Studies: Wind Power and Property Values

Documents attached:

1. Press Release – Fenner Renewable Energy Education (FREE) Center – May 24, 2006

2. Hoen-Bard College, *Impacts of Windmill Visibility on Property Values in Madison County, NY* – Overview & Executive Summary – May 2006

3. Renewable Energy Policy Project (REPP), *The Effect of Wind Development on Local Property Values,* Executive Summary, May 2003

THE FREE CENTER

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FOR IMMEDIATE RELEASE
May 24, 2006

NEW REPORT FINDS NO EVIDENCE OF IMPACTS ON PROPERTY VALUES FROM WIND FARM

Suggests property value effects should take on less importance in siting proceedings

FENNER, NEW YORK (MAY 24, 2006): The FREE Center, a Fenner (NY) based organization dedicated to renewable energy education and sustainable practices, today released a study examining the impacts on local property values of the Fenner wind farm. Despite persistent claims that all wind farms adversely affect property values, a report by Ben Hoen a graduate student of the Bard Center for Environmental Policy at Bard College, finds that property values were unaffected by the installation, in 2001, of a 20 turbine wind farm in the Fenner Township of Madison County, NY.

The report, *Impacts of Windmill Visibility on Property Values in Madison County, New York,* is being released by the Fenner Renewable Energy Education Foundation (FREE), and will be made available via a website hosted by the Alliance for Clean Energy New York (ACE NY). Hoen says, "The likelihood that property values were affected in Madison County is negligible, thereby reducing similar concerns for other communities hosting wind farms."

"Much as we expected," said Donna Griffin, a longtime Fenner resident, wind farm neighbor and FREE Board member, "this study concludes that well-planned wind farms can generate lots of clean power, local tax revenue and still be good neighbors."

High profile proposals for wind farm installations, such as Cape Cod, Massachusetts, have concentrated on the subject of property value effects, where one study projected the effects of the proposal to be $1.35 billion[1] in reduced property values. The phrase, "The wind farm will ruin my view!" has often been heard at public planning meetings for wind farms. "A ruined view would be translated into home prices, yet few studies of actual property value effects from existing wind facilities exist", added Hoen. New York, with its adoption of the Renewable Portfolio Standard, in 2004, plans to increase the percentage of renewable power produced in the state by 7% (over its current 18%) to reach the goal of 25% renewable energy generation by the year 2013. This could mean as many as 30 new wind farms across the state, the report states, and many states in the Northeast have similar goals for renewable energy use and production in their state.

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[1] Haughton, J., D. Giuffre, *et al.* (2004). "*An Economic Analysis of a Wind Farm in Nantucket Sound*." Beacon Hill Institute at Suffolk University. 2-83. May 1, 2004. Pg. 16.

The director of the Bard Center for Environmental Policy, Joanne Fox-Przeworski says, "As the Northeast's wind energy capacity grows, the frequency of clashes between communities and wind farms will likely increase. Understanding the effects of these developments, through empirical studies of existing sites, is crucial."

"Wind power plays a key role in New York's clean energy future. From an environmental perspective, it's a safe source of energy that reduces our dependence on polluting fossil fuels and foreign oil," said Larisa Washburn, program associate of Environmental Advocates of New York. "This study sheds light on a common concern in communities deciding whether or not to build a wind farm and shows that property values are not impacted."

"This study provides valuable information for communities considering wind farm developments", said Carol Murphy, Executive Director of ACE NY. "The Fenner wind farm is a showcase for New York showing how wind energy can bring economic development for rural communities with many positive attributes for local residents while producing pollution free energy."

The study is the first on record to visit each home in the study area and ascertain if visibility of the wind farm is possible, and to what degree. Previous studies[2] have made the assumption that all homes within a certain radius (for instance 5 miles) could see the wind farm, yet this study found that only 33% of the homes in its study area, within 5 miles, could see the turbines. In addition to visibility, distance to the nearest turbine was calculated. The author used this data to ascertainif property value data, obtained from the Madison County Tax Office, was uniquely affected by the turbines. The report finds there to be no measurable effect on values. These findings held even when concentrating on homes that were within a mile of the turbines and those that sold in 2001, immediately following the announcement and construction of the wind farm. Hoen recommends further study of this issue at other sites around the country, and makes specific recommendations for policy makers based on his findings.

The report will be made available through the ACE NY website www.aceny.org

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The Fenner Renewable Energy Center is a grass-roots organization recently formed to educate the public on the benefits of renewable energy and other sustainable practices. It has created an informational kiosk for visitors to the Fenner wind farm, and is raising funds to build a LEED-certified energy education center on the wind farm site in Fenner, NY.

The Alliance for Clean Energy New York's mission is to promote the use of clean, renewable electricity technologies and energy efficiency in New York State, in order to increase energy diversity and security, boost economic development, improve public health, and reduce air pollution.

Environmental Advocates of New York is the state's government watchdog, holding lawmakers and agencies accountable for implementing policy that protects natural resources and safeguards public health. The nonprofit organization is a 501(c) (3) and is the New York State affiliate of the National Wildlife Federation. For more information call 518.462.5526 or visit www.eany.org.

[2] For Example: Sterzinger, G., F. Beck, *et al.* (2003). "*The Effect of Wind Development on Local Property Values*." Renewable Energy Policy Project. 1-77. May 2003.

Impacts of Windmill Visibility on Property Values in Madison County, New York

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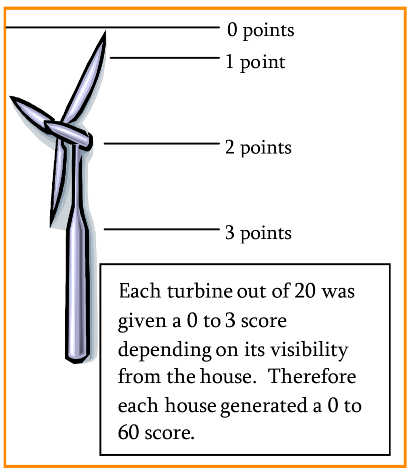
Background

With a growing reliance on wind energy to mitigate risks from energy security, air pollution and global warming, a continuance of federal renewable energy tax credits, and a number of state incentive packages, U.S. states are seeing wind energy development grow at an unprecedented rate. Additionally windmill and wind farm sizes are growing larger in order to capture greater efficiencies. Conflicts have occurred between community members and facility developers over expected aesthetic impacts and their corresponding property value impacts. Changes in property values can potentially represent "hidden costs" borne by the community. Tom Grey, of the American Wind Energy Association (AWEA) ranks aesthetics and property values as the "number one" concern of communities considering wind farms. Without proper analysis of this subject and a thorough understanding of effects on communities surrounding existing facilities, upcoming projects will be either needlessly delayed or inappropriately approved. Many opinions exist on the effects of wind development on surrounding property values, but no study to date has empirically analyzed the subject and actually visited the homes in the community to establish the degree of turbine visibility.

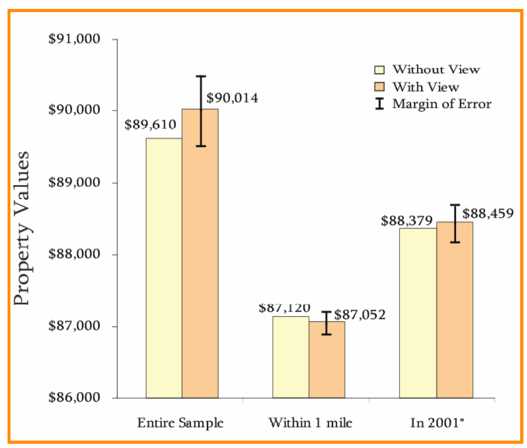
Purpose & Methods

This report analyzed property values surrounding a 20-turbine windfarm, constructed in 2001, in Madison County, New York to establish if any effects actually exist, and to set standards for future research. 280 arms-length residential home sales within 5 miles of the windfarm and occurring between 1996 and 2005 were analyzed. A visit to each home was made and an unbiased scoring method was used (see left) to quantify the degree to which each of these homes could see the wind farm, and the distance from each home to the turbines. These and other characteristics obtained from the county assessor records were incorporated into an econometric model to ascertain if the properties' sale prices were uniquely affected by the windmill visibility.



Results

The report finds no measurable effects of windmill visibility on property values (p-value 0.410). This absence of evidence holds even when concentrating on homes within a mile (p-value 0.656) or on those that sold immediately following announcement in 2001 (p-value 0.742) (See right).



Conclusions & Recommendations

The report suggests a number of reasons why no effects were found: The windmill array fits the landscape; wind farming fits this community's "sense of place;" the payments the community received "balanced" any adverse impacts; a well respected landowner/proponent swayed others; and possibly residents swapped local impacts for global benefits. Further, the report offers the possibility that effects are more myth than reality citing empirical survey studies conducted in Europe which report resident reaction to wind farms largely to be neither good nor bad, but rather "acceptable"[1], and another study which finds the local wind facility is rarely (< 3.0%) spontaneously mentioned in residents' descriptions of their surroundings.[2] The author recommends further study of 6 to 10 other sites in the U.S. to ascertain if his results can apply to many of the communities considering wind facilities currently across the county.

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[1] Warren, C., C. Lumsden, et al. (2005). "Green on Green: Public Perceptions of Wind Power in Scotland and Ireland." Journal of Environmental Planning and Management 48 (6): 853-875.

[2] Braunholtz, S. and MORI-Scotland (2003). "Public Attitudes to Windfarms: A Survey of Local Residentsin Scotland." Scottish Executive Social Research. 1-21.

1 Executive Summary

With federal renewable energy tax credits and a number of state incentive packages in place (AWEA, 2005b), U.S. states are increasingly relying on wind energy to mitigate risks related to resource scarcity, increasing costs of fossil fuel extraction, greenhouse gas emissions and other environmental hazards (CRS, 2005). This shft has caused wind energy development to grow at an unprecedented rate. In 2005 new capacity totaling 2,400 megawatts (MW) was installed in the U.S., an increase of 35% over 2004 U.S. capacity (AWEA, 2006).[1] At the same time windmill sizes have become increasingly large in order to capture greater efficiencies per turbine, and the numbers of turbines installed per windfarm has increased to capture economies of scale (AWEA, 2005c) Litigious conflicts between community members and facility developers have occurred(Adams, 2005) and are likely to increase if the industry trends of increasing size and number continue. Community attitudes regarding wind energy are often promoted by small groups of organized opponents or proponents, therefore the sentiments of the entire community on average may be missed. One way to measure the community's disposition is to use property transaction prices (transaction values) as a proxy. If the visibility of a windfarm is believed by the members of the community to adversely affect the view from the home, the transaction value, with all else being equal, will be lower as compared to other homes without a view. Alternatively, if residents find the view acceptable, no change in property values will be discernable.

Many opinions exist on the effects of wind development on surrounding property values. For example, the two largest studies completed in the U.S. reach contradictory

[1] The American Wind Energy Association (AWEA) estimates that 2,400 MW of wind energy will supply energy for 600,000 homes (AWEA, 2006)

results. Haughton (2004) predicts sizable negative effects from windfarm development on property values in Cape Cod, Massachusetts while Sterzinger (2003) concludes from his analysis of 10 communities around the U.S. there are strong positive effects. Despite these contradictory results no studies to date have rigorously analyzed the subject by using a large sample of arms-length home transaction values combined with a verification to what degree each home in the sample can see the wind farm or not. Instead, with each new wind development interested parties are forced to rely on poorly constructed or inconclusive studies (Jordal-Jorgensen, 1996; Grover, 2002; Sterzinger *et al.*, 2003; Poletti, 2005), or comparisons to inappropriately analogous research (Zarem, 2005a). For instance in 2004, the Public Service Commission (PSC) of Wisconsin heard opposing conclusions of studies conducted by experienced economists (Poletti, 2005; Zarem, 2005b) Both cited, in their testimony, their frustration with the lack of available evidence in this subject area.

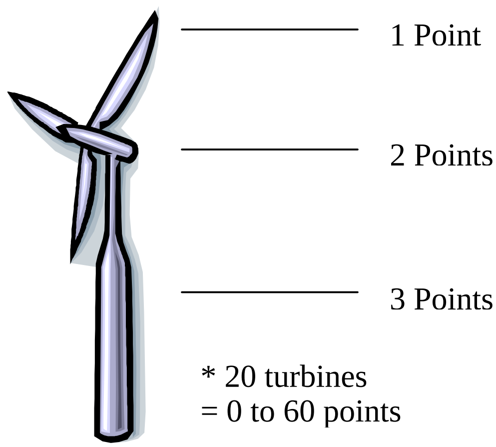
Compounding the lack of data problem, changes in property values are not likely to be taken into consideration by the developer and the community. These “hidden costs” or “externalities” are not weighed against the benefits of a project. Without proper analysis of these potential costs or externalities and a thorough understanding of when and how they affect property values, facilities may be either needlessly delayed or inappropriately approved. This report studies property values and windfarms with the hope of shedding light on these issues.

First the report reviews the existing literature on property values and windfarms finding in most cases a lack of rigor and insufficient detail to capture the complex relationship between home transaction prices and views, such as those found in research of high voltage transmission lines (HVTL) and property values (e.g. Des-Rosiers, 2002). Then using data from a Madison County, New York community surrounding a 20 turbine windfarm, the report analyses home transaction values in an effort to ascertain if effects exist and to create a potential blueprint for future analysis of other communities. The data contains 280 arms-length single-family residential home sales which took place between 1996 and 2005; 140 occurred after facility construction began in 2001. None of the home sales were on properties that contained turbines, or received compensation from the operation of the turbines. Two methods of measuring the degree to which each home can see the turbines are developed, a simulated method and one involving field visits. Ultimately, as is discussed below, the method involving field visits was used for the regression model. The simulated method uses a geographical information system (GIS) model to predict visibility. Ten meter digital elevation model (DEM)[2] data provided by the United States Geological Survey (USGS) is combined with 10 meter ground-cover data by estimating heights of ground cover types and adding these heights to the surface elevations. The ESRI 3-D analyst viewshed algorithm, which is included in the Arc Map product, is used to analyze visibility. Then, GIS predictions are compared to field collected data. Although it incorporates techniques not previously used and reaches an accuracy rate of 85%, which is higher than the 50% accuracy rate found in the literature (Dean, 1997; Maloy and Dean, 2001), it is deemed an unsatisfactory level of accuracy for this report's hedonic analysis which requires greater than 95% accuracy. Therefore, the second, field visit method is used.

[2] The DEM is a digital representation of the elevation of locations on the land surface. A DEM is often used in reference to a set of elevation values representing the elevations at points in a rectangular grid on the earth's surface.

For this method, each home in the sample is visited and the degree to which each of these homes can see the windfarm is quantified using a scoring method which attempts to minimize bias. From each home each of the twenty turbines is given a 0 (no view) to 3 (full view) score, which are then totaled resulting in a 0 to 60 score specific to that property.[3]

Figure I: Turbine Visibility Scoring Method



As well, a GIS is used to quantify the exact distance from each home to the nearest turbine. These two characteristics, view of and distance from turbines, are combined with a number of house and neighborhood characteristics. The combination of characteristics is then used in a hedonic regression model to investigate the marginal effect that the view of and distance from turbines has on home sale prices. The hedonic pricing model is well established in its usefulness in investigating the effects environmental characteristics have on home values (e.g. Dale *et al.*, 1999).

The report finds that the model significantly predicts home values (f-value 49-56, p-value 0.000, R^2 0.792), and on average that there are no measurable effects on property values based on the view of and distance from turbine characteristics (p-value 0.410 and

[3] The actual range of scores for the sample set used in this report is 0 to 43.

0.679 respectively). This finding holds both temporally and spatially. In other words, homes which sold in the year the project was announced and constructed (2001), and had a clear view of the turbines, are not affected uniquely (p- value 0.742); and no measurable effect is found for homes located within a mile of the facility (p-value 0.656)[4].

Additional tests are run to see if the township of Fenner in which the turbines are located, and to which payments are made by the facility owner, is accordingly perceived to have a positive value in the eyes of home purchasers as compared to the other townships. If the payment to the township is considered to be a distinct advantage by home purchasers, by adding needed dollars to the town budget, for example, it might be found the homes in Fenner are priced at a premium to other townships, all else being equal. In our analysis no measurable premium is found (p-value 0.689).

These results are important to policy makers and other stakeholders because they dispel the supposition that windfarm development has universally negative effects on home values. They support the results previously collected via surveys which find that a majority of residents in communities surrounding other wind facilities not only perceive the turbines to be "acceptable" (Warren *et al.*, 2005), but also "relatively nonexistent," by rarely (< 3.0%) spontaneously mentioning them in descriptions of their surroundings (Braunholtz and MORI-Scotland, 2003).

[4] A p-value is a measure of statistical significance, which can be reported in a number of ways in studies (e.g. margin of error, probability, or significance). They all report the same thing, the degree of confidence that the results were not reached by simple chance. As sample sizes grow, and variation among them becomes more predictable, more confidence can be had that "statistically significant" results from the analysis of the sample set can be transferred to the entire population. Conversely, if sample sizes are small, and variation among them is less predictable, results can not be validated against an average, and therefore present difficulties in being extrapolated to the population. In these cases results should be taken anecdotally or should not be transferred outside of the sample set.

With a paucity of research on the subject of effects of wind facilities on property values and a great deal of speculation regarding the actual effects, policy makers are forced to rely on poorly constructed studies and opinions. This report attempts to move the discussion toward the facts. Its research finds that in this community of 280 homes no effect is found. To the degree that these results are corroborated by further analytical research in other communities, the issue of negative impacts of windfarms on property values might take a lower priority in the decision making process. This report makes policy recommendations to stakeholders based on the results of this study and outlines possible areas for consideration which should be explored in future research.

The Effect of Wind Development on Local Property Values

R E P P

Renewable Energy Policy Project

Analytical Report | May 2003

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Chapter I. Project Overview

The Claim Against Wind Development

Wind energy is the fastest growing domestic energy resource. Between 1998 and 2002 installed capacity grew from 1848 MW to 4685 MW, a compound growth rate of 26 percent. Since wind energy is now broadly competitive with many traditional generation resources, there is wide expectation that the growth rate of the past five years will continue. (Source for statistics: www.awea.org).

As the pace of wind project development has increased, opponents have raised claims in the media and at siting hearings that wind development will lower the value of property within view of the turbines. This is a serious charge that deserves to be seriously examined.

No Existing Empirical Support

As a result of the expansion of capacity from 1998 to 2002, it is reasonable to expect any negative effect would be revealed in an analysis of how already existing projects have affected property values. A search for either European or United States studies on the effect of wind development on property values revealed that no systematic review has as yet been undertaken.

As noted above, the pace of development and siting hearings is likely to continue, which makes it important to do systematic research in order to establish whether there is any basis for the claims about harm to property values. (For recent press accounts of opposition claims see: The Charleston Gazette, WV, March 30, 2003; and Copley News Service. Ottawa, IL, April 11, 2003).

This REPP Analytical Report reviews data on property sales in the vicinity of wind projects and uses statistical analysis to determine whether and the extent to which the presence of a wind power project has had an influence on the prices at which properties have been sold. The hypothesis underlying this analysis is that if wind development can reasonably be claimed to hurt property values, then a careful review of the sales data should show a negative effect on property values within the viewshed of the projects.

A Serious Charge Seriously Examined

The first step in this analysis required assembling a database covering every wind development that came on-line after 1998 with 10 MW installed capacity or greater. (Note: For this Report we cut off projects that came on-line after 2001 because they would have insufficient data at this time to allow a reasonable analysis. These projects can be added in future Reports, however.) For the purposes of this analysis, the wind developments were considered to have a visual impact for the area within five miles of the turbines. The five mile threshold was selected because review of the literature and field experience suggests that although wind turbines may be visible beyond five miles, beyond this distance, they do not tend to be highly noticeable, and they have relatively little influence on the landscape's overall character and quality. For a time period covering roughly six years and straddling the on-line date of the projects, we gathered the records for all property sales for the view shed and for a community comparable to the view shed.

For all projects for which we could find sufficient data, we then conducted a statistical analysis to determine how property values changed over time in the view shed and in the comparable community. This database contained more than 25,000 records of property sales within the view shed and the selected comparable communities.

Three Case Examinations

REPP looked at price changes for each of the ten projects in three ways: Case 1 looked at the changes in the view shed and comparable community for the entire period of the study; Case 2 looked at how property values changed in the view shed before and after the project came on-line; and Case 3 looked at how property values changed in the view shed and comparable community after the project came on-line.

Case 1 looked first at how prices changed over the entire period of study for the view shed and comparable region. Where possible, we tried to collect data for three years preceding and three years following the on-line date of the project. For the ten projects analyzed, property values increased faster in the view shed in eight of the ten projects. In the two projects where the view shed values increased slower than for the comparable community, special circumstances make the results questionable. Kern County, California is a site that has had wind development since 1981. Because of the existence of the old wind machines, the site does not provide a look at how the new wind turbines will affect property values. For Fayette County, Pennsylvania the statistical explanation was very poor. For the view shed the statistical analysis could explain only 2 percent of the total change in prices.

Case 2 compared how prices changed in the view shed before and after the projects came on-line. For the ten projects analyzed, in nine of the ten cases the property values increased faster after the project came on line than they did before. The only project to have slower property value growth after the on-line date was Kewaunee County, Wisconsin. Since Case 2 looks only at the view shed, it is possible that external factors drove up prices faster after the on-line date and that analysis is therefore picking up a factor other than the wind development.

Finally, **Case 3** looked at how prices changed for both the view shed and the comparable region, but only for the period after the projects came on-line. Once again, for nine of the ten projects analyzed, the property values increased faster in the view shed than they did for the comparable community. The only project to see faster property value increases in the comparable community was Kern County, California. The same caution applied to Case 1 is necessary in interpreting these results.

If property values had been harmed by being within the view-shed of major wind developments, then we expected that to be shown in a majority of the projects analyzed. Instead, to the contrary, we found that for the great majority of projects the property values actually rose more quickly in the view shed than they did in the comparable community. Moreover, values increased faster in the view shed after the projects came on-line than they did before. Finally, after projects came on-line, values increased faster in the view shed than they did in the comparable community. In all, we analyzed ten projects in three cases; we looked at thirty individual analyses and found that in twenty-six of those, property values in the affected view shed performed better than the alternative.

This study is an empirical review of the changes in property values over time and does not attempt to present a model to explain all the influences on property values. The analysis we conducted was done solely to determine whether the existing data could be interpreted as supporting the claim that wind development harms property values. It would be desirable in future studies to expand the variables incorporated into the analysis and to refine the view shed in order to look at the relationship between property values and the precise distance from development. However, the limitations imposed by gathering data for a consistent analysis of all major developments done post-1998 made those refinements impossible for this study. The statistical analysis of all property sales in the view shed and the comparable community done for this Report provides no evidence that wind development has harmed property values within the view shed. The results from one of the three Cases analyzed are summarized in Table 1 and Figure 1 below.

Regression Analysis

REPP used standard simple statistical regression analyses to determine how property values changed over time in the view shed and the comparable community. In very general terms, a regression analysis "fits" a linear relationship, a line, to the available database. The calculated line will have a slope, which in our analysis is the monthly change in average price for the area and time period studied. Once we gathered the data and conducted the regression analysis, we compared the slope of the line for the view shed with the slope of the line for the comparable community (or for the view shed before and after the wind project came on-line).

Table 1: Summary of Statistical Model Results for Case 1

Project/On-Line Date	Monthly Average Price Change ($/month)	
	View Shed	Comparable
Riverside County, CA	$1,719.65	$814.17
Madison County, NY (Madison)	$576.22	$245.51
Carson County, TX	$620.47	$296.54
Kewaunee County, WI	$434.48	$118.18
Searsburg, VT	$536.41	$330.81
Madison County, NY (Fenner)	$368.47	$245.51
Somerset County, PA	$190.07	$100.06
Buena Vista County, IA	$401.86	$341.87
Kern County, CA	$492.38	$684.16
Fayette County, PA	$115.96	$479.20

While regression analysis gives the best fit for the data available, it is also important to consider how "good" (in a statistical sense) the fit of the line to the data is. The regression will predict values that can be compared to the actual or observed values. One way to measure how well the regression line fits the data calculates what percentage of the actual variation is explained by the predicted values. A high percentage number, over 70%, is generally a good fit. A low number, below 20%, means that very little of the actual variation is explained by the analysis. Because this initial study had to rely on a database constructed after the fact, lack of data points and high variation in the data that was gathered meant that the statistical fit was poor for several of the projects analyzed. If the calculated linear relationship does not give a good fit, then the results have to be looked at cautiously.

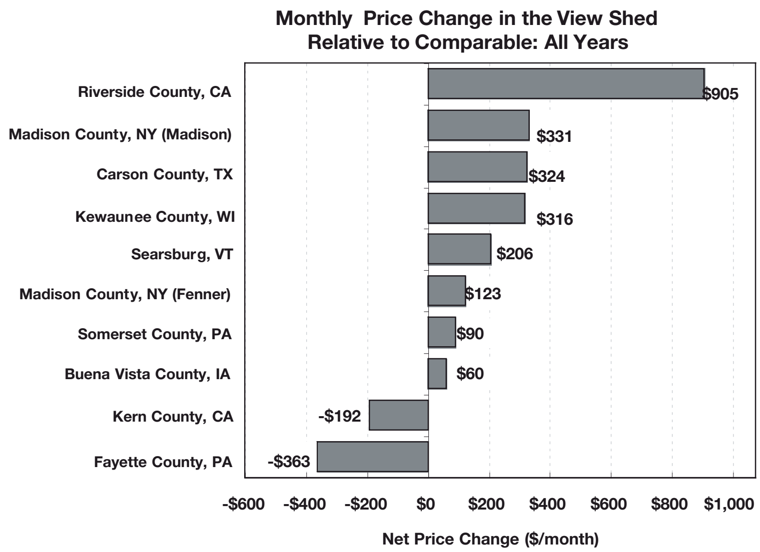

Figure 1: Monthly Price Change in the View Shed
Relative to Comparable: All Years

Case Result Details

Although there is some variation in the three Cases studied, the results point to the same conclusion: the statistical evidence does not support a contention that property values within the view shed of wind developments suffer or perform poorer than in a comparable region. For the great majority of projects in all three of the Cases studied, the property values in the view shed actually go up faster than values in the comparable region. Analytical results for all three cases are summarized in Table 2 below.

Table 2: Detailed Statistical Model Results

Location: Buena Vista County, IA
Project: Storm Lake I & II

Model	Dataset	Dates	Rate of Change ($/month)	Model Fit (R2)	Result
Case 1	View shed, all data Comparable, all data	Jan 96 - Oct 02 Jan 96 - Oct 02	$401.86 $341.87	0.67 0.72	The rate of change in average view shed sales price is 18% greater than the rate of change of the comparable over the study period.
Case 2	View shed, before View shed, after	Jan 96 - Apr 99 May 99 - Oct 02	$370.52 $631.12	0.51 0.53	The rate of change in average view shed sales price is 70% greater after the on-line date than the rate of change before the on-line date.
Case 3	View shed, after Comparable, after	May 99 - Oct 02 May 99 - Oct 02	$631.12 $234.84	0.53 0.23	The rate of change in average view shed sales price after the on-line date is 2.7 times greater than the rate of change of the comparable after the on-line date.

Location: Carson County, TX
Project: Llano Estacado

Model	Dataset	Dates	Rate of Change ($/ month)	Model Fit (R2)	Result
Case 1	View shed, all data	Jan 98 - Dec 02	$620.47	0.49	The rate of change in average view shed sales price is 2.1 times greater than the rate of change of the comparable over the study period.
	Comparable, all data	Jan 98 - Dec 02	$296.54	0.33	
Case 2	View shed, before	Jan 98 - Oct 01	$553.92	0.24	The rate of change in average view shed sales price after the on-line date is 3.4 times greater than the rate of change before the on-line date.
	View shed, after	Nov 01 - Dec 02	$1,879.76	0.83	
Case 3	View shed, after	Nov 01 - Dec 02	$1,879.76	0.83	The rate of change in average view shed sales price after the on-line date increased at 13.4 times the rate of decrease in the comparable after the on-line date.
	Comparable, after	Nov 01 - Dec 02	-$140.14	0.02	

Location: Fayette County, PA
Project: Mill Run

Model	Dataset	Dates	Rate of Change ($/ month)	Model Fit (R2)	Result
Case 1	View shed, all data	Dec 97-Dec 02	$115.96	0.02	The rate of change in average view shed sales price is 24% of the rate of change of the comparable over the study period.
	Comparable, all data	Dec 97-Dec 02	$479.20	0.24	
Case 2	View shed, before	Dec 97 - Nov 01	-$413.68	0.19	The rate of change in average view shed sales price after the on-line date increased at 3.8 times the rate of decrease before the on-line date.
	View shed, after	Oct 01-Dec 02	$1,562.79	0.32	
Case 3	View shed, after	Oct 01-Dec 02	$1,562.79	0.32	The rate of change in average view shed sales price after the on-line date is 13.5 times greater than the rate of change of the comparable after the on-line date.
	Comparable, after	Oct 01-Dec 02	$115.86	0.00	

Location: Kern County, CA
Project: Pacific Crest, Cameron Ridge, Oak Creek Phase II

Model	Dataset	Dates	Rate of Change ($/ month)	Model Fit (R2)	Result
Case 1	View shed, all data	Jan 96 - Dec 02	$492.38	0.72	The rate of change in average view shed sales price is 28% less than the rate of change of the comparable over the study period.
	Comparable, all data	Jan 96 - Dec 02	$684.16	0.74	
Case 2	View shed, before	Jan 96-Feb 99	$568.15	0.44	The rate of change in average view shed sales price is 38% greater after the on-line date than the rate of change before the on-line date.
	View shed, after	Mar 99 - Dec 02	$786.60	0.75	
Case 3	View shed, after	Mar 99 - Dec 02	$786.60	0.75	The rate of change in average view shed sales price after the on-line date is 29% less than the rate of change of the comparable after the on-line date.
	Comparable, after	Mar 99 - Dec 02	$1,115.10	0.95	

Location: Kewaunee County, WI
Project: Red River (Rosiere), Lincoln (Rosiere), Lincoln (Gregorville)

Model	Dataset	Dates	Rate of Change ($/month)	Model Fit (R2)	Result
Case 1	View shed, all data Comparable, all data	Jan 96 - Sep 02 Jan 96 - Sep 02	$434.48 $118.18	0.26 0.05	The rate of change in average view shed sales price is 3.7 times greater than the rate of change of the comparable over the study period.
Case 2	View shed, before View shed, after	Jan 96 - May 99 Jun 99 - Sep 02	-$238.67 $840.03	0.02 0.32	The increase in average view shed sales price after the on-line date is 3.5 times the decrease in view shed sales price before the on-line date.
Case 3	View shed, after Comparable, after	Jun 99 - Sep 02 Jun 99 - Sep 02	$840.03 -$630.10	0.32 0.37	The average view shed sales price after the on-line date increases 33% quicker than the comparable sales price decreases after the on-line date.

Location: Madison County, NY
Project: Madison

Model	Dataset	Dates	Rate of Change ($/month)	Model Fit (R2)	Result
Case 1	View shed, all data Comparable, all data	Jan 97 - Jan 03 Jan 97 - Jan 03	$576.22 $245.51	0.29 0.34	The rate of change in average view shed sales price is 2.3 times greater than the rate of change of the comparable over the study period.
Case 2	View shed, before View shed, after	Jan 97 - Aug 00 Sep 00 - Jan 03	$129.32 $1,332.24	0.01 0.28	The rate of change in average view shed sales price after the on-line date is 10.3 times greater than the rate of change before the on-line date.
Case 3	View shed, after Comparable, after	Sep 00 - Jan 03 Sep 00 - Jan 03	$1,332.24 -$418.71	0.28 0.39	The rate of change in average view shed sales price after the on-line date increased at 3.2 times the rate of decrease in the comparable after the on-line date.

Location: Madison County, NY
Project: Fenner

Model	Dataset	Dates	Rate of Change ($/month)	Model Fit (R2)	Result
Case 1	View shed, all data Comparable, all data	Jan 97 - Jan 03 Jan 97 - Jan 03	$368.47 $245.51	0.35 0.34	The rate of change in average view shed sales price is 50% greater than the rate of change of the comparable over the study period.
Case 2	View shed, before View shed, after	Jan 97 - Nov 01 Dec 01 - Jan 03	$587.95 -$418.98	0.50 0.04	The rate of decrease in average view shed sales price after the on-line date is 29% lower than the rate of sales price increase before the on-line date.
Case 3	View shed, after Comparable, after	Dec 01 - Jan 03 Dec 01 - Jan 03	-$418.98 -$663.38	0.04 0.63	The rate of decrease in average view shed sales price after the on-line date is 37% less than the rate of decrease of the comparable after the on-line date.

Location: Riverside County, CA
Project: Cabazon, Enron, Energy Unlimited, Mountain View Power Partners I & II, Westwind

Model	Dataset	Dates	Rate of Change ($/ month)	Model Fit (R2)	Result
Case 1	View shed, all data Comparable, all data	Jan 96 - Nov 02 Jan 96 - Nov 02	$1,719.65 $814.17	0.92 0.81	The rate of change in average view shed sales price is 2.1 times greater than the rate of change of the comparable over the study period.
Case 2	View shed, before View shed, after	Jan 96 - Apr 99 May 99 - Nov 02	$1,062.83 $1,978.88	0.68 0.81	The rate of change in average view shed sales price is 86% greater after the on-line date than the rate of change before the on-line date.
Case 3	View shed, after Comparable, after	May 99 - Nov 02 May 99 - Nov 02	$1,978.88 $1,212.14	0.81 0.74	The rate of change in average view shed sales price after the on-line date is 63% greater than the rate of change of the comparable after the on-line date.

Location: Bennington and Windham Counties, VT
Project: Searsburg

Model	Dataset	Dates	Rate of Change ($/ month)	Model Fit (R2)	Result
Case 1	View shed, all data Comparable, all data	Jan 94 - Oct 02 Jan 94 - Oct 02	$536.41 $330.81	0.70 0.45	The rate of change in average view shed sales price is 62% greater than the rate of change of the comparable over the study period.
Case 2	View shed, before View shed, after	Jan 94 - Jan 97 Feb 97 - Oct 02	-$301.52 $771.06	0.88 0.71	The rate of change in average view shed sales price after the on-line date increased at 2.6 times the rate of decrease before the on-line date.
Case 3	View shed, after Comparable, after	Feb 97 - Oct 02 Feb 97 - Oct 02	$771.06 $655.20	0.71 0.78	The rate of change in average view shed sales price after the on-line date is 18% greater than the rate of change of the comparable after the on-line date.

Location: Somerset County, PA
Project: Excelon, Green Mountain

Model	Dataset	Dates	Rate of Change ($/ month)	Model Fit (R2)	Result
Case 1	View shed, all data Comparable, all data	Jan 97 - Oct 02 Jan 97 - Oct 02	$190.07 $100.06	0.30 0.07	The rate of change in average view shed sales price is 90% greater than the rate of change of the comparable over the study period.
Case 2	View shed, before View shed, after	Jan 97 - Apr 00 May 00 - Oct 02	$277.99 $969.59	0.37 0.62	The rate of change in average view shed sales price after the on-line date is 3.5 times greater than the rate of change before the on-line date.
Case 3	View shed, after Comparable, after	May 00 - Oct 02 May 00 - Oct 02	$969.59 -$418.73	0.62 0.23	The rate of change in average view shed sales price after the on-line date increased at 2.3 times the rate of decrease in the comparable after the on-line date.

Each of the three Cases takes a different approach to evaluating the price changes in the view shed and comparable community. By finding consistent results in all three Cases, the different approaches help to address concerns that could be raised about individual approaches. The selection of the comparable community is based upon a combination of demographic statistics and the impressions of local assessors and is inherently subjective. It is possible that arguments about the legitimacy of the selection of the comparable could arise and be used to question the legitimacy of the basic conclusion. However, since Case 2 looks only at the view shed and since the results of the Case 2 analysis are completely consistent with the other Cases, the selection of the comparable community will not be crucial to the legitimacy of the overall conclusion. To take another example, Case 1 uses data from the entire time period, both before and after the on-line date. We anticipate possible criticisms of this Case as masking the "pure" effect of the development that would only occur after the project came on-line. However, Cases 2 and 3 look separately at the before and after time periods and produce results basically identical to the Case 1 results. Because all three Cases produce similar results, Cases 2 and 3 answer the concerns about Case 1.

The Database

The results of the analysis depend greatly upon the quality of the database that supports the analysis. The Report is based on a detailed empirical investigation into the effects of wind development on property values. The study first identified the 27 wind projects over 10 MW installed capacity that have come on-line since 1998. REPP chose the 1998 on-line date as a selection criterion for the database because it represented projects that used the new generation of wind machines that are both taller and quieter than earlier generations. (REPP did not consider projects that came on-line in 2002 or after since there would be too little data on property values after the on- line date to support an analysis. These projects can be added to the overall database and used for subsequent updates of this analysis, however.) REPP chose the 10 MW installed capacity as the other criterion because if the presence of wind turbines is having a negative affect it, should be more pronounced in projects with a large rather than small number of installations. In addition, we used the 10 MW cut-off to assure that the sample of projects did not include an over-weighting of projects using a small number of turbines.

Of the 27 projects that came on-line in 1998 or after and that were 10MW or larger installed capacity, for a variety of reasons, 17 had insufficient data to pursue any statistical analysis. For six of the 17 projects we acquired the data, but determined that there were too few sales to support a statistical analysis. For two of the remaining 11, state law prohibited release of property sales information. The remaining nine projects had a combination of factors such as low sales, no electronic data, and paper data available only in the office. (For a project-by-project explanation, see Chapter 2 of the Report.)

For each of the remaining ten projects, we assembled a database covering roughly a six-year period from 1996 to the present. For each of these projects we obtained individual records of all property sales in the "view shed" of the development for this six-year period. We also constructed a similar database for a "comparable community" that is a reasonably close community with similar demographic characteristics. For each of the projects, we selected the comparable community on the basis of the demographics of the community and after discussing the appropriateness of the community with local property assessors. As shown in Table 3 below, the database of view shed and comparable sales included more than 25,000 individual property sales. The initial included database of view shed and comparable sales included over 25,000 individual property sales. After review and culling, the final data set includes over 24,300 individual property sales, as shown in Table 3 below.

Table 3: Number of Property Sales Analyzed, by Project

Project/On-Line Date	Viewshed Sales	Comparable Sales	Total Sales
Searsburg, VT / 1997	2,788	552	3,340
Kern County, CA / 1999	745	2,122	2,867
Riverside County, CA / 1999	5,513	3,592	9,105
Buena Vista County, IA / 1999	1,557	1,656	3,213
Howard County, TX / 1999*	2,192	n/a	2,192
Kewaunee County, WI / 1999	329	295	624
Madison Co./Madison, NY/2000	219	591	810
Madison Co./Fenner, NY / 2000**	453	591	1,044
Somerset County, PA/2000	962	422	1,384
Fayette County, PA / 2001	39	50	89
Carson County, TX / 2001	45	224	269
TOTAL	14,842	9,504	24,346

*Howard County, TX comparable data not received at time of publication.

**Both wind projects in Madison County, NY, use the same comparable. Column totals adjusted to eliminate double counting.

Recommendations

The results of this analysis of property sales in the vicinity of the post-1998 projects suggest that there is no support for the claim that wind development will harm property values. The data represents the experience up to a point in time. The database will change as new projects come on-line and as more data becomes available for the sites already analyzed. In order to make the results obtained from this initial analysis as useful as possible to siting authorities and others interested in and involved with wind development, it will be important to maintain and update this database and to add newer projects as they come on-line.

Gathering data on property sales after the fact is difficult at best. We recommend that the database and analysis be maintained, expanded and updated on a regular basis. This would entail regularly updating property sales for the projects already analyzed and adding new projects when they cross a predetermined threshold, for example financial closing. In this way the results and conclusions of this analysis can be regularly and quickly updated.