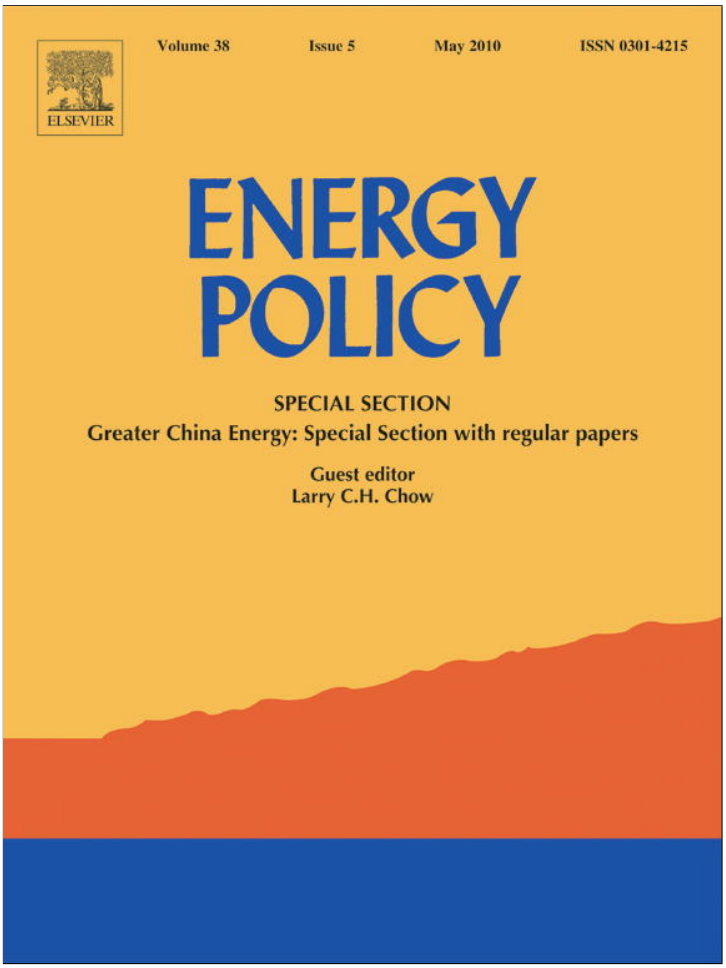

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Public attitudes of wind energy in Texas: Local communities in close proximity to wind farms and their effect on decision-making

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ABSTRACT

Wind energy is now recognized as an important energy resource throughout the world. Within the United States, the state of Texas currently has the largest wind energy capacity with 8797 total megawatts and an additional 660 MW under construction. With this rapid growth, it is important to achieve a better understanding of how wind energy is being perceived by the public.

This paper explores three research strands: (i) describing the environmental attitudes of a population in close proximity to a wind farm development, (ii) determining the influence that proximity has on wind energy attitudes, and (iii) determining if the Not-In-My-Backyard (Nimby) phenomenon is appropriate for explaining human perceptions of wind energy. A survey questionnaire was developed to explore perceptions of wind energy in the region as well as general attitudes about energy and the environment.

Results regarding general wind energy attitudes signify overall public support for wind energy. In addition, those living closest to the wind farm indicate the lowest levels of support, while those living farthest away indicate much stronger support. Findings support the view that the use of Nimby does not adequately explain the attitudes of local wind farm opposition. Alternative explanations and planning implications are discussed with a focus on public participation and education.

1. Introduction

The global response to climate change is underway. Many scientists agree that implementing more carbon-free sources of electricity is necessary for such a response to be successful (Schiermeier et al., 2008). The production of electricity has been recognized as something that needs innovation. Its generation comprises approximately 40% of humanity's total energy use bringing along with it man's biggest contribution of fossil fuel-based emissions (Schiermeier et al., 2008). Shifting world oil markets and the threat of human-induced climate change have made non-fossil fuel sources of energy increasingly more imperative (de Vries et al., 2007).

Wind power, in particular, is now recognized as an important energy resource throughout the world. In several scenarios for future electricity production, wind power is shown to be able to produce electricity at lower costs than that from biomass and solar-pv sources approaching 2050 (de Vries et al., 2007). Wind energy has also been recognized as one of the most environmentally benign sources of electricity generation (Brittan Jr., 2002; Warren et al., 2005). Wind energy development has increased substantially over the last decade. This growth has resulted from concern over climate change, energy security, the rising cost of fossil fuels, and economic investments, among others (Bolinger and Wiser, 2009). The United States has 31,109 megawatts (MW) of installed capacity and approximately 5567 MW under construction (AWEA, 2009). This makes the US the world leader in largest amount of wind energy capacity installed of any country. In the US, planned capacity for wind energy exceeds that for coal and gas operations combined (Schiermeier et al., 2008). With such rapid growth, it is important to develop a better understanding of how wind energy is being perceived by the general public.

Wind energy studies have explored a variety of topics such as landscape aesthetics (Johansson and Laike, 2007; Pasqualetti, 2000, 2001; Thayer and Freeman, 1987), impacts on bird and bat populations (Arnett et al., 2008; Kunz et al., 2007), and economic analyses (Bolinger and Wiser, 2009; de Vries et al., 2007; Sims et al., 2003), among others. In addition to these topics of study, a sizable literature has developed on the public perception of wind energy. Thayer and Freeman (1987, p. 383) were among some of the first researchers who "began to suspect that public reaction to wind developments was far more complex than previous literature or circumstance suggested". The authors argued that it was vital that more research be conducted exploring the public attitudes of wind energy landscapes. Along with several others who would soon agree, they had foreseen wind farms becoming

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"one of the most distinct energy landscapes in the world" (Pasqualetti, 2001, p. 692).

The present study focuses on public perceptions of wind energy and is divided into two main sections. The first is a review of the current wind energy debate and various studies that have explored public attitudes towards wind energy. Where wind energy has emerged as a viable technology, so have controversies regarding public attitudes towards wind energy. Studies that attempt to characterize and explain these public responses to wind farm developments are briefly discussed. The second section of the paper presents the results of a survey questionnaire exploring public perceptions of wind energy in Texas. The results are then used to further the discussion of public perceptions of wind energy. Implications for future wind energy developments in Texas are also explored, with a focus on public involvement and education.

1.1. The wind energy debate

Arguments over land-use and conservation have usually pinned environmentalists on one side of the argument (Warren et al., 2005). However, the wind energy debate has been characterized by many as a unique environmental struggle. On one side of the argument are wind energy advocates who often refer to environmental benefits (e.g. no emissions, low water usage) as wind energy's most important features. They argue that the advantages of wind energy far outweigh its disadvantages. Any impacts on the visual landscape are compromised by the fact that wind power is the most environmentally benign source of electricity available (Brittan Jr., 2002). On the other side of the argument are individuals who oppose wind energy projects because of local externalities such as visual landscape impact and noise (Groothuis et al., 2008). These individuals find that the technology used to produce electricity (i.e. wind turbines) is simply too visible and disruptive (Righter, 2002).

This two-sided argument, where both sides claim to be pro-environment, is referred to as a 'green vs. green' debate in several studies (Groothuis et al., 2008; Kahn, 2000; Warren et al., 2005). Both sides of the argument have legitimate claims regarding wind energy and the environment. It has thus become vital to examine both sides of this argument as well as those who find themselves in between. Pasqualetti et al. (2002, p. 3) argue that "it is a question of how to best balance the nature we want with the energy we need". There is great need to explore the winners and losers of local wind energy developments, the role of ownership, the size of wind farms, and how all of these characteristics influence public attitudes (Pasqualetti, 2001). Indeed, these local attitudes have a strong influence on the acceptance of wind energy technology which determines, at least partially, the level of market penetration (Dimitropoulos and Kontoleon, 2009). Again, this 'green vs. green' debate requires us to examine both attitudes related directly to wind energy as well as general attitudes regarding energy and the environment.

There is a wide variety of studies examining the social acceptance of wind energy. Studies examining public attitudes towards wind energy come from many areas of the world including Australia (Gross, 2007), Greece (Dimitropoulos and Kontoleon, 2009; Kaldellis, 2005), the Netherlands (Wolsink, 1994), Scotland (Braunholtz, 2003; Warren et al., 2005), Sweden (Ek, 2005; Johansson and Laike, 2007), the United Kingdom (Bell et al., 2005; Eltham et al., 2008), and the United States (Groothuis et al., 2008; Pasqualetti, 2001). A number of these studies explore the social acceptance of renewable energy in general (Wüstenhagen et al., 2007) while others target wind energy specifically (Breukers and Wolsink, 2007; Krohn and Damborg, 1999). Some of the most notable studies explore topics including community involvement (Gross, 2007; Higgs et al., 2008), attitudes of electricity consumers (Ek, 2005; Groothuis et al., 2008), and planning/policy implications (Devine-Wright, 2005b; Sovacool, 2009; Toke, 2005). Devine-Wright (2005a) and van der Horst (2007) both provide an excellent review of topics that have been studied and identify several key research questions. A selection of these includes the following:

(1) What physical and environmental characteristics are associated with wind farm attitudes?
(2) What role does proximity and location have in influencing public attitudes?
(3) How do public perceptions towards wind farms change over time?
(4) Does the NIMBY (Not-In-My-Backyard) phenomenon appropriately explain wind farm opposition?

The most common technique used to answer these questions in studies is the public survey, used to explore a wide variety of attitudes in the wind energy debate. In conducting these public surveys, a large assortment of methods has been undertaken. These include postal surveys, telephone surveys, door-to-door questionnaires, semi-structured interviews, and several others. Overall, there is a growth of literature covering a diverse collection of topics and methodologies in the wind energy debate.

Results from previous studies indicate notable findings. In a summary of available surveys, Krohn and Damborg (1999) conclude that public attitudes towards wind energy in general are very high. This acceptance and continual development of wind energy is most likely due to it being both one of the least costly of available renewable energies and one of the most environmentally benign sources of electricity production (Warren et al., 2005). Furthermore, in many countries, wind energy is simply too abundant and too valuable to overlook (Righter, 2002). In the US, wind energy growth is primarily a result of federal tax incentives, new state-level legislation, concern over climate change, and uncertainty regarding the future cost of electricity generated from fossil fuel sources (Bolinger and Wiser, 2009). Additionally, support for wind energy development seems to be higher than that for conventional fossil fuel and nuclear energy development (Devine-Wright, 2005a). Nonetheless, wind energy development seems to remain controversial in many locations for a number of reasons.

While the acceptance of wind energy in general remains high, specific wind developments are often opposed. One of the most commonly referred to explanations for this gap in attitudes has been the NIMBY (Not-In-My-Backyard) phenomenon. While this acronym is commonly referred to in a number of fields of study, the theory itself is most often never explained. Wolsink (1994) was one of the first authors to argue that this lack of definitions was the most important problem in assessing the NIMBY theory, indicating that most authors using the term fail to fully describe its meaning. Since then, several studies have presented definitions of the supposed NIMBY phenomenon in numerous ways. Some examples of these definitions are presented here:

- The basic theory is that people support wind energy on an abstract level but object to specific local projects because of the expected consequences concerning primary noise and visual impact (Krohn and Damborg, 1999, p. 957).
- …the phenomenon that certain services are *in principle* considered as beneficial by the majority of the population, but that proposed facilities to provide these services are *in practice* often strongly opposed by local residents (van der Horst, 2007, p. 2705).

- The idea of NIMBY is rather simplistic as it suggests that people have positive attitudes towards something (wind power) until they are actually confronted with it, and that they then oppose it for selfish reasons (Wolsink, 2007, p. 1199).
- NIMBY is used to describe opponents of new developments who recognise that a facility is needed but are opposed to its siting within their locality (Burningham, 2000, p. 56)
- More formally, NIMBY refers to the protectionist attitudes of and oppositional tactics adopted by community groups facing an unwelcome development in their neighborhood (Dear, 1992, p. 288)

Definitions of NIMBY (when actually presented) are thus varied and not always clear. The use of NIMBY in the explanation of public perceptions of wind energy has been highly criticized in recent studies (Bell et al., 2005; van der Horst, 2007; Wolsink, 2006). Bell et al. (2005, p. 460) argue that "the NIMBY concept has rightly been criticised on the grounds that it fails to reflect the complexity of human motives and their interaction with social and political institutions". Have past studies been too quick in explaining public attitudes towards wind energy as a case of NIMBYism? Many studies have argued yes. Indeed, the explanatory validity of NIMBYism to account for the gap observed in public attitudes towards wind energy has been rebutted in several studies (Braunholtz, 2003; Devine-Wright, 2005a; Ek, 2005; Eltham et al., 2008; Wolsink, 2007). Devine-Wright (2009) provides one of the most thorough reviews of literature on the NIMBY concept. Of particular interest for our study is an individual's attitude toward having a wind farm in their 'backyard'. This aspect of NIMBY, which gives it its name, holds assumptions that are commonly overlooked as Wolsink (2007) suggests. The study of backyard and proximity to a wind farm are quite vital. Several past studies explore this aspect of NIMBY in determining whether the term correctly explains wind farm perceptions in various locations as well as whether the term is politically appropriate. The present study aims to extend this research to the United States and Texas.

1.2. The proximity hypothesis in wind farm attitudes

One of the central components of NIMBYism is the notion of 'backyard'. The term 'backyard' is frequently used in NIMBY discussions, most often expressed to imply some geographic area for selfish behavior (van der Horst, 2007). Geographic proximity is the one universal factor to all NIMBY-related controversies (Dear, 1992). Under the NIMBY explanation, an individual is willing to support wind energy as long as it is not located in his or her 'backyard'. One would tend to expect that the closer an individual is in proximity to a wind farm the greater their opposition or negative attitudes towards it would be. Dear (1992, p. 291) argues that "the closer residents are to an unwanted facility, the more likely they are to oppose it". This explanation of attitudes has commonly been referred to as the 'proximity hypothesis'.

Several studies (Devine-Wright, 2005a; van der Horst, 2007; Warren et al., 2005) explore the proximity hypothesis and a number of others (Braunholtz, 2003; Johansson and Laike, 2007; McGowan et al., 2005) provide results on the subject. Of particular interest to the proximity hypothesis is how the study area is defined. Braunholtz (2003) and Warren et al. (2005) were the first studies to employ using concentric circles to classify zones surrounding the associated wind farm of study. Warren et al. (2005) provides one of the best examples (and most extensive studies) of explaining this technique and incorporating it into traditional survey methodology. The method is primarily used to separate respondents' attitudes at aggregate distances from the wind farm. Both Braunholtz (2003) and Warren et al. (2005) employ the methodology using aggregate distance bands of 0–5 kilometers (km), 5–10, and 10–20 km. Used as a way to measure for the proximity hypothesis, the method has provided important results. The present study incorporates this methodology but identifies the entire wind farm as a single polygon with concentric buffer distances extending beyond its perimeter. This provides a better representation of the shape of the wind farm, especially when dealing with facilities with large numbers of turbines and varying wind farm configurations.

In a recent study (Johansson and Laike, 2007), results showed that there were no differences in intention to oppose additional turbines between three groups living at varying proximities from the associated wind farm. These results contest, along with others (Braunholtz, 2003; Warren et al., 2005), the traditional proximity hypothesis. Those living closest to wind farms do not seem to be showing the most negative attitudes towards them. In fact, some studies have shown the exact opposite. Several studies (Braunholtz, 2003; Krohn and Damborg, 1999; Warren et al., 2005) show results indicating that those living closest to wind farms hold the most favorable attitudes towards them. Warren et al. (2005, p. 866) defines this reverse proximity hypothesis as "an 'inverse NIMBY' syndrome, whereby those with windfarms in their 'backyard' are amongst the most supportive of the technology". Results from Warren et al. (2005) provide evidence that support a positive relationship between proximity and degree of acceptance of the wind farm. Thus, Warren et al. (2005) also argue that the NIMBY phenomenon does not fully explain variations in public attitudes about wind farms.

The proximity of a wind farm and its wind turbines has a strong influence on public attitudes "but the nature, strength and spatial scale of this effect may vary according to local context and 'value' of the land" (van der Horst, 2007, p. 2705). The aim of this study is not to contest this view, but rather further explore it. More research regarding the proximity hypothesis is needed in the United States as it is becoming one of the world's leaders in wind energy. Historically, much of the public perception literature has come out of Europe (e.g. Braunholtz, 2003; Johansson and Laike, 2007; Warren et al., 2005). As the existence of some form of 'inverse NIMBY' continues to emerge from studies, it is important to further explore this classification (and possibly rename it as well) where applicable. More studies are needed to see if similar results carry over to other locations of wind energy across the world.

1.3. Research objectives

To date, no noteworthy research on public attitudes of wind energy has been conducted in Texas. Such work is needed for several reasons. Texas now has a total existing wind energy capacity of 8797 MW and an additional 660 MW under construction (AWEA, 2009). This capacity makes Texas the leader in providing wind energy in the United States. If it were a country, Texas would rank sixth internationally trailing only Germany, Spain, China, India, and the remaining states in the US. The potential capacity of wind energy in Texas is also vast, estimated to be approximately 136,100 MW (AWEA, 2009). Texas also houses many of the world's biggest wind farms. The world's second largest wind farm, Horse Hollow Wind Energy Center, is comprised of 421 turbines totaling a capacity of 735.5 MW (AWEA, 2008). Research involving larger wind farms is needed when investigating public attitudes (Eltham et al., 2008). Few studies have examined the impacts of these larger wind farms. More information on how wind energy is being perceived in Texas

needs to be acquired as rapid growth in wind farm development is being observed.

The present study aims to explore the following primary research questions: (1) What are the wind energy and environmental attitudes of a population that is in proximity to a wind farm development?, (2) Does NIMBYism appropriately explain wind energy attitudes in Texas?, and (3) What influence does proximity have on public perceptions of wind energy? These questions are then used to further discuss how and where results fit into the ongoing debate of studies exploring wind farm attitudes.

2. Methods

2.1. Study area

The Wolf Ridge wind farm facility is located in Cooke County, Texas (Fig. 1) and was commissioned in October 2008. The characteristics of the wind farm are given in Table 1. The wind farm was chosen because it has a reasonably sized surrounding population, is relatively isolated from any other wind farm facilities, and its size. Although average in size when compared to other wind farms in Texas, at 75 turbines the wind farm is reasonably larger than those wind farms examined in other studies on public attitudes, especially those examined in Europe.

2.2. Survey methodology

A survey questionnaire was developed to assess perceptions of wind energy as well as general attitudes about energy and the environment in the local community (copies available from the authors). The survey was developed primarily from results of a pilot study in which focus groups were conducted to ascertain key issues related to wind energy developments (Slattery et al., 2008). In addition, several survey questions were derived from survey

Table 1
Wolf Ridge wind farm characteristics.
Source: (AWEA, 2008)

Date commissioned	Capacity (MW)	Number of turbines	Height (m)
October 2008	112.5	75	80

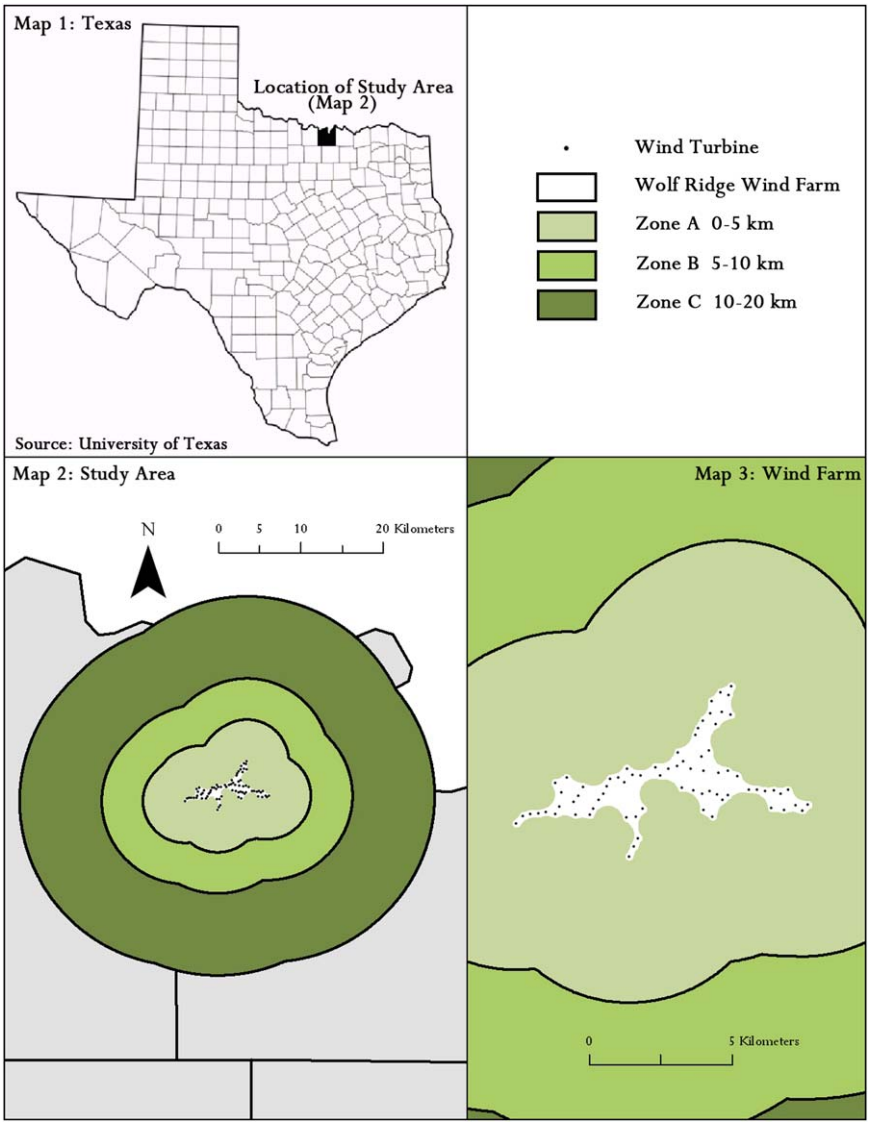

Fig. 1. Location of study area. Wolf Ridge wind farm located in Cooke County, TX. Survey questionnaires were mailed to households within the shaded study area. Polygon zones differentiate aggregate distances from wind farm.

questionnaires used in previous studies (e.g. Soderholm et al., 2007; Warren et al., 2005). The same format of questions was used from the pilot study; however, the number of questions was reduced in an attempt to increase response rate. A mix of closed, open, and supplementary questions was used as suggested by Warren et al. (2005). Questions were developed to identify the physical and environmental characteristics that are linked to both negative and positive perceptions of wind farms. In addition, basic demographic and socio-economic-based questions were also asked in order to develop a profile of the typical yes-sayer and nay-sayer involving wind energy and its associated environmental attitudes. For this study, a postal survey was chosen over other methods such as personal interviews and the door-to-door questionnaire mainly because it was the most cost efficient. Although there are several benefits and disadvantages to using postal surveys, the method often gives opportunity for respondents to read over questions more thoroughly and contemplate questions further (Ek, 2005). Surveys are best suited to divulge emotional responses and attitudes held by individuals surrounding the project (Devine-Wright, 2009). This method also was best suited to be used with the geospatial database that was created (see below). It allowed survey responses to be separated into various geographic zones in order to examine the effect proximity had on public attitudes. The survey was mailed in February 2009.

2.3. Geographic methodology

Research was also undertaken to determine what effect proximity and location had on wind energy attitudes. The study area was defined by households living within a 20 km radius of the wind farm. A geospatial database was developed and used to map the location of the wind turbines using Geographic Information Systems (GIS), within ArcMap (ESRI Inc.). Within the study area, a wind farm boundary was defined by using a distance of 100 m from each turbine located on the perimeter of the wind farm. Thereafter, polygon regions were generated extending around the wind farm boundary using the following stratification: 0–5, 5–10, and 10–20 km. The original 100 m wind farm boundary buffer zone was used to define these zones (A, B, and C; see Fig. 1).

A database of addresses was obtained for households living within the 20 km wind farm 'backyard' study area. Addresses were then geocoded to associate their location with geographic coordinates. This technique was used to identify how many households were located in each wind farm zone. In addition, this method was used to help analyze results within these different zones and any corresponding differences. Within the study area, participants were selected according to the random sampling method. A random sample of 1500 households was generated from the addresses located within the study area. During this phase, the relative population densities of each wind farm zone were retained to limit any disproportionate sampling (Table 2). Accordingly, surveys were mailed out to the consequent number of households located within each zone.

Table 2
Survey statistics (n=200).

Zone	Study area households	% of study area household population (%)	Surveys mailed
0–5 km	127	6	90
5–10 km	891	42	630
10–20 km	1118	52	780
All	2136	100	1500
Zone	Survey responses (n)	#No. vacant or undeliverable households	Response rate (%)[a]
0–5 km	8	1	9.0
5–10 km	106	46	18.2
10–20 km	86	54	11.8
All	200	101	14.3

[a] Response rate calculation does not include surveys returned from vacant or undeliverable households.

3. Results

The following section presents the results from a survey questionnaire regarding public attitudes towards wind energy in Texas. Results are categorized into three primary themes: environmental attitudes, wind energy attitudes, and findings relevant to proximity. Of the 1500 surveys mailed, 200 completed surveys were returned. Additional details regarding the mailing of the survey can be found in Table 2. The resulting data from completed surveys is summarized in the following sections.

A relatively even distribution of males (54.2%) and females (45.8%) participated in the survey questionnaire. The majority of respondents (85.5%) were 45 years of age or older. The sample does not include individuals under the age of 18. Aside from excluding this age group, the sample is largely representative of people living locally (among age and sex). Most respondents had at least some level of knowledge regarding renewable energy (88.6%) and wind energy (93.7%). A much smaller proportion of respondents (30.4%) indicated that they attended at least one public meeting regarding wind energy prior to the wind farm's construction. In addition, during the time of the survey a total of 5 respondents (2.6%) indicated that they had wind turbines located on their property.

3.1. Environmental attitudes

Several questions regarding attitudes towards key environmental issues were included in the survey questionnaire (Fig. 2). General attitudes regarding the protection of the environment were largely positive. Protection of the environment was very important for most respondents (93.4%) as was the conservation of water (95.4%). When asked, on the other hand, about level of concern regarding global climate change, there was a significant decrease in those expressing concern (58.4%). This corresponds with a small percentage of respondents (33.8%), who indicated that the use of fossil fuels for generating electricity is detrimental to the environment. Interestingly, women were more likely to be concerned about climate change (68.6%) than men (51.0%). Most respondents believe that the US should use more renewable energy (84.2%) and wind energy (70.2%) to fulfill energy demands. On the other hand, a much smaller proportion of respondents (34.5%) would be willing to support renewable energy if it cost more that energy derived from fossil fuel sources. Attitudes regarding climate change were also compared to general attitudes towards wind energy (Table 3). Accordingly, of respondents who are concerned about global climate change, the majority of respondents (63.3%) indicated positive support for wind energy. Of those who are not concerned about global climate change, a smaller amount of respondents (45.9%) indicated positive support for wind energy. Of the number of respondents who agree that fossil fuels are detrimental to the environment, two-thirds (66.6%) indicated support for wind energy. Of those who disagreed that fossil fuels are detrimental to the environment, a smaller amount (52.1%) indicated support for wind energy. A similar relationship between these topics is also found regarding negative attitudes towards wind energy (Table 3).

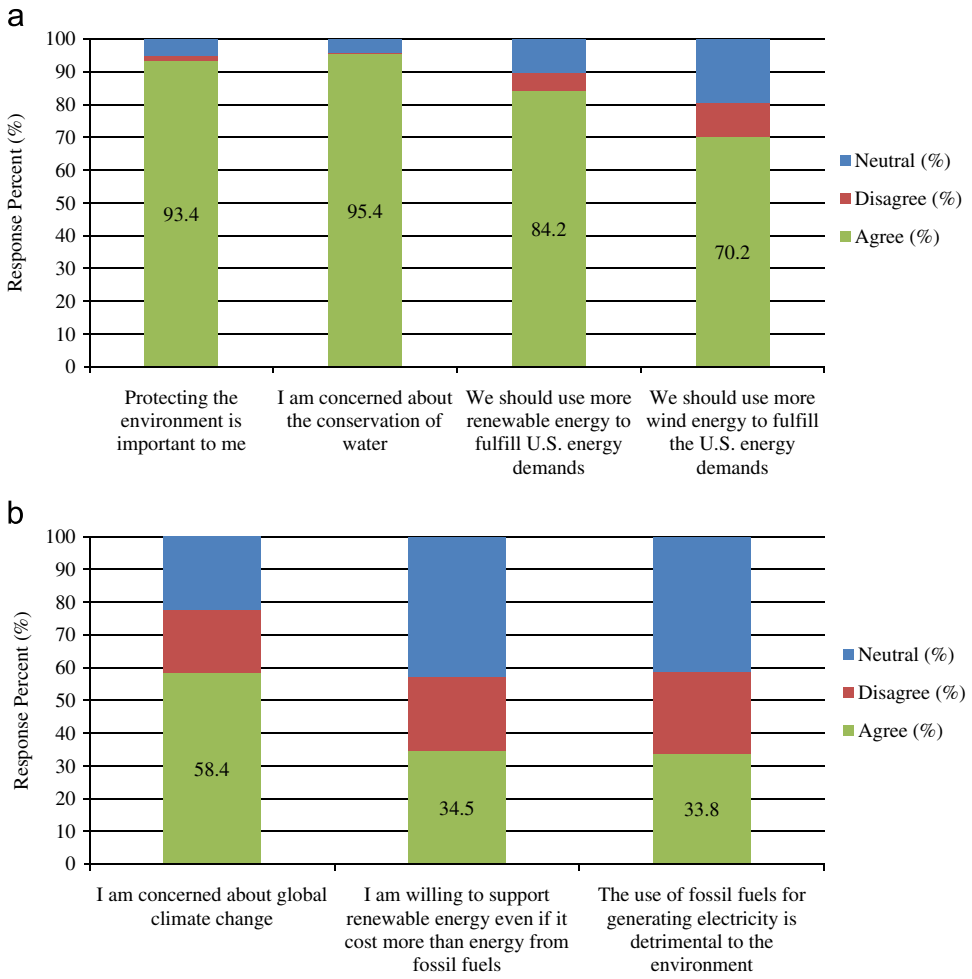

Fig. 2. General environmental attitudes (a) and climate change attitudes (b); respondents were asked if they agreed or disagreed with several statements.

Table 3
Climate change-related attitudes corresponding to level of support for wind energy (positive and negative).

Response indicated	Positive support for wind (%)	Negative support for wind (%)
Concerned about global climate change	63.3	17.4
Not concerned about global climate change	45.9	27.0
Use of fossil fuels for generating electricity is detrimental to the environment	66.6	14.3
Use of fossil fuels for generating electricity is not detrimental to the environment	52.1	25.0

3.2. Wind energy attitudes

Several questions regarding wind energy attitudes were included in the survey questionnaire. The majority of respondents (59.6%) indicated a positive attitude toward wind energy with only a small proportion of respondents (18.1%) indicating a negative attitude. The age group indicating the highest ratio of *positive* attitude toward wind energy was ages 18–24 (75.0% positive). The age category indicating the highest ratio of *negative* attitude towards wind energy was ages 65–74 (25.0% negative). The results of attitudes towards several key issues related to wind energy are summarized in Table 4. Overall, results regarding general attitudes towards wind energy suggest that the overall perception towards wind energy is favorable. When asked about their attitudes prior to wind energy development in their community, the majority of respondents (57.2%) had positive attitudes towards wind energy while fewer (20.7%) held negative attitudes.

There are a number of noteworthy findings regarding noise and visual impact of the wind farm. A fairly small proportion of respondents (30.1%) indicated that wind energy creates a disturbing noise from turbines. Almost half of the respondents (47.2%) indicated that wind farms are an unattractive feature of the landscape. Survey participants were also given the opportunity to indicate what locations they most often see wind turbines (Table 5). Most noteworthy of these findings are that a large majority of respondents (89.9%) see wind turbines when they are driving.

The survey questionnaire also included questions pertaining to the practicality of wind energy technology. A large number of respondents (79.5%) indicated that wind energy is a clean as well as a safe source of energy production (72.2%). A large percentage of respondents (66.5%) also agreed that wind turbines symbolize a sign of progress in our modern energy crisis. Findings also suggest that respondents are relatively unsure whether wind energy is a reliable source of electricity. The proportion of respondents indicating that wind energy is reliable (36.5%), unreliable (32.5%), and those indicating a neutral stance (31.0%) is relatively equal.

Table 4
General wind energy attitudes.

Wind energy	Agree (%)	Disagree (%)	Neutral (%)
Increases property values	18.1	49.7	32.1
Causes TV interference	7.2	41.1	51.8
Creates a disturbing noise from turbines	30.1	40.3	29.6
Creates a strobe affect from turbine blades	22.6	36.9	40.5
Requires too many number of turbines	24.0	40.3	35.7
Allows land to be reverted to its natural state	34.0	37.0	28.9
Allows multiple land uses	55.4	18.9	25.6
Is an attractive feature of the landscape	26.7	49.7	23.6
Is an unattractive feature of the landscape	47.2	30.5	22.3
Is a danger to wildlife	19.5	55.7	24.7
Is a safe energy source	72.2	9.1	18.7
Is a clean energy source	79.5	7.7	12.8
Is an unreliable output of electricity	32.5	36.5	31.0
Is a renewable resource	69.7	12.1	18.2

Table 5
Locations wind turbines are most often seen.

	Response percent (%)
When at home	37.7
When driving	89.9
When in town	25.1
When walking in the countryside	29.6
Never have seen them	1.5
Other	16.1

Note: Respondents were allowed to indicate multiple answer choices.

3.3. Proximity findings

When asked about general attitudes towards wind energy after wind farm construction, findings from survey responses suggest that proximity has an influence on respondents' attitudes. Survey response data were separated by wind farm proximity zone and analyzed accordingly. Results indicate an inverse relationship between proximity and positive attitudes, whereby acceptance of wind energy decreases closer to the wind farm (Fig. 3, Table 6). Those living closest to the wind farm indicate the lowest levels of support for them, while those living farthest away indicate much stronger support. Similar findings were also discovered regarding respondents' willingness to support wind farms in various locales (Table 7). Those living closest to the wind farm were least likely to support wind farms on their property (28.6%), while those living farthest away indicated much greater support (56.0%). Comparable findings were also found regarding support for wind farms within sight of respondents' property, community, and within Texas.

4. Discussion

4.1. Wind energy and environmental attitudes

Results presented here regarding general attitudes towards wind energy support earlier work (Devine-Wright, 2005a; Krohn and Damborg, 1999), which signify an overall public support for wind energy. In general, the community considered here shows a positive attitude towards the wind farm and wind energy technology. Individuals who oppose wind energy and the local wind farm project are in a small minority. Previous literature has stated that visual impact is the most important environmental issue related to wind energy (Pasqualetti, 2000; Thayer and Freeman, 1987; Wolsink, 2007). Devine-Wright (2005a) argues that despite a large emphasis on visual impacts present in most studies, there is little evidence that wind turbines are universally perceived as unsightly. Results here support this view, with slightly less than the majority of respondents (47.2%) indicating that wind turbines are unattractive and a notable amount of respondents (26.7%) indicating that wind turbines are an attractive feature of the landscape. Interestingly, more positive visual evaluations of wind farms are also beginning to appear in the literature (Devine-Wright, 2005a). One can assume that individuals are beginning to accept wind turbines, at least in some regions, and are even beginning to view them as a pleasing aspect of the landscape. The visual impact of a wind energy landscape is indeed important, but this impact will fluctuate greatly across unique locations and societies. Levels of environmental concern will surely differ by location and will depend greatly on local context and place attachment (Devine-Wright, 2008, 2009; Vorkinn and Riese, 2001). These expected variations must be considered when evaluating data from different regions and countries. Lastly, no significant correlation between age and general attitude toward wind energy exists for this data set. Although attitudes among age group categories vary slightly, no clear relationship has emerged.

So what factors are individuals basing their attitudes on? Krohn and Damborg (1999) argue that the positive acceptance of wind power is largely based on public attitudes regarding the benefits of *wind energy*, while the negative opposition of wind power is largely based on public attitudes regarding the negative aspects of *wind turbines*. Results presented in this study appear to be consistent with this view. On the other hand, there will always be additional factors influencing attitudes that are unique to locale. For example, one should note that most wind farm projects in Texas are located on private lands. Land is leased by private landowners for wind turbine construction and operation. This provides an added financial incentive for individuals with land suitable for wind turbines. Wind turbines also allow for an additional land-use and corresponding income, which often gives opportunity to relieve the practice of some previous land uses that may have been less financially supportive. In turn, this may correspond to a decrease in water consumption and also an opportunity for vegetation to begin to return to its natural state. These local-scaled benefits of wind energy are often overlooked. More than likely, examples such as those presented here have a significant influence on the attitudes of landowners and non-landowners alike. In addition, public attitude towards wind farms is influenced by several social factors and may be altered through a person's interaction with family, friends, and neighbors (Johansson and Laike, 2007). Additional studies incorporating

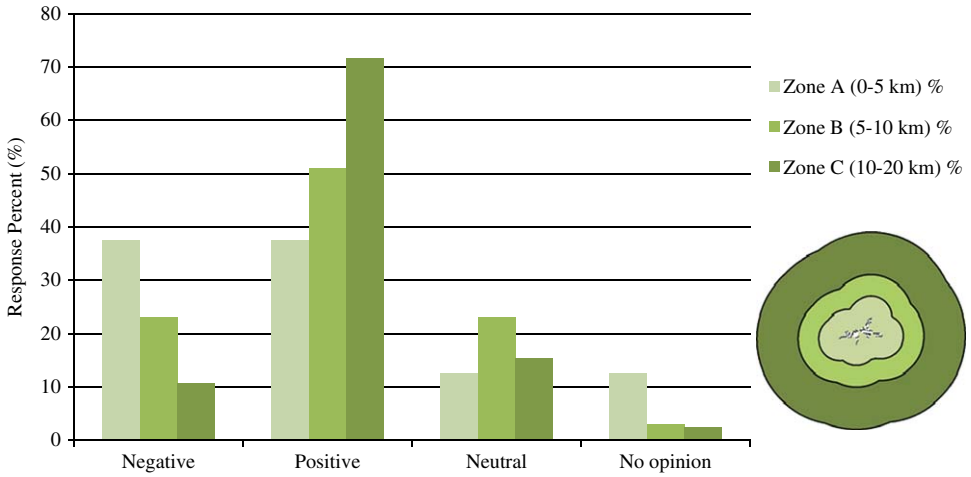

Fig. 3. General attitudes about wind energy after wind farm construction.

Table 6
General attitudes about wind energy now that wind farm in community exists by wind farm zone.

	Zone A (0–5 km)	Zone B (5–10 km)	Zone C (10–20 km)	All
Negative (%)	37.5	23.0	10.6	18.1
Positive (%)	37.5	51.0	71.7	59.6
Neutral (%)	12.5	23.0	15.3	19.2
No opinion (%)	12.5	3.0	2.4	3.1
No. of responses	8	100	85	193

Table 7
Willingness to support wind farms; respondents were asked where they would be willing to support wind farms.

	Zone A (0–5 km)	Zone B (5–10 km)	Zone C (10–20 km)	All
On my property (%)	28.6	39.8	56.0	46.6
Within sight of my property (%)	14.3	39.8	48.8	42.9
Within my community (%)	28.6	42.9	53.6	47.1
Within Texas (%)	57.1	58.2	65.5	61.4
Within the US (%)	71.4	66.3	63.1	65.1
I do not support wind farms (%)	14.3	14.3	13.1	13.8
No. of responses	7	98	84	189

Note: Respondents were allowed to indicate multiple answer choices.

these interactions and the behavior of individual landowners are needed, especially for large-scale wind projects.

The present study relates wind energy attitudes to general protection of the environment, climate change, water conservation, and the current energy status of the US. It has been suggested there is a need to link wind energy attitudes to 'higher concepts' such as climate change and other environmental issues (Devine-Wright, 2005a). Results presented here indicate that a significant number of respondents (66.5%) believe that wind turbines symbolize a sign of progress in our modern energy crisis. Wind turbines most likely symbolize a mixture of concepts for different individuals, but results here focus on linking attitudes to the above-mentioned topics. While the majority of respondents had a very high level of concern for the general environment (93.4%) and water conservation (95.4%), only a small proportion of respondents (33.8%) indicated that producing electricity using fossil fuels is detrimental to the environment. Results also suggest a link between wind energy attitudes and attitudes related to climate change. Concerns for both global warming and the detrimental effect fossil fuels have on the environment seem to influence both positive and negative attitudes towards wind energy (Table 3). Opinions on climate change and energy policy most likely have a great influence on attitudes towards wind energy. Although these linkages in attitudes may seem obvious, it is important to assess public attitudes on these issues in different regions.

4.2. The abandonment of NIMBY

Results from the present study support the view that the traditional label of NIMBYism does not adequately explain the attitudes of local wind farm opposition. This work supports conclusions from previous studies (Braunholtz, 2003; Devine-Wright, 2005a; Ek, 2005; Eltham et al., 2008; Warren et al., 2005; Wolsink, 2000, 2007) that do not support the NIMBY phenomenon. Although results here indicate that those living closest to the wind farm are least favorable towards the project, there is still an overall positive attitude towards the wind farm. Those individuals who do not support the wind farm are too small of a minority to indicate NIMBY-like behavior. NIMBYism, when defined by its traditional view, would dictate and thus require an overall local opposition to the project by those living in close proximity to the wind farm (in this case 20 km). No such majority opposition

appears to exist in the community examined for this study. Instead, we see nearly half of all respondents (46.6%) willing to support wind farms on their property and a very small portion (13.8%) that do not support wind farms at all. For lack of a better term, these results instead suggest some form of a PIMBY (Please-In-My-Backyard) relationship. But like the NIMBY concept, using such a term is flawed and inadequate.

Measuring the so-called NIMBY effect is very problematic as previous studies have suggested. With so many variations and definitions of the term existing in the literature, an attempt to measure the theory across inconsistent methodologies is virtually impossible (van der Horst, 2007). We suggest that an attempt to label behavior or individuals as NIMBY is equally as impractical, echoing the recommendations of several studies. The term is politically inappropriate and can often lead to misunderstanding, adding little value to the decision-making process. Van der Horst (2007, p. 2712) provides useful commentary arguing that definitions of the phenomenon and attempting to measure it may vary with respect to:

- the spatial distance over which NIMBYism should be measured;
- how long a specific wind farm and surrounding community should be studied;
- whether or not to include both passive and active forms of opposition in the study;
- how the study examines and studies both protest leaders and 'followers';
- the weight of public attitudes towards wind energy in principle;
- the notion by which survey participants may purposely avoid being labeled as a NIMBY by giving and creating other reasons for opposing a wind farm project.

The traditional view of NIMBYism is no doubt damaging to the implementation of new wind farm projects (Wolsink, 2006). Its use by both sides of opposition as well as advocates for wind energy should be abandoned. The term does not define the many complexities and interactions occurring between public attitudes and social or political institutions (Bell et al., 2005). Nor does it include characteristics of a community that are unique. Many studies have concluded that the NIMBY concept is inadequate, but few have proposed alternative solutions. A notable exception is Devine-Wright's (2009) work in explaining NIMBY responses as 'place-protective actions'. This new 'psychological framework', as Devine-Wright (2009, p. 432) explains, reframes the issue stating "that so-called 'NIMBY' responses should be re-conceived as place-protective actions, which are founded upon processes of place attachment and place identity. This enables a deeper understanding of the social and psychological aspects of change arising from the siting of energy technologies in specific locations." Emotional attachments to place are essential, and any disruption to those attachments can affect an individual's attitude and alter behavior (Devine-Wright, 2009). This is particularly true for a wind energy landscape, which involves an energy source that is especially visible. For some, the installation of wind turbines is a violation to the natural landscape—a violation which many find difficult to cope with (Pasqualetti, 2000). Sense of place, an undeniable right for many individuals in Texas, has been tampered with. For many long-term residents, the landscape and open space is simply not negotiable, regardless of what would replace it. Knowing this, one could hardly expect a confined acronym such as NIMBY to fully capture oppositional attitudes towards wind energy. While important debate surrounding NIMBYism will likely continue within academia, we suggest abandoning the use of the term at media, institutional, and decision-making levels.

4.3. The role of proximity

In the present study, it is clear that proximity has at least some effect on individual perceptions. Results suggest that those living closest to the wind farm have the most negative attitudes towards them relative to other groups living at greater distances from the wind farm (Table 6). This differs from results of previous studies (Braunholtz, 2003; Krohn and Damborg, 1999; Warren et al., 2005) whereby those living closest to wind farms possessed the most favorable attitudes towards them. In addition to general attitudes towards the wind farm, data were also compiled regarding willingness to support wind turbines in various locations. Results support those presented in a recent study (Johansson and Laike, 2007), where there were no differences in individuals who do not support wind farms between three groups living at varying proximities from a wind farm (Table 7). On the other hand, results here do indicate differences regarding willingness to support wind farms on their property between these proximity groups (Table 7). Survey participants were much less willing to support wind farms on their own property. In terms of proximity, those living at greater distances from the wind farm were more likely to support wind turbines on their property than were those living at closer proximity to the wind farm. Van der Horst (2007, p. 2707) proposes that those living further away from an existing wind farm are more opposed to it because "they lack the local experience to alter their perception of some of the impacts". While those living further away from the wind farm may have less direct contact with wind turbines, the opposite may be true for the community examined for this study. Results here suggest that those individuals with greater chance of daily contact with wind turbines show higher levels of opposition than those living at greater distances from the wind farm. This speaks to the locally restricted nature of many of the commonly cited negative aspects of wind energy such as noise and visual pollution (van der Horst, 2007). As predicted by van der Horst (2007), more than likely some level of 'distance decay' exists whereby levels of public concern regarding the negative impacts of a wind farm diminish with distance.

The attitudes of those living in close proximity to a wind farm project have a strong effect on planning implications. A greater chance of contact with wind turbines likely changes the landscape values of individuals in these areas. And at a community level, the overall attitude towards a specific wind development can often sway decision-making in either direction. Indeed, those living in immediate vicinity of planned wind farm projects (and their associated attitudes) are found to be the most important factors in decision-making by local authorities (Toke, 2005). The local communities' approval for a project is not only a key aspect for the success of that project but also a driving factor for future wind energy developments in general (Dimitropoulos and Kontoleon, 2009). The extent of this effect, on the other hand, has varied widely in the literature as previously discussed (Devine-Wright, 2005a). The influence of proximity on attitudes has also varied from region to region. Distance to the wind farm appears to have a strong influence on perceptions, but the intensity of this effect may vary due to local characteristics and values (van der Horst, 2007). And lastly, attitudes have also varied among *proposed* wind farm projects when compared to *existing* wind farm facilities. As noted to above, van der Horst (2007) suggests that those living in close proximity to a proposed wind farm project are concerned and often opposed to the facility because of the level of risk perception related to the distance to the site. Individuals residing

a large distance away from an existing wind farm may be opposed to it because of a lack of direct experience with the wind farm itself – which would allow individuals to alter perceptions held regarding various anticipated negative impacts. On the other hand, "levels of familiarity are unlikely to be derived solely from direct experience" (Devine-Wright, 2009, p. 431). Instead, others argue that familiarity is also shaped by interactions among individuals between developers, media sources, and interpersonal communication between family and friends (Devine-Wright, 2009; Johansson and Laike, 2007). Individuals undoubtedly obtain information from a variety of sources, a topic discussed further in the next section.

This paper adds to conflicting reports regarding the role of proximity in wind farm attitudes. The proximity hypothesis should not be regarded as insignificant as Johansson and Laike (2007) argue. Instead, it should continue to be explored and incorporated into wind energy studies of various methodologies to provide a wider set of findings. Judging by the varying results regarding the proximity hypothesis presented here relative to the literature, it is clear that the role of proximity differs largely with respect to different locations both in physical and social settings. Knowledge of wind energy and overall environmental literacy will undoubtedly be different among various communities and nations. As mentioned previously, environmental education, whether initiated by wind energy planners or independently, will likely have a large influence on how local communities shape attitudes towards a specific venture.

4.4. Promoting public involvement and education

Based on our results showing linkages between climate change and wind energy attitudes and the importance of communities living in close proximity to wind farms, we suggest that more aggressive measures be taken to promote education and public participation in these regions. Communities that are in close proximity to wind farms are typically inadequately informed about wind energy projects and are often excluded from decision-making and the planning process (Dimitropoulos and Kontoleon, 2009). Individuals most likely obtain information regarding wind energy from a variety of sources, some more reliable than others. This, of course, will vary widely across different regions and stakeholders involved. Numerous studies (Dimitropoulos and Kontoleon, 2009; Eltham et al., 2008; Wolsink, 2000) have suggested the abandonment of the top-down model of new wind farm installation and adopt a model with higher levels of public education and involvement in decision-making. Our view supports that of Dimitropoulos and Kontoleon (2009, p. 1853), which argue that "unless such a planning path is adopted, there are unnecessary external costs imposed to the advance of wind technology, which might even lead to its under-exploitation". Krohn and Damborg (1999) suggest that channels of information and dialogue are the key for local wind projects being accepted. It is here where more focus should be placed.

We predict that increasing the environmental literacy of a population in close proximity to a planned or constructed wind farm project will have a large influence on the levels of support and opposition towards the facility. More groups are realizing that increasing levels of public participation during the early stages of a project will increase the likelihood of a project being accepted by the public (Higgs et al., 2008). Communicating the various issues related to wind energy, both perceived and actual, will improve the value of decision-making for both planned and operational projects. This participation can consist of a variety of formats including survey questionnaires, public meetings, focus groups, and semi-structured interviews with the goal of providing participants with the means to establish informed opinions about wind energy and environmental issues (Higgs et al., 2008). Renewable energy groups should establish sound educational programs in areas of planned projects. These programs should not only educate the public concerning a specific planned or proposed project, but also inform the public about all renewable technologies. Education regarding climate change and energy policy should also be established in these communities. Without it, the full advantages and disadvantages of a renewable technology (in this case wind energy) are not communicated entirely. Wind energy must be shown to be more than a financial investment; it is at the forefront of environmentally benign sources of electricity production and a new form of carbon mitigation. By not communicating these aspects of wind energy to the public, many of the hidden benefits of wind energy are often left unspoken. Overall, increasing the level of transparency between all groups involved together with an increase in public involvement may lead to less local resistance to specific wind farm developments (Dimitropoulos and Kontoleon, 2009). These individuals living near wind farms are part of a new energy future and should be included as much as possible as we move towards a lower-carbon society.

Sovacool (2009) identifies a system in which a national systems benefit charge (SBC) could be established to develop education programs and distribute resources to the public. Sovacool (2009, p. 1536) further elaborates, providing several recommendations on how to use funding to educate the public:

- establish grade-school coursework to cover climate, energy, and the environment;
- initiate public demonstrations and tours of renewable energy facilities;
- establish the mandatory disclosure of electricity usage for new buildings;
- provide free energy audits and workshops for all electricity consumers;
- improve current labeling, rating, and certification systems for electrical devices;
- establish a national information hub that collects and provides resources for decision-makers and electricity users.

Such a system would not rely on individual wind developers promoting their own education systems but instead a larger scaled program being implemented. It would also utilize the existing education infrastructure, by providing wind energy resources to local schools and teachers to include in their curriculum. Wind energy developers have begun implementing several of these initiatives voluntarily, many aware of the long-term benefits. By establishing a more mandatory approach, these benefits can be shared by all wind farm communities. Due to the expected rapid growth of wind energy in the near future, such a system should be established immediately.

5. Conclusion

A study was conducted exploring the public attitude towards a wind energy development in northern Texas. Research was undertaken by the use of a survey questionnaire to identify the physical and environmental characteristics that are linked to both negative and positive perceptions of wind energy. The attitudes of a community living in close proximity to a wind farm were examined. Results indicate overall support for the wind farm and wind energy in general. Those living farthest from the wind farm development show a greater willingness to support wind energy in various locations. Results show an overall concern for the

environment but less concern with issues related to climate change and use of fossil fuels. The attitudes of those living near a wind farm facility play a fundamental role in decision-making for wind energy planning.

The authors would like to acknowledge that a survey questionnaire is capable of obtaining only a snapshot of what public attitudes appear to be. Respondents who have very strong views regarding wind energy are more likely to participate than those with more passive views. Response rate and sample size varied across each wind farm zone. This was most prevalent in zone A, where the population density was much lower relative to the other two zones. In addition, results regarding the proximity hypothesis were reported using the aggregate distances chosen (0–5, 5–10, and 10–20 km). As suggested by van der Horst (2007), results may differ if other distances were used instead. Exploring results plotted across a continuous distance scale (research forthcoming) would be useful and would stimulate further discussions regarding the proximity hypothesis. Other research pieces and methodologies are needed to provide a fuller understanding of community attitudes towards wind farm projects. These include personal interviews, economic analyses, as well as additional social science techniques such as q-methodology (Ellis, 2007). As Devine-Wright (2009) and Vorkinn and Riese (2001) suggest, more research is needed that adopts a social constructivist perspective that further evaluates the role of place attachment. It would also be useful to further investigate the role of education and income levels of those participating in studies as well as any interaction with wind farm developers. The authors of the present study wished to examine those items here but chose to eliminate them from the survey questionnaire, among other items, for sake of length. More studies incorporating state and federal-level energy policies should be established as these policies rapidly progress. As Texas becomes one of the world's largest suppliers of wind energy, more studies are needed to examine the advantages and disadvantages of this renewable energy source.

Wind energy is becoming an important electricity resource throughout the global community. The economic consequences of a large dependency on oil as well as a growing need to respond to climate change has resulted in a large surge in wind energy developments (Dimitropoulos and Kontoleon, 2009). If wind energy development in Texas continues to expand as anticipated, more efforts to increase public participation in the planning process are encouraged. By doing so, both advocates and opponents of local wind farm projects can have better means of forming educated opinions of the many issues surrounding wind energy and specific wind farms. Communication between stakeholders must continue to take place as more groups become involved and new technologies become available. As the world begins to equip itself to enter a new era with less dependence on fossil fuels, there will undoubtedly be major changes in the ways we think about energy. This, in turn, will bring new forms of technology to our landscapes. Wind energy provides one of the first examples of these new landscapes. How we perceive and accept these landscapes will surely influence their future success and development.

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