.

Finally, only one of the U.S. studies discussed above have been published in peer-reviewed academic literature (Laposa and Mueller, 2010).[2]

Table 11.1: Summary of Existing US Literature on Impacts of Wind Projects on Property Values

Document Type Author(s)	Year	Number of Transactions/ Respondents	Before or After Wind Facility Construction	Area Stigma	Scenic Vista Stigma	Nuisance Stigma
Homeowner Survey						
Haughton et al.	2004	501	Before	- *	- *	
Goldman	2006	50	After	**none**		
Firestone et al.	2007	504	Before	- *	- *	
Expert Survey						
Grover	2002	13	After	**none**		**none**
Haughton et al.	2004	45	Before	- *	- *	
Goldman	2006	50	After	**none**		**none**
Crowley	2007	42	After	**none**	**none**	**none**
Kielisch	2009	57	Before‡			- ?
Transaction Analysis - Simple Statistics						
Jerabek	2001	25	After			**none**
Jerabek	2002	7	After			**none**
Sterzinger et al.	2003	24,000	After	**none**		
Beck	2004	2	After			**none**
Poletti	2005	187	After	**none**		**none**
DeLacy	2005	21	Before†	**none**		
Goldman	2006	4	After	**none**		
Poletti	2007	256	After	**none**		**none**
McCann	2008	2	After			- ?
Kielisch	2009	103	After			- ?
Schneider	2010	2,330	Before	- */**none**		
Transaction Analysis - Hedonic Model						
Hoen	2006	280	After		**none**	
Laposa & Mueller	2010	2,910	After		**none**	
Hinman	2010	3,851	Before	- *		
Hinman	2010	3,851	After	**none**		
Heintzelman & Tuttle	2011	9,393	Mostly Before	- *		
Heintzelman & Tuttle	2011	1,938	Mostly After	**none**		

" none " indicates the majority of the respondents do not believe properties have been affected (for surveys) or that no effect was detected at 10% significance level (for transaction analysis)

"- ?" *indicates a negative effect without statistical significance provided*

"- *" *indicates statistically significant negative effect at 10% significance level*

"-/+ *" *indicates positive and negative statistically significant effects at 10% significance level*

† *Sales were collected after facility announcement but before construction*

‡ *Some respondents had experience with valuations near facilities while others did not*

[2] As of 1/8/2011 during the writing of this book, both the present research outlined below and the Heintzelman & Tuttle paper have been accepted for publication.

3 Present Research

This research builds on the previous literature that has investigated the potential impact of wind projects on residential property values by avoiding many of the shortcomings enumerated above. First, and most importantly, the research uses a set of hedonic models, the literature standard for this type of analysis (see discussion of methodology in the Tools Chapter).[3] Secondly, a large quantity of residential home sales (i.e., transactions) (*n* = 7,459) from within ten miles (16km) of 24 different existing wind facilities in the U.S., allowing for a robust statistical analysis across a pooled dataset that includes a diverse group of wind facility sites. Third, all three potential stigmas are investigated by exploring the potential impact of wind facilities on home values based both on the distance to and view of the facilities from the homes. Fourth, field visits were made to every home in the sample, allowing for a reliable assessment of the scenic vista enjoyed by each home and the degree to which the wind facility was visible from the home, and to collect other value-influencing data from the field (e.g., if the home is situated on a cul-de-sac). Finally, a set of robustness tests, including the estimation of a number of different hedonic regression models, were conducted.

3.1 Data

The 24 wind facilities included in the sample (see Figure 11.1) were chosen from a set of 241 wind facilities in the U.S. with a nameplate capacity greater than 0.6 megawatts (MW) and that were constructed prior to 2006. These 24 facilities, encompassing 10 different study areas, were selected based on: (1) the number of available residential real estate transactions both before and, more importantly, after wind facility construction, and especially in close proximity (e.g., within 2 miles (3.2km)) to the facility; (2) the availability of comprehensive data on home characteristics, sales prices, and locations in electronic form from local assessors; and (3) the representativeness of the types of wind energy facilities being installed in the United States.

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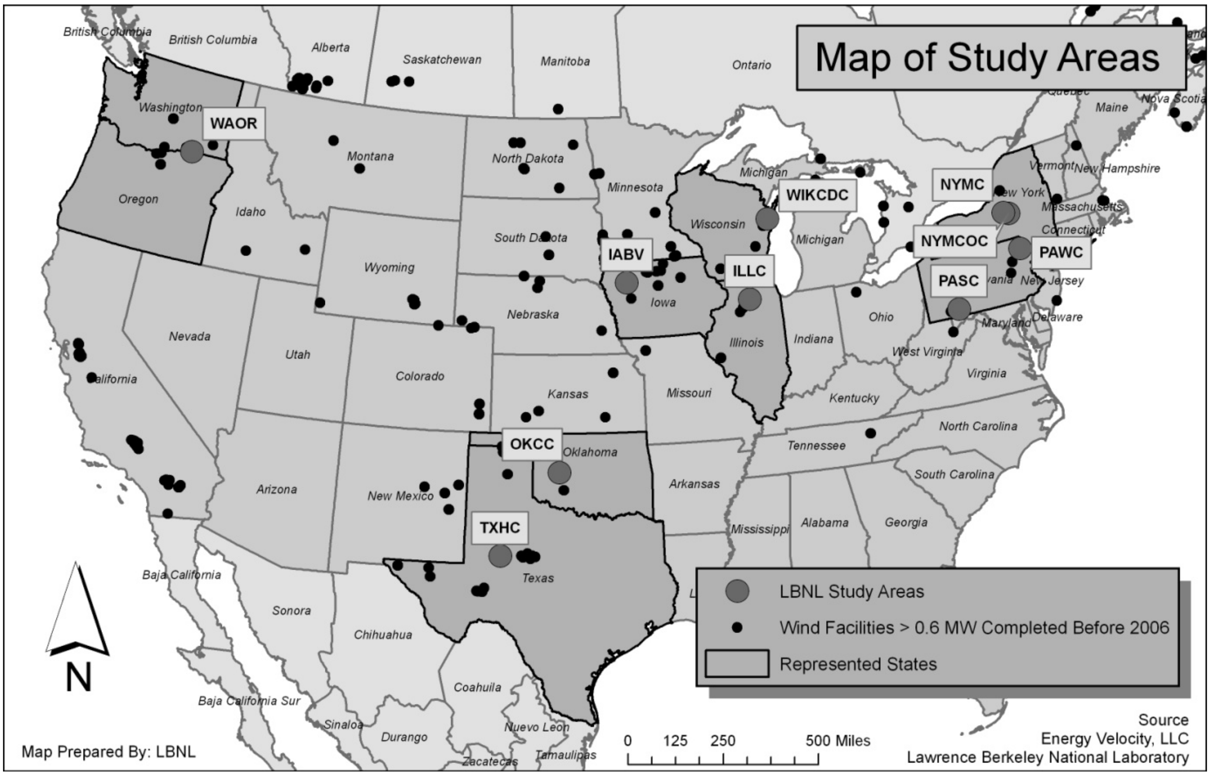
[3] For further discussion of the hedonic model and its application to the quantification of environmental stigmas see Jackson (2005) and Simons (2006) and Chapter Two of this book.

The ten study areas are located in nine separate states and include facilities in the Pacific Northwest, upper Midwest, the Northeast, and the South Central region, and total 1,286 MW, or roughly 13% of total U.S. wind power capacity installed at the time (the end of 2005). See Table A1.1 in Appendix 1 for a summary of the study areas. Turbine hub heights in the sample range from a minimum of 164 feet (50 meters) in the Washington/Oregon (WAOR) study area, to a maximum of 262 feet (80 meters) (TXHC, OKCC and PASC), with four of the ten study areas having maximum hub heights of 262 feet (80 meters) (TXHC, OKCC, ILLC, PASC), five with maximum heights of at least 213 feet (65 meters) (IABV, WIKCDC, PAWC, NYMCOC, NYMC), and the remaining site with a maximum of 196 feet (60 meters) (WAOR). The sites include a diverse variety of land types, including combinations of ridgeline (WAOR, PASC, and PAWC), rolling hills (ILLC, WIKCDC, NYMCOC, and NYMC), mesa (TXHC), and windswept plains (OKCC, IABV).

Figure11.1: Map of Study Areas



The final dataset consists of 7,459 valid (i.e., arm's length) residential transactions occurring between January 2, 1996 and June 30, 2007.[4] Homes included in this sample are located from 800 ft (244 m)

[4] See Table A1.4 in Appendix 1 for a summary of the transactions across study areas.

to over five miles (8 km) from the nearest wind energy facility, and were sold at any point from before wind facility announcement to over four years after the construction of the nearby wind project. Of the total 7,459 transactions, 4,937 occurred after construction commenced on the relevant wind facilities. More specifically, 23% of the transactions (*n*=1,755) took place before any wind facility was announced and 10% occurred after announcement but before construction commenced (*n*=767), with the rest of the transactions occurring after construction commenced (66%, *n*=4,937).

As is summarised in Table A1.5 in Appendix 1, the mean nominal residential transaction price in the sample is $102,968, or $79,114 in 1996 dollars.[5] The average house in the sample can be described as follows: it is 46 years old, has 1,620 square feet (150.5 sq. metres) of finished living area above ground, is situated on 1.13 acres (4571 sq. metres), has 1.74 bathrooms, and has a slightly better than average condition.

With respect to the variables of interest, among the post-construction subset of 4,937 transactions, the frequency of the transactions at various distances is found to follow geometry with the smallest numbers of transactions occurring near the wind turbines and ever increasing numbers further away. Sixty seven transactions (1%) are situated inside of 3,000 feet (914 m), 58 (1%) are between 3,000 feet and one mile (0.9 -1.6 km), 2,019 (41%) occur outside of one mile but inside of three miles (1.6 – 4.8 km), 1,923 (39%) occur between three and five miles (4.8 – 8 km), and 870 (18%) occur outside of five miles (8km). In this same post-construction group, a total of 730 homes that sold (15%) have a view of the wind turbines.

A large majority of those homes have minor view ratings (n = 561, 11% of total), with 2% having moderate ratings (n=106) and the remaining transactions roughly split between substantial and extreme ratings (n=35, 0.6%, and n=28, 0.5%, respectively). In addition to views of turbines, a rating of the overall quality of the scenic vista was made from the home during the site visit that was

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[5] Prices were adjusted using a Freddie Mac Conventional Mortgage Home Price Index based on the municipal statistical area (MSA) that was in closest proximity to the study area. Because most of the study areas do not fall within the MSAs, a collection of local experts was relied upon, including real estate agents, assessors, and appraisers, to decide which MSA most-closely matched that of the local market. In all cases, the experts had consensus as to the best MSA to use. In one case (NYMCOC), the sample was split between two MSAs. See: http://www.freddiemac.com/finance/cmhpi/ for more information.

independent of whether the turbines were visible or not. Within the full sample, 6% and 58% of homes had a poor or below average vista rating, respectively; 26% of homes received an average rating on this scale, with 9% above average and 2% experiencing premium vista (see Tables A1.2 & A1.3 in Appendix 1 for definitions of view of turbine and scenic vista ratings).

3.2 Methodology

To assess the potential impacts of all three of the property value stigmas described earlier, four alternative hedonic models are applied; each designed to investigate the reliability of the results and to explore other aspects of the data (see Table 11.2 below). Additionally, as will be discussed below, a variety of robustness tests are conducted to test and ensure the reliability of the results. The full set of variables used for these models are shown in Table A1.5 in Appendix 1.

Though all models test some combination of the three possible stigmas, they do so in different ways. For instance, the Model 2 asks the question, "All else being equal, do homes near wind facilities sell for prices different than for homes located farther away?", while the Model 3 asks, "All else being equal, do homes near wind facilities that sell after the construction of the wind facility sell for prices different from similar homes that sold before the announcement and construction of the facility?" Each model is therefore designed to not only test for the reliability of the overall results, but also to explore the myriad of potential effects from a variety of perspectives.

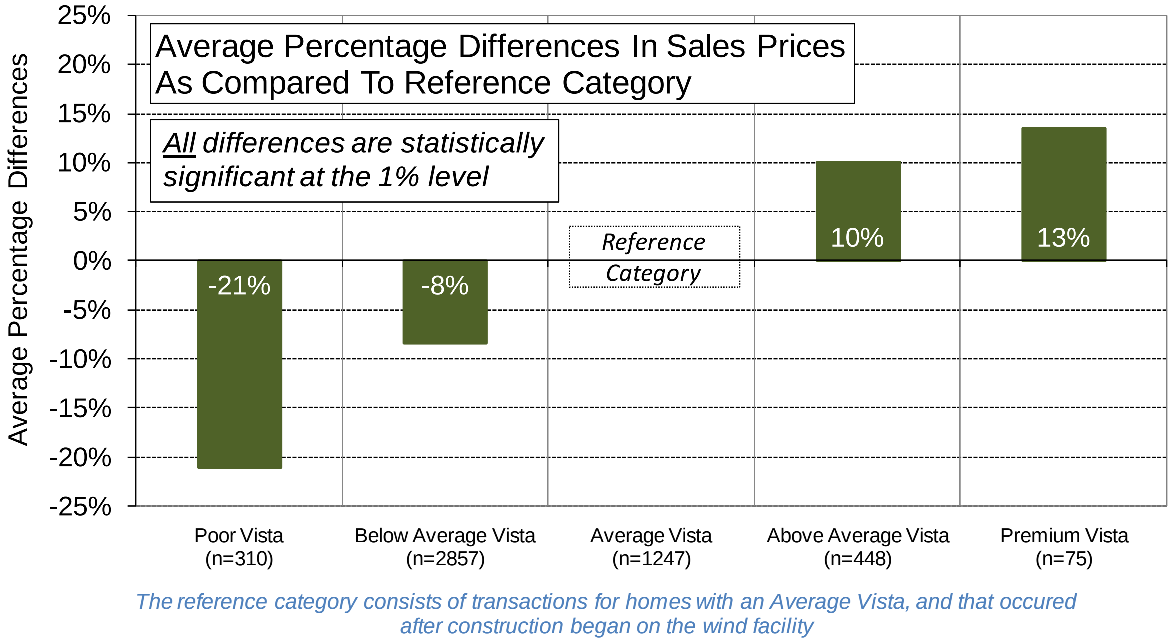
Table11.2: Description of Statistical Models

Statistical Model	Description
Model 1: **Continuous Distance Model**	Using only "post-construction" transactions (those that occurred after the wind facility was built), this model applies a continuous distance parameter as opposed to the categorical variables for distance used in Model 2
Model 2: **Categorical Distance Model**	Using only "post-construction" transactions, this model investigates apploies a categorical distance parameter as opposed to the continuous parameter in Model 1
Model 3: **All Sales Model**	Using all transactions, this model investigates whether the results for the three stigmas change if transactions that occurred before the announcement and construction of the wind facility are included in the sample
Model 4: **Temporal Aspects Model**	Using all transactions, this model further investigates Area and Nuisance Stigmas and how they change for homes that sold more than two years pre-announcement through the period more than four years post-construction

3.3 Results

Overall, the models perform quite well (see Table A1.6 in Appendix 1); the range of adjusted R^2 values for the four models is between 0.75 and 0.77. Further, the sign and magnitudes of the site and home control variables are consistent with *a priori* expectations, are stable across all four hedonic models, and all are statistically significant at the 1% level. Of particular interest are the coefficient estimates for scenic vista (e.g., see Figure 11.2 and Table A1.6 in Appendix 1). Homes with a scenic vista rated as poor are found to sell for 21% to 25% less on average than homes with an average rating, while homes with a premium vista sell for 9% to 13% more than homes with an average rating. In all four of the models, differences between homes with an average scenic vista and homes with other scenic vistas are significant at the 1% level. Based on these results, it is evident that the quality of the scenic vista is capitalised into sales prices, and that the qualitative vista variable is able to effectively capture these effects.

Figure 11.2: Model 2 Results for Scenic Vista



Next the discussion focuses on the three potential stigmas surrounding wind facilities (the results of which are presented in Table A1.7 in Appendix 1).

3.3.1 Scenic Vista Stigma

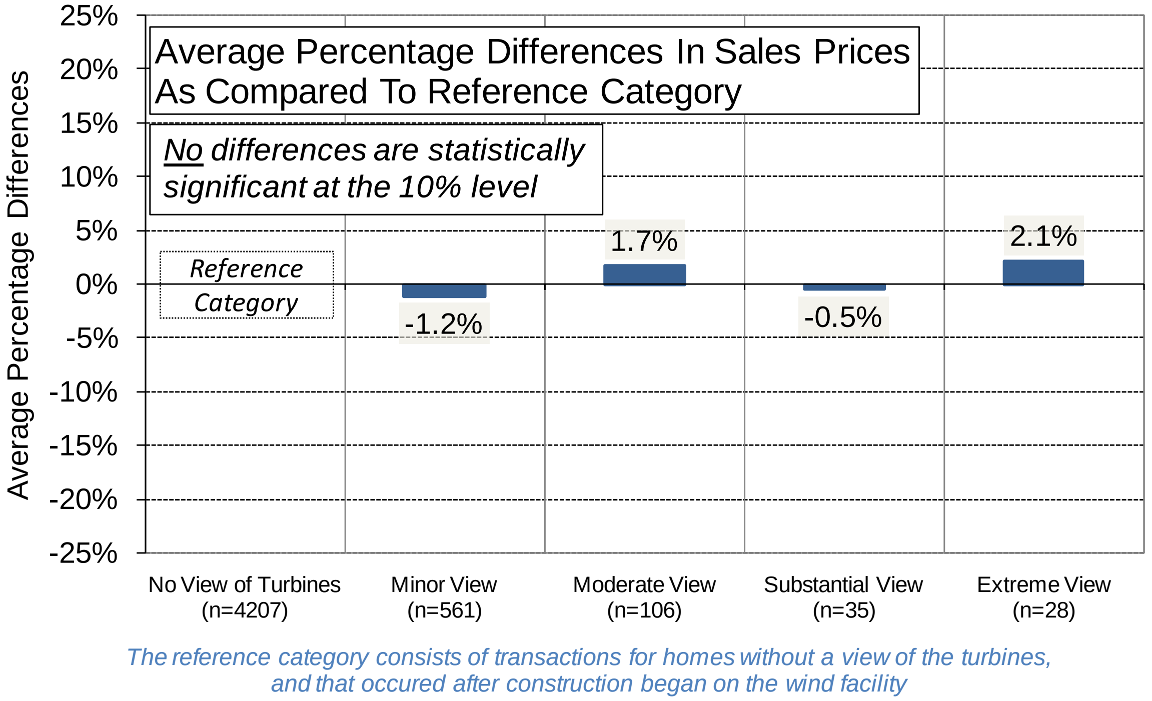
Scenic vista stigma is defined as a concern that a home may be devalued because of the view of a wind energy facility, and the potential impact of that view on an otherwise scenic vista. This concern is premised on the notion that home values are, in part, derived from the quality of what can be viewed from the property.

As mentioned earlier, the results from all four models demonstrate persuasively that the quality of the scenic vista does impact sales prices. Along the same lines, homes in the sample with water frontage or situated on a cul-de-sac sell for 33% to 35% more and 9% to 10% more, on average, respectively, than those homes that lack these characteristics, differences that are significant at or above the 1% level. Taken together, these results demonstrate that home buyers and sellers consistently take into account what can be seen from the home when sales prices are established, and that the models presented in this paper are able to clearly identify those impacts when they exist.[6]

Despite this finding, the models are unable to identify any evidence of a scenic vista stigma associated with the wind facilities in the sample. Specifically (as shown in Table A1.7), the 25 homes with extreme views in the sample, where the home site is "unmistakably dominated by the [visual] presence of the turbines," are not found to have statistically different selling prices than either those that sold in the same period but which did not have a view (Models One and Two) or that sold prior to the wind facility's construction (Models Three and Four). The same finding holds for the 106 and 561 homes that were rated as having either moderate or minor views of the wind turbines, respectively (e.g., see Figure 11.3).

[6] Of course, cul-de-sacs and water frontage bestow other benefits to the home owner beyond the quality of the scenic vista, such as safety and privacy in the case of a cul-de-sac, and recreational potential and privacy in the case of water frontage.

Figure 11.3: Model 2 Results for View (of Turbines)

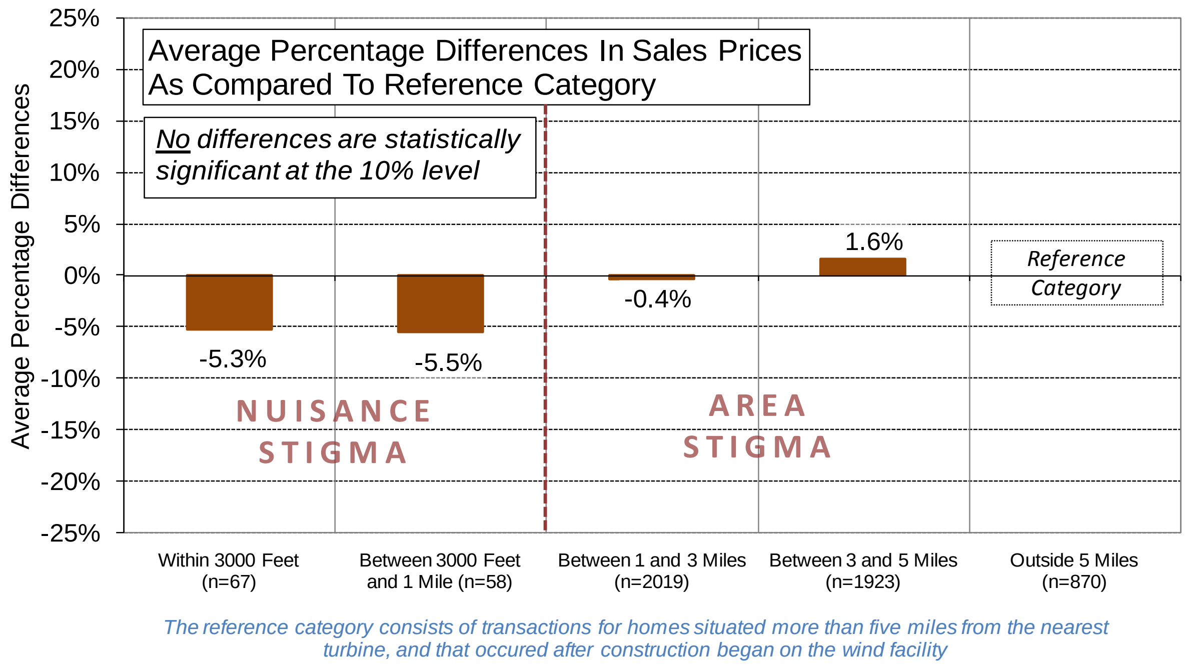


3.3.2 Area Stigma

Area stigma is defined as a concern that the general area surrounding a wind energy facility will appear more developed, which may adversely affect home values in the local community regardless of whether any individual home has a view of the wind turbines. Though these impacts might be expected to be especially severe at close range to the turbines, the impacts could conceivably extend for a number of miles around a wind facility. Modern wind turbines are visible from well outside of five miles (8km) in many cases, so if an area stigma exists it is possible that all of the homes in the study areas inside of five miles (8km) could be affected. To distinguish this generalised area stigma effect from nuisance effects, we focus on transactions of homes located outside of one mile (1.6km).

The presence of area stigmas was tested in each of the four models. Model One uses a continuous linear distance function and finds a relatively small (0.004) and non-significant (*p* value 0.25) relationship between distance (in miles) from the nearest turbine and the value of residential properties for the 4,937 transactions occurring after construction commenced. Similarly, results from Model Two, shown in Figure 11.4 below, indicate no statistical difference between the sales prices of homes located more than five miles (8km) from the turbines and those located in any nearer distance band. Likewise, in Model Three, the coefficients of distance for homes that sold outside of one mile (1.6km) after announcement are essentially no different to those that sold prior to announcement, with coefficients ranging between 0.00 and 0.01, none of which are statistically significant. Further, homes that sold after facility construction but that had No View of the turbine are found to appreciate in value, after adjusting for inflation, when compared to homes that sold before wind facility construction (0.02, *p* value 0.06); any area stigma effect that impacts the general area surrounding wind facilities should be reflected as a negative coefficient for this parameter. It should also be noted that the stability of the distance coefficients across Models Two and Three, where different reference cases are used, reinforces both the stability of the models and the appropriateness of the reference case selection.

Figure 11.4: Model 2 Results for Distance Categories



Perhaps a more direct test of area stigma comes from Model Four (as shown in Figure 11.5). In this model, homes in all distance bands outside of one mile (1.6km) and that sold after wind facility announcement are found to sell, on average, for prices that are not statistically different from sales that occurred more than two years prior to wind facility announcement.

To summarise, there is little evidence of the existence of an area stigma among the homes in this sample. On average, homes in these study areas are not demonstrably and measurably stigmatised by the arrival of a wind facility based on area stigma, regardless of when they sold in the wind power development process and regardless of whether those homes are located one mile (1.6km) or five miles (8km) away from the nearest wind facility.

3.3.3 Nuisance Stigma

Nuisance stigma is defined as any adverse impacts, such as sound and shadow flicker, which might uniquely affect residents of homes in *close* proximity to wind turbines, thereby leading to a potential reduction of home sales prices.

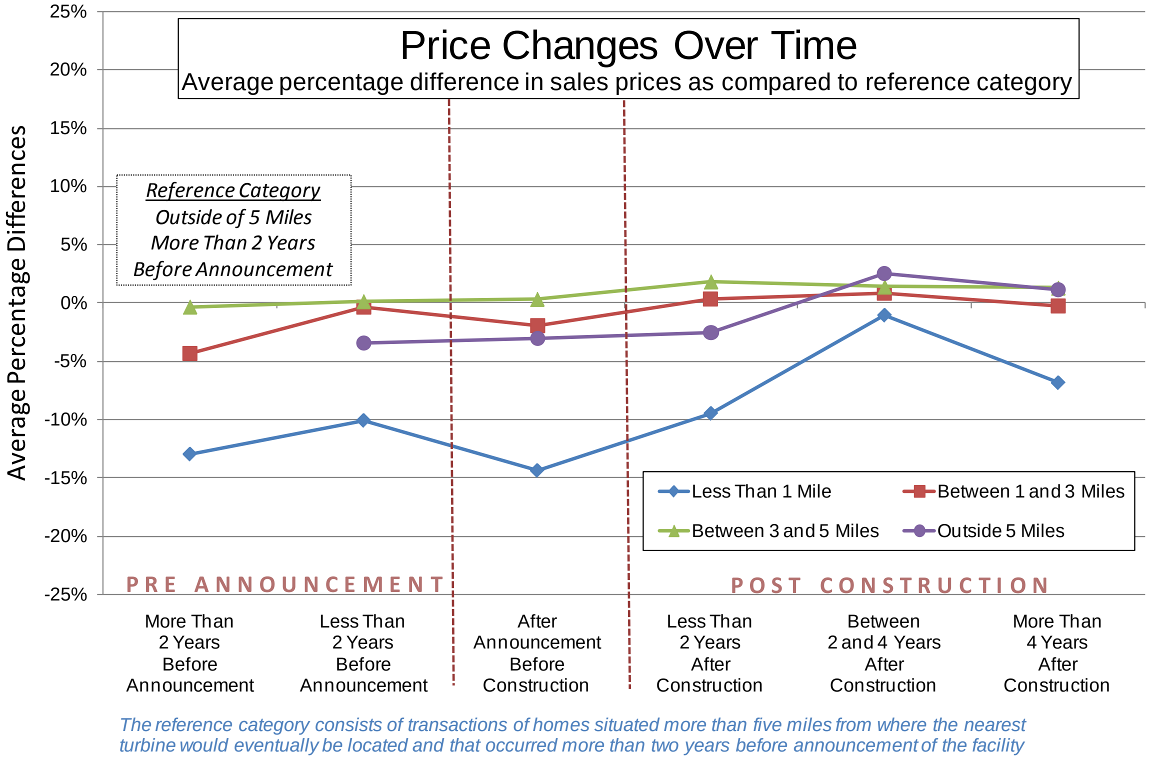
The results of Model One, where a continuous linear function is estimated for only those homes within one mile (1.6km), imply a 4.1% reduction in the values of homes located one half mile (0.8km) away from the wind facility, and a 6.4% reduction for those within one quarter of a mile (0.4km), though these results are not statistically significant.[7] Similarly, Model Two finds that those homes within 3000 feet (914 meters) and those between 3000 feet and one mile (1.6km) of the nearest wind turbine sold for roughly 5% less than similar homes located more than five miles (8km) away that sold in the same post-construction period (as shown in Figure 11.4). Again, these differences are not statistically significant (*p*-values 0.40 and 0.30, respectively). In Model Three, when all transactions occurring after wind facility announcement are assumed to potentially be impacted, and a comparison is made to the average of all transactions occurring pre-announcement, the adverse impacts are estimated to be -6% (*p* value 0.23) and -8% (*p* value 0.08), respectively.

Though none of these results are statistically significant, they are possibly consistent with the presence of a nuisance stigma. Model Four, however, provides the clearest picture of these findings,

[7] Effects for homes within a mile (1.6km) are calculated as follows from the estimated coefficients as reported in Table A1.7 in Appendix 1 for Model One: DISTANCE*0.004 + 0.086 - (DISTANCE*0.086).

and demonstrates that these effects are not likely to have been caused by the presence of the wind facilities. As is illustrated in Figure 11.5, homes that sold prior to wind facility announcement, but situated within one mile (1.6km) of the eventual location of the turbines, sold, on average, for between 10% and 13% less than homes that sold in the same time period but located more than five miles (8km) away. Therefore, the homes nearest the wind facility's eventual location were depressed in value, in comparison to homes further away, *prior* to the announcement of the facility. Moreover, comparing the sales prices of the homes located within a mile (1.6km) of the turbines between those that transacted more than two years prior to the facilities' announcement and those that sold in later periods (e.g., after announcement or after construction), would be illustrative of changes in value as it relates to the turbines, not some pre-existing condition. Figure 11.5 shows that relative prices did not fall after the announcement and eventual construction of the wind facility for this sample of homes.

Figure 11.5: Model 4 Results



The weak (i.e., not statistically significant) evidence of a nuisance stigma found in Models One, Two, and Three therefore appear to be a reflection of depressed home prices that preceded the construction of the relevant wind facilities, rather than a reaction to the turbines. If construction of the wind facilities were downwardly influencing the sales prices of these homes, as might be deduced from Models One, Two, or Three alone, a diminution in the inflation adjusted price would be seen as compared to pre-announcement levels in Model Four. Instead, an increase (albeit not-statistically significant) is observed. As such, no persuasive evidence of a nuisance stigma is apparent in this sample.

4 Robustness Tests

The results reported above suggest that wind facilities in this sample do not demonstrably cause scenic vista, area, or nuisance stigmas. Because this result is somewhat counter-intuitive and possibly controversial, several alternative model specifications to the four presented earlier were estimated to determine whether or not the results were robust. These alternative specifications included: (1) interacting the study-area fixed effects variables with the home and site characteristics to mimic the estimation of separate regressions for each study area; (2) replacing the study-area fixed effects variables with alternative location measures (specifically, census tract and school district delineations, the importance of which is discussed in Seo and Simons (2009)); (3) including additional micro-spatial variables in the models (specifically, distance to nearest highway ramp and proximity to a major road); (4) omitting either view or distance (to turbines) measurements from the model to explore potential collinearity between these variables; (5) removing the variable for the spatially weighted sales price of the five nearest neighbours (Spatial Control – Post Con) ; (6) including five outlier and influential observations that had previously been removed from the dataset (as discussed in Hoen at al., 2009); (7) including a <u>quantitative</u> measurement of VIEW (pct_vis) constructed from the total number of turbines visible and the distance of the home to the nearest wind turbine[8] rather than using the <u>qualitative</u> VIEW categories; and (8) adding fixed effects variables for the year in which the home sold.

[8] Pct_vis (i.e., Percent Visible) was constructed by dividing the total area of turbines visible from each home (as determined by the distance to the nearest turbine and the numbers of turbines visible), by the total viewing area possible.

Key results for these robustness checks are presented in Table A1.8 in Appendix 1. In the interest of brevity and because this model best captures the intent of the study to investigate post-construction impacts, only Model Two is used with these alternative specifications, and only the estimated coefficients on two view categories (substantial and extreme) and two distance categories (within 3000 feet (914 meters) and 3000 feet to one mile (1.6km)) are reported (although all were investigated). The re-estimated models, unless otherwise noted, include all of the same control variables and variables of interest as Model Two specified above.

The estimated coefficients for the robustness models are similar in magnitude to the baseline Model Two estimates (presented at the top of Table A1.8 for comparison purposes) and *none* are statistically different from zero (this also holds for the other variables that are not presented). The results are therefore robust to pooling the data across study areas; alternative location measures; the inclusion/exclusion of additional micro-spatial, neighbour's price, and/or year fixed effects variables; the omission of either set of variables of interest (distance or view of turbines); the inclusion of previously omitted outliers and influential observations; and an alternative, quantitative measure of the view (of turbines) variable. In addition, although not shown here, the results of Model One are robust to various distance functions, and the full set of results are consistent with repeat sales and sales volume models (all of which are presented in Hoen et al., 2009, along with several other robustness tests not otherwise mentioned here).

4.1 Conclusions to the Present Research

Though each of the analysis techniques used in this research has strengths and weaknesses, the results as a whole are strongly consistent in that none of the models uncovers conclusive evidence of the presence of any of the three property value stigmas that might be present in communities surrounding wind power facilities. Table 11.3 summarises the results from these models.

Table 11.3: Impact of Wind Projects on Property Values: Summary of Key Results

Statistical Model	Is there statistical evidence of: Area Stigma?	Scenic Vista Stigma?	Nuisance Stigma?
Model 1	No	No	No
Model 2	No	No	No
Model 3	No	No	Limited
Model 4	No	No	No
"No"…………………	*No statistical evidence of a negative impact*		
"Yes"…………………	*Strong statistical evidence of a negative impact*		
"Limited"……………	*Inconsistent statistical evidence of negative impact*		

Therefore, based on the data sample and analysis presented here, no evidence is found that home prices surrounding these U.S. wind facilities are consistently, measurably, and significantly affected by either the view of wind facilities or the distance of the home to those facilities. Although the analysis cannot dismiss the possibility that individual homes or small numbers of homes have been or could be negatively impacted, it finds that if these impacts do exist, they are either too small and/or too infrequent to result in any widespread, statistically observable impact.

Consistent with the location of existing wind facilities in the United States, the sample described herein is dominated by rural areas with relatively low median home prices. Therefore, although we would expect that these results would be relevant to new wind facilities located in similar areas, the relevance of these results to situations much different from those studied cannot be determined without additional research.

5 Conclusions to All U.S. Research

Overall the conclusions that can be drawn from the previous U.S. literature are that wind facilities are often *predicted* to negatively impact residential property values in pre-construction surveys, but negative impacts have largely failed to materialise post-construction when actual transaction data become available for analysis. In the two studies using transaction data that did find a statistically significant adverse effect, the effects occurred prior to wind facility operation and not after operation (Hinman, 2010) or the data was limited to pre-operation only (Heintzelman and Tuttle, 2011). For the present research, which is based on the most comprehensive data on and analysis of the subject to date, a similar result is found. Across various model specifications and after a number of robustness tests were conducted, no statistical evidence of the presence of these stigmas post-operation was found for the 24 wind facilities and 7,459 residential real estate transactions included in the sample.

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Appendix 1

Table A1.1: Summary of Study Areas

Study Area Code	Study Area Counties, States	Facility Names	Number of Turbines	Number of MW	Max Hub Height (meters)	Max Hub Height (feet)
WAOR	Benton and Walla Walla Counties, WA & Umatilla County, OR	Vansycle Ridge, Stateline, Nine Canyon I & II, Combine Hills	582	429	60	197
TXHC	Howard County, TX	Big Spring I & II	46	34	80	262
OKCC	Custer County, OK	Weatherford I & II	98	147	80	262
IABV	Buena Vista County, IA	Storm Lake I & II, Waverly, Intrepid I & II	381	370	65	213
ILLC	Lee County, IL	Mendota Hills, GSG Wind	103	130	78	256
WIKCDC	Kewaunee and Door Counties, WI	Red River, Lincoln	31	20	65	213
PASC	Somerset County, PA	Green Mountain, Somerset, Meyersdale	34	49	80	262
PAWC	Wayne County, PA	Waymart	43	65	65	213
NYMCOC	Madison & Oneida Counties, NY	Madison	7	12	67	220
NYMC	Madison County, NY	Fenner	20	30	66	218
		TOTAL	**1345**	**1286**		

Table A1.2: Definition of view (of turbines) categories

NO VIEW	The turbines are not visible at all from this home.
MINOR VIEW	The turbines are visible, but the scope (viewing angle) is narrow, there are many obstructions, or the distance between the home and the facility is large.
MODERATE VIEW	The turbines are visible, but the scope is either narrow or medium, there might be some obstructions, and the distance between the home and the facility is most likely a few miles.
SUBSTANTIAL VIEW	The turbines are dramatically visible from the home. The turbines are likely visible in a wide scope and most likely the distance between the home and the facility is short.
EXTREME VIEW	This rating is reserved for sites that are unmistakably dominated by the presence of the wind facility. The turbines are dramatically visible from the home and there is a looming quality to their placement. The turbines are often visible in a wide scope or the distance to the facility is very small.

An ordered qualitative view (of turbines) ranking system was developed by the authors to encompass considerations of multiple characteristics (e.g., distance to turbines visible, number of turbines visible, and viewing angle of the turbines visible) into one ordered categorical scale to be used in conjunction with the scenic vista rankings at each home.

View (of Turbine) Ratings with Photos

MINOR VIEW

<INSERT MINOR VIEW 1 PHOTO>

Image A1.1 - 3 turbines visible, nearest 1.4 miles (TXHC)

<INSERT MINOR VIEW 2 PHOTO>

Image A1.2 - 5 turbines visible, nearest 0.9 miles (NYMC)

MODERATE VIEW

<INSERT MODERATE VIEW 1 PHOTO>

Image A1.3 - 18 turbines visible, nearest 1.6 miles (ILLC)

<INSERT MODERATE VIEW 2 PHOTO>

Image A1.4- 6 turbines visible, nearest 0.8 miles (PASC)

SUBSTANTIAL VIEW

<INSERT SUBSTANTIAL VIEW 1 PHOTO>

Image A1.5- 90 turbines visible, nearest 0.6 miles (IABV)

<INSERT SUBSTANTIAL VIEW 2 PHOTO>

Image A1.6- 27 turbines visible, nearest 0.6 miles (TXHC)

EXTREME VIEW

<INSERT EXTREME VIEW 1 PHOTO>

Image A1.7- 6 turbines visible, nearest 0.2 miles (WIKCDC)

<INSERT EXTREME VIEW 2 PHOTO>

Image A1.8- 212 turbines visible, nearest 0.4 miles (IABV)

Table A1.3: Definition of Scenic Vista Categories

POOR VISTA	These vistas are often dominated by visually discordant man-made alterations (not considering turbines), or are uncomfortable spaces for people, lack interest, or have virtually no recreational potential.
BELOW AVERAGE VISTA	These scenic vistas contain visually discordant man-made alterations (not considering turbines) but are not dominated by them. They are not inviting spaces for people, but are not uncomfortable. They have little interest or mystery and have minor recreational potential.
AVERAGE VISTA	These scenic vistas include interesting views that can be enjoyed often only in a narrow scope. These vistas may contain some visually discordant man-made alterations (not considering turbines), are moderately comfortable spaces for people, have some interest, and have minor recreational potential.
ABOVE AVERAGE VISTA	These scenic vistas include interesting views that often can be enjoyed in a medium to wide scope. They might contain some man-made alterations (not considering turbines), yet still possess significant interest and mystery, are moderately balanced and have some potential for recreation.
PREMIUM VISTA	These scenic vistas would include "picture postcard" views that can be enjoyed in a wide scope. They are often free or largely free of any discordant man made alterations (not considering turbines), possess significant interest, memorable qualities, and mystery and are well balanced and likely have a high potential for recreation.

Drawing heavily on the landscape-quality rating system developed by Buhyoff et al. (1994) and to a lesser degree on the systems described by others (Daniel and Boster, 1976; USDA, 1995), a qualitative ordered scenic vista ranking system, consisting of five categories, was developed to be used in conjunction with the view (of turbines) rankings at each home.

Scenic Vista Ratings with Photos

POOR VISTA

<INSERT POOR VISTA 1 PHOTO>
Image A1.9 - Poor Vista 1

<INSERT POOR VISTA 2 PHOTO>
Image A1.10 - Poor Vista 2

BELOW AVERAGE VISTA

<INSERT BAVG VISTA 1 PHOTO>
Image A1.11 – Below Average Vista 1

<INSERT BAVG VISTA 2 PHOTO>
Image A1.12 – Below Average Vista 2

AVERAGE VISTA

<INSERT AVG VISTA 1 PHOTO>

Image A1.13 – Average Vista 1

<INSERT AVG VISTA 2 PHOTO>

Image A1.14 - Average Vista 2

ABOVE AVERAGE VISTA

<INSERT AAVG VISTA 1 PHOTO>

Image A1.15 – Above Average Vista 1

<INSERT AAVG VISTA 2 PHOTO>

Image A1.16 - Above Average Vista 2

PREMIUM VISTA

<INSERT PREMIUM VISTA 1 PHOTO>

Image A1.17 - Premium Vista 1

<INSERT PREMIUM VISTA 2 PHOTO>

Image A1.18 - Premium Vista 1

Table A1.4: Summary of Transactions across Study Areas and Development Periods

	Pre Announcement	Post Announcement Pre Construction	1st Year After Construction	2nd Year After Construction	2+ Years After Construction	Total
Benton/Walla Walla, WA & Umatilla, OR (WAOR)	226	45	76	59	384	790
Howard, TX (TXHC)	169	71	113	131	827	1,311
Custer, OK (OKCC)	484	153	193	187	96	1,113
Buena Vista, IA (IABV)	152	65	80	70	455	822
Lee, IL (ILLC)	115	84	62	71	80	412
Kewaunee/Door, WI (WIKCDC)	44	41	68	62	595	810
Somerset, PA (PASC)	175	28	46	60	185	494
Wayne, PA (PAWC)	223	106	64	71	87	551
Madison/Oneida, NY (MYMCOC)	108	9	48	30	268	463
Madison, NY (NYMC)	59	165	74	70	325	693
TOTAL	1,755	767	824	811	3,302	7,459

Table A1.5: Summary Statistics

Variable Name	Description	All Sales Mean	All Sales Standard Deviation	Post-Construction Sales Mean	Post-Construction Sales Standard Deviation
SalePrice	Unadjusted sale price of the home (in US dollars)	102,968	64,293	110,166	69,422
SalePrice96	Sale price of the home in 1996 US dollars	79,114	47,257	80,156	48,906
LN_SalePrice96	Natural log of sale price of the home in 1996 US dollars	11.117	0.58	11.12	0.60
AgeatSale	Age of the home at the time of sale	46	37	47	36
AgeatSale_Sqrd	Age of the home at the time of sale squared	3,491	5,410	3,506	5,412
Sqft_1000	Number of finished square feet of above grade (in 1000s)	1.623	0.59	1.628	0.589
Acres	Number of acres sold with the residence	1.128	2.42	1.10	2.40
Baths	Number of bathrooms (full bath = 1, half bath = 0.5)	1.738	0.69	1.75	0.70
ExtWalls_Stone	Home has exterior walls of stone, brick or stucco (Yes = 1, No = 0)	0.307		0.301	
CentralAC	Home has a central AC unit (Yes = 1, No = 0)	0.507		0.522	
Fireplace	Number of fireplace openings	0.390	0.55	0.40	0.55
Cul_De_Sac	Home is situated on a cul-de-sac (Yes = 1, No = 0)	0.133		0.136	
FinBsmt	Finished basement square feet > 50% first floor square feet (Yes = 1, No = 0)	0.197		0.201	
Water_Front	Home shares property line with body of water or river (Yes = 1, No = 0)	0.014		0.018	
Cnd_Low	Condition of the home is Poor (Yes = 1, No = 0)	0.014		0.014	
Cnd_BAvg	Condition of the home is Below Average (Yes = 1, No = 0)	0.070		0.073	
Cnd_Avg	Condition of the home is Average (Yes = 1, No = 0)	0.584		0.552	
Cnd_AAvg	Condition of the home is Above Average (Yes = 1, No = 0)	0.274		0.293	
Cnd_High	Condition of the home is High (Yes = 1, No = 0)	0.059		0.068	
Vista_Poor	Scenic Vista from the home is Poor (Yes = 1, No = 0)	0.063		0.063	
Vista_BAvg	Scenic Vista from the home is Below Average (Yes = 1, No = 0)	0.577		0.579	
Vista_Avg	Scenic Vista from the home is Average (Yes = 1, No = 0)	0.256		0.253	
Vista_AAvg	Scenic Vista from the home is Above Average (Yes = 1, No = 0)	0.088		0.091	
Vista_Prem	Scenic Vista from the home is Premium (Yes = 1, No = 0)	0.016		0.015	
SaleYear	Year the home was sold	2002	2.9	2004	2.3
View_None	Home sold post-construction with no view of turbines (Yes = 1, No = 0)	0.564		0.852	
View_Minor	Home sold post-construction with Minor View (Yes = 1, No = 0)	0.075		0.114	
View_Mod	Home sold post-construction with Moderate View (Yes = 1, No = 0)	0.014		0.021	
View_Sub	Home sold post-construction with Substantial View (Yes = 1, No = 0)	0.005		0.007	
View_Extrm	Home sold post-construction with Extreme View (Yes = 1, No = 0)	0.004		0.006	
DISTANCE †	Distance to nearest turbine for post-announcement homes, otherwise 0	2.53	2.59	3.57	1.68
Mile_Less_0.57 †	Home sold post-announcement and was located within 0.57 miles (3000 feet) from nearest turbine (Yes = 1, No = 0)	0.011		0.014	
Mile_0.57to1 †	Home sold post-announcement and was located between 0.57 miles (3000 feet) and 1 mile from nearest turbine (Yes = 1, No = 0)	0.009		0.012	
Mile_1to3 †	Home sold post-announcement and was located between 1 and 3 miles from nearest turbine (Yes = 1, No = 0)	0.316		0.409	
Mile_3to5 †	Home sold post-announcement and was located between 3 and 5 miles from nearest turbine (Yes = 1, No = 0)	0.295		0.390	
Mile_Gtr5 †	Home sold post-announcement and was located at least 5 miles from nearest turbine (Yes = 1, No = 0)	0.134		0.176	

† *"All Sales" mean and standard deviation DISTANCE and DISTANCE fixed effects variables (e.g., Mile_1to3) include transactions that occurred after facility "announcement" and before "construction" as well as those that occured post-construction*

Table A1.6: Results for Controlling Variables in Models 1 - 4

	Model 1	Model 2	Model 3	Model 4
Number of Cases	4,937	4,937	7,459	7,459
Number of Predictors	35	37	39	56
F Statistic	468	443	580	404
Adjusted R2	0.77	0.77	0.75	0.75

Intercept	7.63 (0.18)**	7.62 (0.18)**	9.08 (0.14)**	9.11 (0.14)**
Spatial Control - Post Con	0.29 (0.02)**	0.29 (0.02)**		
Spatial Control - All Sales			0.16 (0.01)**	0.16 (0.01)**
AgeatSale	-0.0059 (0.00)**	-0.0059 (0.00)**	-0.007 (0.00)**	-0.007 (0.00)**
AgeatSale_Sqrd	0.00002 (0.00)**	0.00002 (0.00)**	0.00003 (0.00)**	0.00003 (0.00)**
Sqft_1000	0.28 (0.01)**	0.28 (0.01)**	0.28 (0.01)**	0.28 (0.01)**
Acres	0.02 (0.00)**	0.02 (0.00)**	0.02 (0.00)**	0.02 (0.00)**
Baths	0.09 (0.01)**	0.09 (0.01)**	0.08 (0.01)**	0.08 (0.01)**
ExtWalls_Stone	0.21 (0.02)**	0.21 (0.02)**	0.21 (0.01)**	0.21 (0.01)**
CentralAC	0.09 (0.01)**	0.09 (0.01)**	0.12 (0.01)**	0.12 (0.01)**
Fireplace	0.11 (0.01)**	0.11 (0.01)**	0.11 (0.01)**	0.12 (0.01)**
FinBsmt	0.08 (0.02)**	0.08 (0.02)**	0.09 (0.01)**	0.09 (0.01)**
Cul_De_Sac	0.1 (0.01)**	0.1 (0.01)**	0.09 (0.01)**	0.09 (0.01)**
Water_Front	0.34 (0.04)**	0.33 (0.04)**	0.35 (0.03)**	0.35 (0.03)**
Cnd_Low	-0.44 (0.05)**	-0.45 (0.05)**	-0.43 (0.04)**	-0.43 (0.04)**
Cnd_BAvg	-0.24 (0.02)**	-0.24 (0.02)**	-0.21 (0.02)**	-0.21 (0.02)**
Cnd_Avg	Omitted	Omitted	Omitted	Omitted
Cnd_AAvg	0.13 (0.01)**	0.14 (0.01)**	0.13 (0.01)**	0.13 (0.01)**
Cnd_High	0.23 (0.02)**	0.23 (0.02)**	0.22 (0.02)**	0.22 (0.02)**
Vista_Poor	-0.21 (0.02)**	-0.21 (0.02)**	-0.25 (0.02)**	-0.25 (0.02)**
Vista_BAvg	-0.08 (0.01)**	-0.08 (0.01)**	-0.09 (0.01)**	-0.09 (0.01)**
Vista_Avg	Omitted	Omitted	Omitted	Omitted
Vista_AAvg	0.1 (0.02)**	0.1 (0.02)**	0.1 (0.01)**	0.1 (0.01)**
Vista_Prem	0.13 (0.04)**	0.13 (0.04)**	0.09 (0.03)**	0.09 (0.03)**
WAOR	Omitted	Omitted	Omitted	Omitted
TXHC	-0.75 (0.03)**	-0.75 (0.03)**	-0.82 (0.02)**	-0.82 (0.02)**
OKCC	-0.44 (0.02)**	-0.44 (0.02)**	-0.53 (0.02)**	-0.52 (0.02)**
IABV	-0.24 (0.02)**	-0.24 (0.02)**	-0.31 (0.02)**	-0.3 (0.02)**
ILLC	-0.09 (0.03)**	-0.09 (0.03)**	-0.05 (0.02)*	-0.04 (0.02)*
WIKCDC	-0.14 (0.02)**	-0.14 (0.02)**	-0.17 (0.01)**	-0.17 (0.02)**
PASC	-0.3 (0.03)**	-0.31 (0.03)**	-0.37 (0.03)**	-0.37 (0.03)**
PAWC	-0.07 (0.03)**	-0.07 (0.03)**	-0.15 (0.02)**	-0.14 (0.02)**
NYMCOC	-0.2 (0.03)**	-0.2 (0.03)**	-0.25 (0.02)**	-0.25 (0.02)**
NYMC	-0.14 (0.02)**	-0.15 (0.02)**	-0.15 (0.02)**	-0.15 (0.02)**

*Significant at or above the: ** 1% level, * 5% level. Standard Errors shown in parenthesis.*

Table A1.7: Results for Variable of Interest

		Model 1	Model 2	Model 3	Model 4
No View		Omitted	Omitted	0.02 (0.01)	Omitted
Minor View		-0.01 (0.01)	-0.01 (0.01)	0.00 (0.02)	-0.02 (0.01)
Moderate View		0.01 (0.03)	0.02 (0.03)	0.03 (0.03)	0.00 (0.03)
Substantial View		-0.01 (0.07)	-0.01 (0.07)	0.03 (0.07)	0.01 (0.07)
Extreme View		0.04 (0.1)	0.02 (0.09)	0.06 (0.08)	0.04 (0.07)
Pre-Construction Sales				Omitted	
Inside 3000 Feet			-0.05 (0.06)	-0.06 (0.05)	
Between 3000 Feet and 1 Mile			-0.05 (0.05)	-0.08 (0.05)	
Between 1 and 3 Miles			0.00 (0.02)	0.00 (0.01)	
Between 3 and 5 Miles			0.02 (0.01)	0.01 (0.01)	
Outside 5 Miles			Omitted	0.00 (0.02)	
Pre-Announcement Sales				Omitted	
DISTANCE		0.004 (0.00)			
DISTANCE*LT1MILE		0.086 (0.11)			
Inside 1 Mile (1.6 km)	Gtr2Yr_PreAnc				-0.13 (0.06)*
	Lt2Yr_PreAnc				-0.10 (0.05)
	PostAnc_PreCon				-0.14 (0.06)*
	Lt2Yr_PostCon				-0.09 (0.07)
	Btw2_4Yr_PostCon				-0.01 (0.06)
	Gtr4Yr_PostCon				-0.07 (0.08)
Between 1-3 Miles (1.6-4.8 km)	Gtr2Yr_PreAnc				-0.13 (0.06)*
	Lt2Yr_PreAnc				0.00 (0.03)
	PostAnc_PreCon				-0.02 (0.03)
	Lt2Yr_PostCon				0.00 (0.03)
	Btw2_4Yr_PostCon				0.01 (0.03)
	Gtr4Yr_PostCon				0.00 (0.03)
Between 3-5 Miles (4.8-8 km)	Gtr2Yr_PreAnc				0.00 (0.04)
	Lt2Yr_PreAnc				0.00 (0.03)
	PostAnc_PreCon				0.00 (0.03)
	Lt2Yr_PostCon				0.02 (0.03)
	Btw2_4Yr_PostCon				0.01 (0.03)
	Gtr4Yr_PostCon				0.01 (0.03)
Outside 5 Miles (8 km)	Gtr2Yr_PreAnc				Omitted
	Lt2Yr_PreAnc				-0.03 (0.04)
	PostAnc_PreCon				-0.03 (0.03)
	Lt2Yr_PostCon				-0.03 (0.03)
	Btw2_4Yr_PostCon				0.03 (0.03)
	Gtr4Yr_PostCon				0.01 (0.03)

*Significant at or above the: ** 1% level, * 5% level. Standard Errors shown in parenthesis.*

Table A1.8: Robustness Test Results

	Substantial View	Extreme View	Inside 3000 Feet	Between 3000 Feet and 1 Mile	pct_vis
Model Two	-0.01 (0.07)	0.02 (0.09)	-0.05 (0.06)	-0.05 (0.05)	
Robustness Models					
Interactions Between Study Area and Home and Site Characteristics Included	0.002 (0.07)	0.01 (0.09)	-0.05 (0.06)	-0.06 (0.05)	
Census Tract and School District Delineations Included	0.03 (0.06)	0.03 (0.08)	-0.07 (0.06)	-0.02 (0.05)	
Micro Spatial Effects - Ramp Distance and Major Roads Included	0.02 (0.06)	0.02 (0.08)	-0.02 (0.06)	0.03 (0.05)	
Spatial Control (Nearest Neighbor) Omitted	-0.03 (0.07)	-0.006 (0.09)	-0.07 (0.06)	-0.06 (0.05)	
View Variables Omitted			-0.04 (0.04)	-0.06 (0.05)	
Distance Variables Omitted	-0.04 (0.06)	-0.03 (0.06)			
Five Outlier and Influencer Cases Included	-0.03 (0.06)	0.02 (0.09)	-0.02 (0.06)	-0.05 (0.05)	
Percent Visible (Quantitative View Variable) Tested			-0.09 (0.06)	-0.06 (0.04)	0.43 (0.23)
Year Dummies Included	-0.01 (0.07)	0.02 (0.09)	-0.05 (0.06)	-0.05 (0.05)	

*Significant at or above the: ** 1% level, * 5% level. Standard Errors shown in parenthesis.*