

Different Shades of Green: A Case Study of Support for Wind Farms in the Rural Midwest

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Abstract

Benton County, in north-central Indiana, USA has successfully sited more than 500 turbines. To understand Benton County's acceptance of wind farms, a holistic case study was conducted that included a document review, a survey of local residents and interviews with key stakeholders. Survey questionnaires were sent to 750 residents asking questions about attitudes towards the wind farms, perceived benefits and impacts from the wind farms, environmental attitudes, and demographic information. Key stakeholders were also interviewed for a deeper understanding of the historical timeline and community acceptance of the wind farm development. While there is limited opposition to the turbines, on the whole the community presents a front of acceptance. Financial, rather than environmental, benefits are the main reason for the acceptance. Although significant in other case studies, transparency and participation do not play a large role in Benton County's acceptance. Most residents are not concerned with either visual impacts or noise from the wind turbines. More concrete benefits to the community, such as reduced energy bills for county residents, could help to extend acceptance even further within the community. Although there are concerns about the acceptance of wind farms and the impacts of those farms on local residents in both peer-reviewed literature and popular media, we found little evidence of those concerns in Benton County. Instead, we found Benton County to be a community largely accepting of wind farms.

Keywords: Wind farm; Social impact; Renewable energy; Midwestern landscape

Introduction

While there are often high levels of general public support for wind energy, in local communities throughout the United States and across the globe, there can be opposition to the installation of individual wind farms (Firestone and Kempton 2007; Loring 2007). In Benton County, Indiana, USA however, the local community has welcomed the development of several large wind farms. Through interviews with local stakeholders and a mail survey to county residents, this study aims to better understand the Benton County social landscape that fostered

such acceptance. It also provides insights into the perceived benefits and impacts of wind farms on the local community. This paper reviews general concepts of social acceptance of wind farms as well as some of the perceived impacts and benefits of wind farm development for local communities. The paper then discusses the successful development, high social acceptance, and perceived threats and impacts of wind farms within the social and geographical context of Benton County, Indiana, USA.

Despite a national electricity goal of 20% energy from wind by 2030 (U.S. DOE 2008), impacts of wind farms on local communities in the United States remain unclear. Research on social impacts and benefits of wind turbines is primarily concentrated outside the United States (including: Agterbosch et al. 2009; Breukers and Wolsink 2007; Halliday 1993; Munday et al. 2011; Wolsink 2007; and Woods 2003). Research on the social impacts of wind turbines and/or wind farms based in the United States has thus far primarily focused on either the West Coast (e.g. Thayer and Freeman 1987; Pasqualetti 2001; Abbot 2010) or the Cape Wind project off of Cape Cod, Massachusetts (e.g. Kempton 2005, Firestone and Kempton 2007). None of these studies has focused on the rural Midwest and the social impacts of its burgeoning wind energy investments on local communities. More recently, Mulvaney et al. (in press) examined general support for wind energy in the Midwest, with a focus on understanding the differences in acceptance across three counties in Indiana. This research builds upon that research with an in-depth case study of one of those counties, Benton County, and its successful development of wind farms.

Generally, there is considerable public support for wind energy (Wolsink 2007; Mulvaney et al. in press) and substantial environmental advantages from wind energy (U.S. DOE 2008), but many communities still do not support the installation of wind turbines or wind farms within their boundaries (Firestone and Kempton 2007; Phadke 2010; Mulvaney et al. in press). Wolsink (2007:2695) notes "Attitudes towards wind power are fundamentally different from attitudes towards wind farms." In order to meet the 20% goal by 2030 for the United States, attitudes towards wind farms and wind power will need to converge. This means that many local communities across the country will need to accept wind farms. State and national wind portfolios necessitate implementation of large wind farms that require localized decisions and investments (Breukers and Wolsink 2007). In particular, zoning changes and local planning are often required to allow wind turbines (Breukers and Wolsink 2007; Martin et al. 2010; and Wüstenhagen et al. 2007). This planning is where and when most of the conflicts occur (Breukers and Wolsink 2007).

It is also during the local planning stages that social acceptance becomes important (Breukers and Wolsink 2007). The concept of social acceptance of wind energy has been studied since the 1980s with a primary focus on European communities (Wüstenhagen et al. 2007). Wüstenhagen et al. (2007) outline three dimensions of acceptance: socio-political (general acceptance), community (acceptance by local stakeholders) and market acceptance (market adoption). More specifically, community acceptance is, "the specific acceptance of siting decisions and renewable energy projects by local stakeholders, particularly residents and local authorities." This research focuses on community acceptance in a specific community, Benton County, where wind farms were sited.

Wüstenhagen et al. (2007) outline several reasons why renewable energy development is unusual in concerns of social acceptance of energy development. The first difference is the matter of scale, in which renewable energy technologies are often smaller-scale, thus requiring more sites in more locations. The second difference is that renewable energy technologies are often more visible, so there may be increased relative visual impact (when thinking about impact in terms of impact/MWh of energy generated). The combination of increased number of sites required and increased relative visual impact means that there is an increased chance of individuals being impacted (visually or otherwise) by the siting of renewable technologies. The final difference outlined by Wüstenhagen et al. (2007) is that renewable energy developments still require important choices to be made between the long-term benefits of renewable energy developments and their short-term costs.

No discussion of the development of wind farms and their acceptance is complete without a discussion of nimbyism (Not In My Backyard) research and the conflicting results in the literature. For example, Bell et al., 2005 found that people support wind energy as long as they are not directly affected. Thayer and Freeman (1987) found that those most affected/familiar with the wind farm area were less likely to support it. In the cases studies investigated by Warren et al. (2005), they found similar results for one case (Black Hill), but found the inverse to be true in the other cases (Dun Law and southwest Ireland) with opposition decreasing as someone lives closer to wind farms. Wolsink (2007) shows that nimbyism cannot explain resistance or acceptance of wind farms and emphasis should be instead given to equity issues and fairness in the decision-making process. Wolsink (2006) emphasizes that opposition to wind farms is not necessarily a reflection of nimbyism. Most recent scholarship has shown that nimbyism rarely fully explains

the difference between social and local acceptance (see, for example, Warren et al. 2005; Wolsink 2007).

Concerns About Wind Farms

The reasons for resistance to wind farms are diverse and include concerns about health and safety, economic impacts (Munday et al. 2011), negative environmental impacts, noise and visual aesthetics (Abbott 2010). An exhaustive examination of local newspaper articles documenting wind farm development in Indiana led to a list of concerns within Indiana. One of these concerns is “wind turbine syndrome.” “Wind turbine syndrome” has not been substantiated in the academic literature, yet it is a concern of some residents because of information available online (for example, see Martin 2010). The online information defines “wind turbine syndrome” as “the constellation of symptoms experienced by many (not all) people who find themselves living near industrial wind turbines” (Martin 2010:2). Another health and safety concern is the potential for ice throw from the wind turbines. Given the appropriate weather conditions, ice may build up on turbine blades and this should be a consideration when developing turbines near public areas (Dalili et al. 2009).

Beyond health and safety concerns, community residents also note economic and environmental concerns from the development of wind farms. Economic concerns focus primarily on the depreciation of property value in areas located near wind farms (Hoen et al. 2011), the costs associated with removing wind turbines that are no longer functional, and differences in financial gain among community members from wind farm development. Environmental concerns are often centered on bird (Wolsink 2007) and bat mortality (Kempton et al. 2005).

While the other factors are important, and some communities may reject wind farms because of them, the factor considered most often by researchers and communities is visual aesthetic impacts. Concerns about aesthetics are largely centered on visual impacts both during the day and at night. A lot of the resistance is from those who do not regard wind turbines as “fitting” into the landscape because of a separation between nature and technology (Brittan 2001). However, Thayer and Freeman (1987:379) found that although most people regard the wind farm as “a highly conspicuous, man-made landscape,” there was a diversity of attitudes regarding the visual aesthetic of a wind farm in California. Those who lived closer to the wind farm or who were more familiar with the area were less likely to like the visual aesthetic than those who lived farther away or who were less familiar with the area. The preservation of the rural landscape is an important component of the visual aesthetic discussion and Woods (2003) documented a conflict in New Wales (UK) between the wider concern of reducing fuel dependency for climate change and the preservation of the rural landscape and local environment.

In addition to the health and safety and visual aesthetic concerns, some individuals are concerned about noise from wind turbines (Abbott 2010). Krohn and Damborg (1999) note that similar to visual aesthetics, noise is a concern to a number of individuals, but that the perception of the impact is not necessarily based on the actual noise level or number of turbines in a wind farm. Instead, in a review of several studies, specific experiences with wind turbines, gender, age and other characteristics influence beliefs about noise levels more than actual noise. Those who have no experience, males and middle-aged people believe that the noise from wind turbines is louder (Krohn and Damborg 1999).

Benefits of Wind Energy and Wind Farms

Proponents of wind energy often advocate the carbon emission benefits that are provided to the environment. For example, the American Wind Energy Association estimates that if we meet the 20% goal, it would reduce greenhouse gas emissions by avoiding more than 7,000 tons of CO₂. They also estimate that the electric sector would reduce water consumption by 4 trillion gallons (8% of total: U.S. DOE 2011b).

In addition to environmental benefits, financial benefits can play a large role in local acceptance (Agterbosch et al. 2009). Munday et al. (2011) discuss five types of financial benefits that can accrue to local communities: conventional economic benefits (rental income, contractors, etc.); flows of financial benefits to local communities (community ownership, community funds/sponsorships, cheaper electricity, etc.); contribution in kind to local assets and facilities (landscape enhancement, tourism facilities); provision of other local services (educational visits); and investment in the development process. While the financial benefits are usually considered

positive, some researchers have brought up important questions of equity in distribution of financial benefits (e.g. Agterbosch et al. 2009; Breukers and Wolsink 2007).

Site Profile- Benton County, Indiana

This case study focuses on Benton County, Indiana, a rural county of approximately 400 square miles that is home to Indiana's first wind farms. It follows the single case study design of Yin (2009) who posits that a case such as Benton County is worthy of study to further understand the contextual conditions that led to the real-life phenomenon (in this case, public acceptance of wind farms). Indiana is among the fastest-growing states for wind power in the United States and added more than 1,000 megawatts of wind energy capacity between 2009 and 2010 (AWEA 2011). At the time of this study (summer 2010), Indiana not among the more than 20 states with a renewable portfolio standard despite the growth of wind farm development. This means that at that time, Indiana's energy providers are not required to source any energy from renewable sources such as wind (U.S. DOE 2011a). The Clean Energy Portfolio Standard was subsequently passed in 2011 by the Indiana State legislature. It incentivizes goals of 10% clean energy by 2025 for public utility companies (DSIRE, 2012).

Major wind farm development in Benton County began in 2003 with the commissioning of the Tall Towers study that developed wind maps for the state and identified candidate sites for wind farms. This study found that the area near Benton County was a "commercially developable area" in terms of wind production (GEC 2005:28). A Benton County zoning ordinance was amended in 2006 to allow for construction of wind turbines within the county. Construction began in Benton County in 2007 and the first turbines were operating by 2008 (Benton County 2011a). As of early 2011, there were three large wind farm developers in Benton County with a combined total of more than 500 approved wind turbines and ongoing turbine construction (Benton County 2011b). See Figure 1 for a timeline of wind farm development in Benton County.

Fig. 1 Timeline of wind energy development in Benton County, Indiana, USA

Benton County is located in north-central Indiana and is greatly reflective of a rural, Midwestern, agricultural community (see Figure 2 for a map of the area). It is home to less than 9,000 residents living in 3,479 households. The county's visual landscape is primarily flat, open farmland dominated by row crop agriculture split between 132,000 acres of corn and 106,500 acres of soybeans (USDA 2010). Within the county, there are several small population centers and a county seat of less than 2,500 residents. Like many other rural American communities, its population is declining with a 6.0% loss from 2000 to 2010. The community is primarily white (95.9%) and 88.7% of residents graduated from high school. Only 13.8% of residents have a Bachelor's degree or higher. In 2010, 10% of the population was living below the poverty line with a median income of \$42,994 (U.S. Census 2011).

Fig. 2 Map of Benton County, Indiana, USA

Wind developers benefited from Benton County's proximity to the PJM regional transmission organization grid that provides energy used to meet the renewable portfolio standards of 13 states and the District of Columbia (Osten 2008). In Benton County, there are currently three wind companies with wind operations. These companies have made financial investments through direct payments to the county government and through lease payments made to individual landowners. The direct payments have gone towards various programs and projects within the county including payments to two different school corporations and some road improvements. Wind company payments have also gone for the restoration of damaged roads and drainage tiles that resulted from the installation of wind turbines in the area. As of June 2010, the county had received approximately \$9 million from the wind companies. The companies will also be contributing to the Benton County economy through taxes, although they have been given tax abatements. In 2010, they were estimated to pay \$670,000 in taxes, but that will gradually increase through 2018, when the abatements expire. Without abatements, the companies will be contributing more than \$3.7 million per year in taxes.

The payments landowners receive vary dependent upon which company they lease their land to and which phase of the project they sign on to. Landowners who lease land to the wind

companies receive yearly compensation for the land lease and also receive money based on the energy output of the turbines. Many of the landowners negotiated their lease compensation in groups. The unofficial range of income quoted to us by stakeholders is from \$5,000 to \$20,000 per turbine per year. For that sum, landowners lease one acre of land, but once constructed, the turbines generally take up less than 25 percent of that space. Because of logistical constraints due to setback restrictions and layout of the wind farms, the landowners typically own large farms. Farmers are allowed to continue with crop production around the footprint of a turbine once construction is complete. County residents who are not landowners with turbine leases do not receive any direct payments from the wind companies, although they may benefit indirectly from the payments given to the county government.

Methods

Our objective was to conduct a holistic case study of Benton County. To do this, we interviewed key players in the county's wind farm development and conducted a survey of county residents. We also reviewed information available through the county government regarding wind farm development and newspaper articles and went on a tour of the wind farms. An extension agent, a county commissioner, a regional wind industry representative and a major landowner were interviewed. The stakeholders provided historical information on the wind farm implementation in that area and a deeper understanding of the community's perspective of the wind farms. Questions were asked about any tax benefits, infrastructure costs and improvements stemming from wind power received or incurred by the county, perceptions of landowner satisfaction, health risks, aesthetics, and how well the ordinances are working. All conversations were recorded using a digital audio recorder and transcribed.

Additionally, a survey of the general population of Benton County was sent to 750 randomly-selected addresses purchased from Survey Sampling International utilizing a modified four-wave Dillman approach (Dillman et al. 2008). Respondents could answer the survey online or by returning a paper copy of the survey in the mail. After accounting for addresses that were returned as undeliverable because the addressee had moved, died, or was otherwise unable to take the survey, the response rate was 46%. A comparison of demographic information with available census information reveals some differences; respondents were more likely to be male (54.8% as compared to 49.5%), better educated (21.8% as compared with 13.8%) and own their houses (89.0% as compared with 77.7%) than the general population (U.S. Census 2011).

The survey included questions about social concerns and benefits of wind farms in Benton County. These questions were based upon a review of Indiana newspapers, discussions with local stakeholders and concerns and benefits discussed in the peer-reviewed literature. Additionally, the surveys asked standard demographic questions. Some open-ended questions and comments were also solicited. The responses to these were referenced on an individual basis in support of findings from other survey questions. Please see Tables 1-4 for a sample of the survey questions. Quantitative information was analyzed using SPSS software. Chi-square analyses were conducted to compare responses.

Results and Discussion

Several major themes emerged from the survey data including: 1) overwhelming community acceptance for the wind farms within the community, 2) financial benefits as the main motivation for that support rather than environmental benefits, 3) transparency of the implementation, 4) a perception of impacts from the wind farms, and 5) identification of some opposition among the support.

Social Acceptance of Wind Farms

General support for wind energy has received some attention in the literature, particularly in the European context, with many researchers (including Bell et al. 2005; Devine-Wright 2005;

and Wolsink 2000) referencing public support and Aitken (2010) questioning the support. In this research, we found high public acceptance of wind energy at the state level by Benton County residents. More than half (56%) of respondents believed that it was necessary to have a renewable energy standard for the state of Indiana (at the time of study, there was no renewable energy standard for Indiana) and 76% of respondents think that wind energy is a smart investment for Indiana.

Although our results show that significantly fewer residents would place a turbine on their property than declare that they are supportive of wind farms in their community ($p < 0.001$, $df = 1$, $n = 313$), this research finds that Benton County has, for the most part, high community acceptance of wind farms. The regional wind industry representative characterized Benton County's support as "...they're a very open and lenient community in terms of how they, of how they want development to occur. I mean they basically wanted development and they wanted it bad." He further elaborated that although wind energy in the area is not that exceptional, the local acceptance made it "probably the lowest hanging fruit" in Indiana. This is confirmed by the survey data with 89% of respondents supporting wind turbines in their community completely or with some reservations (see Figure 3).

Fig. 3 Wind energy support in Benton County, Indiana, USA

The widespread community support is different from Thayer and Freeman's (1987) research of the Altamont wind area in California that found widely mixed reactions to wind turbines among viewers. More specifically, they found that those more familiar with the area were less supportive of wind turbines in Altamont. In Benton County, 86% of respondents could see at least one wind turbine from their home, yet there was no difference in support between those who could see the turbines and those who could not ($p = 0.893$, $df = 1$, $n = 334$). This represents the acceptance of wind by a community who lives with its benefits and consequences.

So what makes Benton County the "lowest hanging fruit" and earliest adopter of wind turbines in Indiana? There are several possibilities for the early adoption. Wolsink (2007:2692) suggests that planning regimes need "institutional changes that create involvement and trust of actors at the actual implementation level." In Benton County, there is a long history of involvement by nearby Purdue University and its Benton County extension office. An extension agent located in Benton County was a central force in the wind farm development and has since assisted wind farms efforts in other counties in Indiana. In addition to extension agents, the extension office has several resources designed to assist local governments with the ordinance process (e.g. Martin et al. 2010; Purdue University Extension 2011).

The key informant interviews also revealed a local government that was extremely supportive of wind energy and provided the wind companies with initial tax abatements to incentivize development. Benton County's website now touts itself as "Home of Indiana's FIRST wind farm" (www.bentoncounty.in.gov) and features an image of a wind turbine in its heading. The webpage links to information about the wind farms and provides information on the companies who have invested in development of the wind farms.

While there is significant local acceptance of the wind turbines, there is room for furthering acceptance. Most respondents (84%) believed that the energy produced on the wind farms in Benton County should be used within Indiana. Only 12% thought that the energy was being sold in Indiana. Although explanation of exact energy distribution is complicated, and many of the residents probably are using the energy generated from the wind turbines, increasing the perception of local use of the energy could help to foster support. Local residents do not appear to support wind energy enough to pay extra for it as only 10% of the respondents said that they would pay extra for their energy to come from wind sources. In fact, the inverse may be true as several respondents commented that their energy bills should be lower because of their close proximity to the energy source.

Financial Benefits as Motivation

One of the strongest characteristics of Benton County that makes it "the lowest hanging fruit" is the local economy. As discussed in the site profile, the median household income of Benton County is \$42,994 which is less than the average household income in Indiana (\$47,697) and the rest of the United States (\$51,914; U.S. Census 2012). The stakeholders interviewed

emphasized the need for local job development in Benton County and the wind farms as one possibility for the community.

Hinshelwood (2001) points out that wind is a local resource of the community in which the turbines are built. Our research shows that financial benefits accrued from this local resource are a major reason for support of wind energy by the community in Benton County. Although the number of respondents who have wind turbines on their property was small (n=16), their responses seem to indicate that the successful implementation of wind energy was based on financial incentives to landowners and the community. These responses include only those of large landowners who have allowed industrial-scale development through leasing their land to wind companies. Most (12) cite financial reasons for allowing wind turbines on their property, with four of those respondents also identifying other reasons. Seven of the respondents cite environmental reasons, but only three of these respondents did not also cite financial reasons. There was one response each to the following reasons: 1) because wind turbines are attractive and 2) to be better informed. This is very different than the environmental merits of wind farms for climate change where many proponents focus their efforts (Wolsink 2007) although Pasqualetti (2001) predicted that support for wind power would increase as monetary benefits became more apparent. None of the stakeholders interviewed mentioned the environmental benefits of wind power. Instead, discussions with stakeholders revealed that financial reasons were the major motivation in the county. The reasons outlined by the key informants included tax income and financial benefits to those who lease land and money that has been gifted from the wind industry to the local community.

There were several mentions of the environment in the open-ended comments of the survey questionnaire, but even those sometimes included references to the financial considerations first. The following three comments are the only comments that focused primarily on the environment.

- 1) "...they are a start to being more aware that we have to stop abusing our world. Learn to rely on our own country's resources."
- 2) "I strongly support green energy and wish that the wind energy generated in Benton Co. was actually used in Indiana."
- 3) "The windmills are good clean energy!"

Of those who do not have wind turbines, most are logistically constrained from installing wind turbines either because their property is too small (67%) and/or because they were not asked to site a turbine on their property (33%). A small percentage of residents reported other reasons for not siting turbines on their property including 1) wind companies were not offering enough money (1%), 2) turbines would be bad for property value (3%), and 3) wind turbines are ugly (4%). Although not directly asked in the survey, several respondents also mentioned that they were expecting future projects to be installed on their property, but they did not currently have a turbine installed.

Discussion of the financial merits and shortcomings of wind energy was much more common. Although there were a considerable number of respondents who answered "Don't Know" about where the money received by the county is being spent, many residents mentioned the financial support that the companies have provided to the community. Pasqualetti (2001) points out that some landowners are supportive of wind turbines because of the realization that the same land can provide multiple incomes. In this case, some of the landowners (10%) already believe that their property value has increased since the wind farms were installed in 2008.

Earlier, we discussed Munday et al.'s (2011) outline for five different types of financial benefits for local communities. Of the five, Benton County has benefited from at least four (1. conventional economic benefits, 2. flows of financial benefits to local communities, 3. contribution in kind to local assets and facilities, and 4. provision of other local services). Conventional economic benefits have accrued to individual Benton County landowners through lease agreements. Payments have been made to the county government for use in the public school system and also for public events such as the Fourth of July fireworks (flows of financial benefits to local communities). A new extension office was built in part through funding from the wind companies (contributions in kind to local assets and facilities) and interested visitors can arrange a tour of the wind farm facilities through a collaboration of the wind companies and the local government (provision of other local services).

In addition to the direct financial benefits related to the wind farms, indirect flows of financial benefits to local communities were also recognized by respondents (see Table 1). In rural Wales (UK), Munday et al. (2011) found economic development in wind farm areas has been questionable and that increasing community ownership could improve income to local residents.

One suggestion that Munday et al. (2011) give for increasing financial benefits to local communities is increasing the possible employment opportunities through appropriate educational training. Only a few more than half of the respondents (55%) believed that employment increased in the local area after the wind farms. This is partially because of the highly technical skills required for many of the repairs and maintenance of the turbines. The closest community college to Benton County has already capitalized upon that need and recently graduated its first sustainable energy wind energy technology graduates. Increased employment of locals would also benefit the wind farms' perception in the community as several respondents, even those that support wind farms, emphasized their distaste for the workers that were not sensitive to the local community. For example, one resident who was supportive of the wind farms in Benton County expressed her discontent with wind farm workers as, "What I do not agree with is the lack of professionalism and courtesy shown by the windmill workers- they are not respectful of our communities, our lifestyles, our privacy, or our driving laws-the workers are the main reason for any unhappiness that I have about the windmills." That said, almost 60% of respondents know someone who is employed by the wind industry. In addition to new jobs, about half of the respondents believed that wind farms can help to keep farms financially viable.

Some researchers have brought up important questions of equity in distribution of financial benefits. While many people in a community with wind turbines will be able to see the turbines from their homes and others will be able to hear the turbines, only some receive direct financial benefits from leasing. In Benton County, we found overall high levels of support even from those who are not receiving direct financial benefits.

One significant caveat to the financial discussion is that it is too soon to tell what the long-term financial benefits will be. This research was conducted in the summer of 2010, just two years after the first turbines began operating in Benton County. The wind companies are currently operating under a system of tax abatement in which they are paying reduced tax rates that will increase incrementally through 2018 when they will be fully taxed. The financial implications of the increased taxes will be much more significant at that point.

Transparency and Participation

The discussions with stakeholders revealed a fairly transparent planning process involving public meetings and feedback and 18% of the respondents attended a public meeting about wind farms. Many other residents were probably also aware of the community meetings, although we neglected to ask questions about this on the survey questionnaire. There was no significant relationship between attendance at public meetings and support for wind turbines ($p=0.683$, $df=1$, $n=327$).

An important caveat to the transparency discussion is that intentionally or unintentionally, the wind industry has kept residents, at least those without turbines, from knowing much about many of the financial aspects of installation. Table 2 shows survey questions to which more than 55% of respondents answered "Don't Know." The table shows that many respondents were not familiar with how compensation worked for landowners nor were they aware of payment amounts. Respondents were also unfamiliar with logistical concepts such as whether or not the company is responsible for removing non-functioning turbines and whether or not local residents disturbed by the wind farms could be compensated. More than half of the respondents did not know whether or not the energy produced in Benton County is sold in Indiana but 84% of respondents believed that the energy should be used in Indiana. Finally, 55% of respondents said that they did not know how that local government's wind revenue was being used.

Perceived Impacts

In this survey, respondents were asked a series of questions about their perception of impacts from the wind farms on their lives. Many of the conflicts and concerns about wind turbines and wind farms boil down to a question of visual aesthetics. Benton County's perception of the visual impacts is diverse across the population, but more than 86% of the respondents can see wind turbines from their homes. Another aspect of Benton County that may make it unique from other areas considering wind farm development is the acceptance of the changes in landscape appearance. Only 36% of respondents believe that wind turbines detract from the aesthetic appeal

(visual appearance) of an area and 33% of respondents believe that wind turbines enhance the area (see Table 3 for responses to aesthetics questions).

Brittan (2001) noted that the wind turbines' "industrial" design clashes with the relatively undeveloped areas in which they are placed. Benton County is not densely populated and has minimal industrial development, except for large-scale agriculture. Thayer and Freeman (1987:394) found that those who "liked" the appearance of the wind turbines in Altamont were willing to "forgive the visual intrusion of the turbines on the existing landscape for the presumably higher goals of the project." There is a possibility that respondents saw the financial benefits for the community as one of those "higher goals."

Respondents were split in their beliefs about whether they do or do not believe that visual appearance is an important consideration for the siting of turbines. Respondents were more likely to report that they enjoy seeing the wind turbines during both the daytime and the nighttime than to respond that they do not. More respondents liked to see the wind turbines during the day than at night, and respondents were less likely to agree or strongly agree that they liked seeing the lights from the turbines at night ($p < 0.001$, $n = 339$). This is particularly important because there has been little discussion of the visual impacts of wind turbines at night in the literature, yet there is an impact. Each of the wind turbines has a red light affixed to the top of the stand for aviation safety. The red lights normally blink simultaneously and can be seen for miles, which disrupts the night sky. Far fewer respondents said that they could hear the wind turbines from their homes than can see the turbines (see Figure 4). Only a small percentage of respondents (7%) felt bothered by the noise from wind turbines in their homes.

Fig. 4 Percentages of respondents who can see and/or hear wind turbines from their homes

Negative effects on property values based on proximity to turbines are a concern of some communities in the development of wind farms. However, Hoen et al. (2011) found that a view of wind farm facilities and distance to the wind farm facilities do not have a statistically significant effect on sales prices. The interview subjects noted that there is low turnover of housing in Benton County, so it may be difficult to identify changes in property values in the short time span since the installation of the wind farms. Survey respondents do not appear to be highly concerned with the impacts on their property values and only 13% of residents believed that their property value has decreased or decreased significantly. Benton County's low population density could also be a factor in these beliefs; there are not that many houses in the county, and large parts of the county are zoned for agricultural use. On the other hand, respondents reported that being able to hear wind turbines would make them choose to not live someplace more often than if they could see the turbines ($p < 0.001$, $df = 1$, $n = 300$). There was also a group of respondents (12%) that would not be willing to live near wind turbines under any circumstances.

Respondents were generally less affected by non-aesthetic considerations (see Table 4). As discussed earlier, "wind turbine syndrome" is a concern discussed in some newspaper articles and websites (e.g. Martin 2010). The interviewed stakeholders dismissed it and only 2% of the population felt that the wind farms have affected their health or the health of a family member. Only 6% believed that turbines affect human health. Most respondents also do not believe that wind turbines are safety threats or that throwing ice is a problem although many respondents did not know if it was a problem or not. Respondents were generally supportive of the current residential setback distances. Fewer respondents perceive wind turbines as threatening the survival of birds and bats than respondents who believe that turbines are a threat and many respondents did not know if wind turbines threaten some species of birds and bats.

Opposition Among Support

While there is considerable support for wind farms in Benton County, that support is not without qualification and is not entirely ubiquitous. Public media reports for other counties in Indiana document a considerable amount of resistance to wind farms, even when the wind farms are successfully installed (e.g. Leininger 2010; Swiatek 2009). Descriptions of support in Indiana by both the media and the stakeholders interviewed describe Benton County very differently and often focus on support from community members (for example, see Robertson 2009). While 89% of respondents agreed or strongly agreed to support wind farms in their community, of the 4% of the respondents were fully unsupportive of the wind farms and 6% were unsupportive with some

reservations. One of the reasons that some of the residents mentioned in the open comments section was the fact that their energy bills were not reduced despite the fact that they had to deal with having the wind farms within their community.

Agriculture's impacts on the community result in a variety of attitudes towards the wind farms. The agricultural aspect of the community increased support by many of the respondents who saw the wind farms as a way to keep farms financially viable (50%). One of the stakeholders also emphasized the cultural value of wind turbines protecting the rural landscape. However, in the open-ended comments, agriculture's impact on the community showed in the lack of support for several reasons. One reason cited was the loss of productive farmland. Many residents of Benton County are proud of its soils and productivity and the loss of even a small footprint of land for each turbine can be seen as a waste of that rich land. Some comments even reflected the animosity towards farmers. One respondent said, "10% of Benton Co. are farmers and they run the other 90%. Wind energy has been good for them... I have had to deal with the road destruction for four years." Another reason for not supporting wind farms was seeing wind farms as "another way the farmers are getting money from the working tax payers." The open-ended question responses did not indicate any concerns about a lack of transparency in the development of wind farms.

Conclusions

Benton County's community has largely accepted their wind farms and their associated positive and negative impacts. This local acceptance has led to the successful development of large wind farms throughout the county. The motivation of most of the community is not based on environmental impacts, but is more often fostered by economic benefits. The process for wind farm establishment was easily implemented in Benton County because of the local government and residents' desire for industrial development. New economic potential convinced many residents to accept any apparent tradeoffs from wind farm development. The acceptance of wind farms by the local community has also motivated wind industry interest in the area.

Despite documented impacts of wind farms in the peer-reviewed literature and undocumented impacts discussed in newspapers and websites, Benton County residents are primarily not concerned about the visual aesthetic changes or noise from the wind turbines. Some residents even like seeing the wind turbines on their landscape, which could be the result of personal preference in visual aesthetics or a result of the "working land" perception of the Midwest. This study suggests that results from other areas such as the Western coast of the United States and Cape Cod are not helpful in explaining social acceptance of aesthetic changes in the very different Midwestern landscape. As wind farm development continues across the Midwestern landscape, there is a need to further explore acceptance in other Midwestern communities to understand if Benton County is an anomaly or is representative of a larger phenomenon.

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Fig. 1 Timeline of wind energy development in Benton County, Indiana, USA

Benton County, Indiana



Fig. 2 Map of Benton County, Indiana, USA

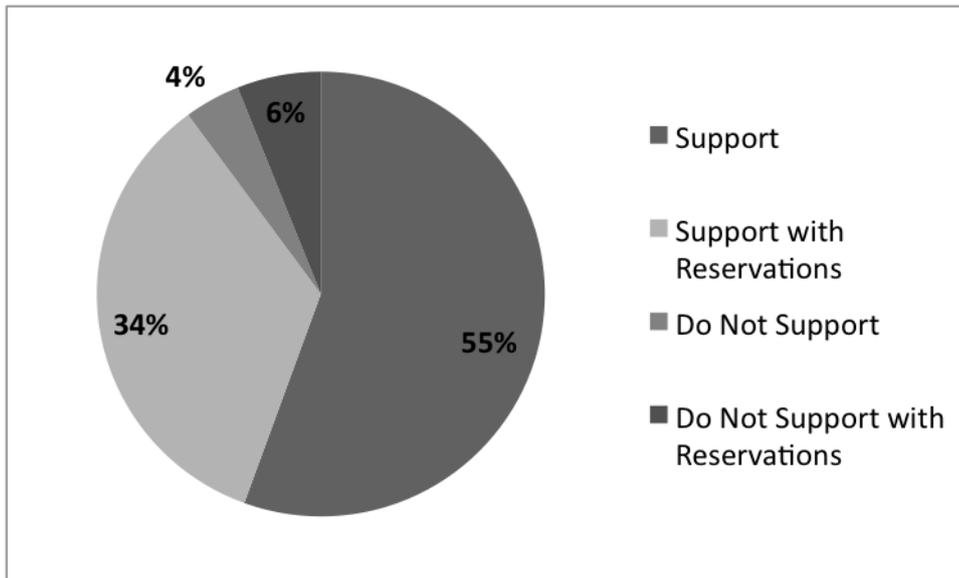


Fig. 3 Wind energy support in Benton County, Indiana, USA

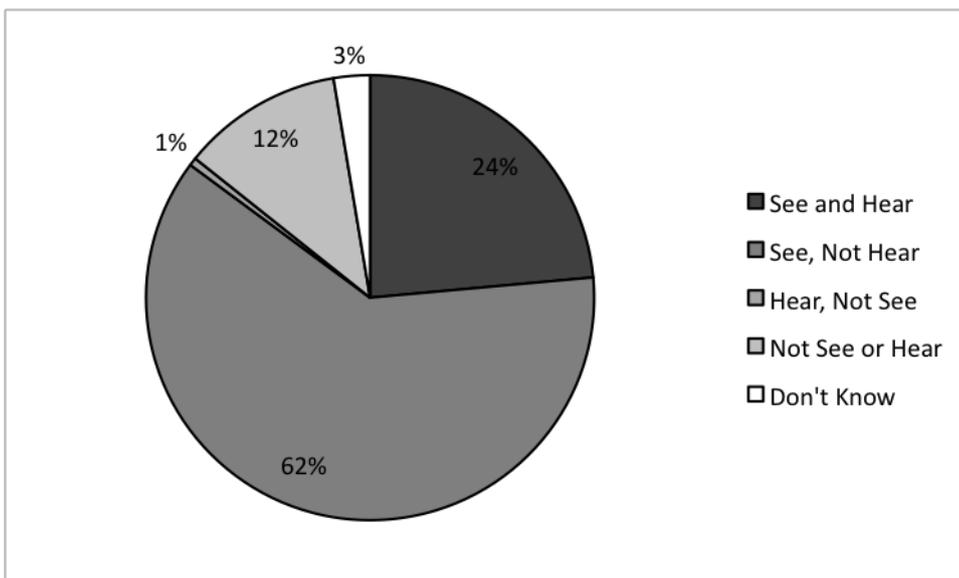


Fig. 4 Percentages of respondents who can see and/or hear wind turbines from their homes

Table 1. Questions and answers for indirect flows of financial benefits to the local community.

Question	Response	Percentage
Has the establishment of wind farms in your county increased the number of available jobs in the area?	Yes	55%
	No	13%
	Don't Know	31%
Do you know anyone who is employed by the wind farms?	Yes	51%
	No	18%
	Don't Know	32%
Do you believe that wind farms can help to keep farms financially viable?	Yes	51%
	No	18%

	Don't Know	32%
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Table 2. Survey questions with higher than 55% “Don’t Know” response rate

Survey Questions	Responses	Actual Status
For each wind turbine project, do all property owners receive the same amount of financial compensation per turbine per year?	68% Don't know 9% Yes 23% No	While only the companies know for sure, group negotiations normally ensure that landowners receive the same compensation per project per company
For each wind turbine project, do property owners receive additional compensation based on the productivity of the turbine?	69% Don't know 24% Yes 7% No	Yes, landowners receive extra compensation based on the productivity of their turbines
In Benton County, how much money do landowners receive for each wind turbine on their property yearly per lease contract?	62% Don't know 1% Less than \$3,000 25% \$3,000 to \$6,000 10% \$6,001 to \$9,000 2% \$9,001 to \$12,000 1% More than \$12,000	This information is sealed, although our stakeholders informed us that the total amount earned (accounting for increased productivity of some turbines) was between \$5,000 and \$20,000 per turbine per year
If landowners allow wind turbines on their property and the contract ends, does the wind company have to remove the turbine?	69% Don't know 23% Yes 9% No	The wind companies have to put money for the removal of the turbines in bonds with the county government.
Is the energy produced on wind farms in Benton County sold in Indiana?	58% Don't know 12% Yes 29% No	The energy is probably being used in Indiana, but is being sold in other states.
In your county, could people who are being disturbed by wind power generation receive financial compensation?	84% Don't know 2% Yes 14% No	Unclear. There is no formalized system for compensating those disturbed at this time.
How has the county government used the money collected from the wind farms? (Check all that apply)	55% Don't know 37% Schools 32% Roads 2% Sewage system <1% The county hasn't received any money 10% Other	Schools, roads

Table 3. Responses to questions regarding the visual aesthetics and noise of wind farms and property value questions.

Questions	Response	Percentage	
Visual Aesthetics	Wind turbines enhance the aesthetic appeal (visual appearance) of an area	Agree/Strongly Agree	33%
		Disagree/Strongly Disagree	54%
		Don't Know	13%
	Wind turbines detract from the aesthetic appeal (visual appearance) of an area	Agree/Strongly Agree	37%
		Disagree/Strongly Disagree	51%
		Don't Know	13%
	I enjoy seeing the wind turbines when I am in my home during the <i>day</i>	Agree/Strongly Agree	53%
		Disagree/Strongly Disagree	30%
		Don't Know	17%
	I enjoy seeing the lights from the wind turbines when I am in my home during the <i>night</i>	Agree/Strongly Agree	45%
		Disagree/Strongly Disagree	37%
		Don't Know	18%

Noise	Noise from the wind turbines bothers me when I am in my home	Agree/Strongly Agree	7%
		Disagree/Strongly Disagree	80%
		Don't Know	13%
Property Values and Choices	How do you think your property value has been affected by the establishment of wind farms in your county?	Value Increased Significantly	1%
		Value Increased	8%
		Value Remained the Same	67%
		Value Decreased	10%
		Value Decreased Significantly	3%
		Do not own property	11%
	Being able to <i>see</i> a wind turbine would make me choose not to live someplace	Agree/Strongly Agree	17%
		Disagree/Strongly Disagree	77%
		Don't Know	6%
	Being able to <i>hear</i> a wind turbine would make me choose not to live someplace	Agree/Strongly Agree	41%
		Disagree/Strongly Disagree	49%
		Don't Know	10%
	I would not live near a wind turbine under any circumstances	Agree/Strongly Agree	12%
		Disagree/Strongly Disagree	77%
		Don't Know	12%

Table 4. Non-aesthetic questions and responses.

Question	Response	Percentage
Wind turbines impact human health	Agree/Strongly Agree	6%
	Disagree/Strongly Disagree	55%
	Don't Know	40%
Has your health or the health of anyone in your immediate family been affected by the wind turbines in your area?	Yes	2%
	No	83%
	Don't Know	15%
Wind turbines are safety threats	Agree/Strongly Agree	11%
	Disagree/Strongly Disagree	60%
	Don't Know	29%
Wind turbines throwing ice is a threat to my community	Agree/Strongly Agree	8%
	Disagree/Strongly Disagree	45%
	Don't Know	47%
The current setbacks (distance from roads) for wind turbines in Benton County are appropriate	Agree/Strongly Agree	65%
	Disagree/Strongly Disagree	16%
	Don't Know	19%
Wind turbines threaten the survival of some birds and bats	Agree/Strongly Agree	23%
	Disagree/Strongly Disagree	49%
	Don't Know	28%