SOCIAL PERCEPTIONS OF WIND ENERGY IN TEXAS:

PROXIMITY AND NIMBY EXPLORED

by

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INTRODUCTION

The global response to climate change is underway. Many scientists agree that implementing more carbon-free sources of electricity is an obligation for such a response to be successful (Schiermeier et al., 2008). Shifting world oil markets and the threat of human-induced climate change have made non-fossil fuel sources of energy progressively more imperative (de Vries et al., 2007). 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). These troubling statistics have led to several considerations on ways to combat global warming, including scaling up renewable energies. Producing electricity using wind power 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. Regardless, electricity generated from wind power will play a vital role in future energy portfolios across the globe for both financial and environmental motives.

Wind energy development has increased substantially over the last decade. The abundance, adaptability, cost effectiveness, and clean characteristics of the resource are the main reasons for its anticipated success (Pasqualetti et al., 2002). The United States now has a wind energy capacity of over 25,000 megawatts (MW) and approximately 4,500 MW under construction (American Wind Energy Association, 2008a). In the United States, planned capacity for wind energy exceeds that for coal and gas operations combined (Schiermeier et

al., 2008). With this rapid growth of wind energy capacity, it is important to achieve a better understanding of how wind energy is being perceived.

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), cost comparison studies (de Vries et al., 2007; Sims et al., 2003), among others. In addition to these topics of study, there is expanding literature on studies exploring the public perception of wind energy. Thayer and Freeman (1987, p. 383) were among some of the first researchers who "began to expect that public reaction to wind developments was far more complex than previous literature or circumstances 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 “one of the most distinctive energy landscapes in the world” (Pasqualetti, 2001, p. 692). The present study aims to focus on this field of research.

This paper 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 examined. The second section of the paper presents the results of a postal survey 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.

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, 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 proclaim 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. Kahn (2000, p. 29) argues that "environmentalism is as wide an ideological umbrella as any other". And as its umbrella continues to increase, with individuals and countries alike going 'green', we may see more of these 'green vs. green' arguments (Warren et al., 2005). 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).

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 (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; 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 is summarized here:

(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 correctly 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 some interesting 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). Wind power development continues at rapidly growing rates worldwide. For most countries, wind energy is simply too abundant and too valuable to overlook (Righter, 2002). 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 proposed 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 countless 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 summarized here:

(1) "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).

(2) "…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).

(3) "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).

(4) "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)

(5) "More formally, NIMBY refers to the protectionist attitudes of an oppositional tactics adopted by community groups facing an unwelcome development in their neighborhood" (Dear, 1992, p. 288)

One can see that definitions of NIMBY (when actually presented) are 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 criticized 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). The idea of NIMBY has several assumptions that ought to be recognized. Wolsink (2007, p.1200) argues that if we assume opposition to wind farms is a result of NIMBYism, there are several implicit assumptions to be noted:

(1) "Decision making as regards wind development tends to be laborious (this usually translates into a call by investors and planners for a speeding-up of decision making)."
(2) "The wind farm represents 'higher' interests than those of the local population."
(3) "Everyone is agreed on the usefulness of wind power developments."
(4) "No-one wants a wind development facility in his own backyard."
(5) "Everyone would prefer to have wind development facilities situated in someone else's backyard."
(6) "The attitudes and opinions which make up the NIMBY phenomenon can be regarded as static. The NIMBY theory does not appear to allow for the possible

alteration of insights regarding usefulness and location, something that already has proven to be faulty."

Of particular interest are Wolsink's (2007) fourth and fifth assumptions which correspond to 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 if the supposed NIMBY phenomenon is to be a correct diagnosis. Several past studies explore this aspect of NIMBY in determining whether the term correctly explains wind farm perceptions in various locations. The present study aims to extend this research to the United States and Texas.

The Role of Proximity in Wind Farm Attitudes

One of the central components of NIMBYism is the notion of 'backyard'. The term 'backyard' is often 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'. If one agrees with this principle, then we 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 in beliefs has commonly been referred to as the 'proximity hypothesis' in NIMBY debates.

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. This has become somewhat of a standardized way to measure for the proximity hypothesis and 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.

Studies examining the proximity hypothesis have presented intriguing results. 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 refute, 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 (2005, p. 866) defines this reverse

proximity hypothesis as “inverse NIMBY syndrome, whereby those with wind farms 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 for this effect may vary according to local context and 'value' of 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 (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.

Research Objectives

To date, no noteworthy research on public attitudes of wind energy has been conducted in Texas. Research is greatly needed for several reasons. Texas now has a total existing wind energy capacity of 7,115.66 MW and another 1,651.35 MW under construction (American Wind Energy Association, 2008a). This capacity makes Texas the leader in providing wind energy in the United States. The potential capacity of wind energy in Texas

is vast, estimated to be approximately 136,100 MW (American Wind Energy Association, 2008b). Texas also houses many of the world's biggest wind farms. The world's largest wind farm, Horse Hollow Wind Energy Center, is comprised of 421 turbines totaling a capacity of 733.5 MW (American Wind Energy Association, 2008b). 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 correctly 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 the use of NIMBY language and wind farm attitudes.

METHODS

Study Area

The Wolf Ridge wind farm facility is located in Cooke County, Texas (Figure 1) and was commissioned in October 2008. The characteristics of the wind farm are given in Table 1. The wind farm was chosen for this study both because of its reasonably sized surrounding population as well as its isolated location from any other wind farm facilities. The wind farm was also chosen because of its size. Although average sized 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.

Table 1
Wolf Ridge wind farm characteristics

Date Commissioned	Capacity (MW)	Number of Turbines	Height (meters)
October 2008	112.5	75	80

Source: American Wind Energy Association (2008a)

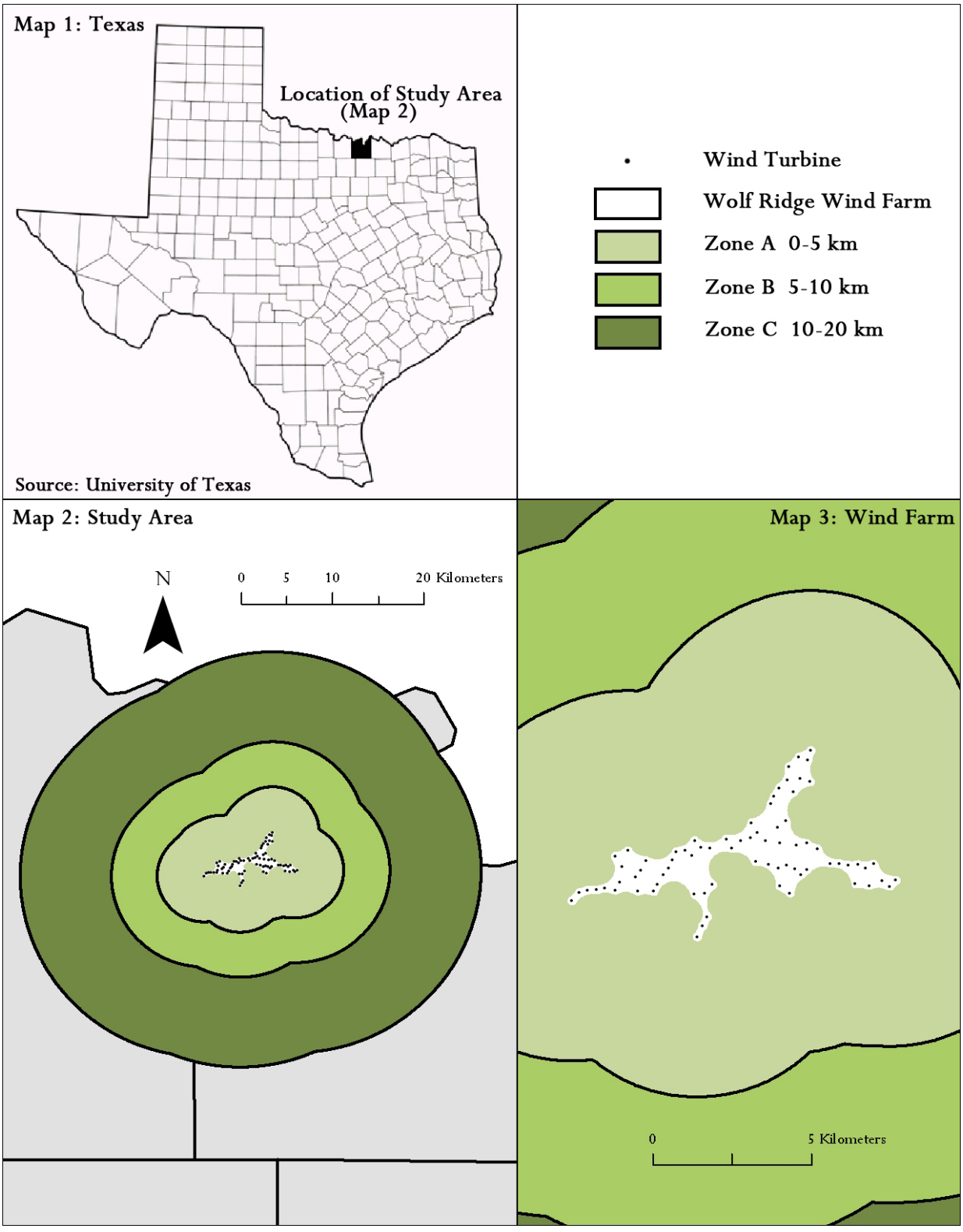


Fig. 1. Location of study area. Wolf Ridge wind farm located in Cooke County, TX. Survey questionnaires were mailed to households within the shaded study area. Polygon zones differentiate aggregate distances from wind farm.

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 (Appendix A). The survey was developed using experiences from a pilot study conducted in a different region of Texas (Slattery et al., 2008). The same format of questions was used from the pilot study; however the number of questions was reduced in order to increase response rate. 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).

Geographic Methodology

Research was 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 meters 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 km, 5 - 10 km, and 10 – 20 km. The original 100 meter wind farm boundary buffer zone was used to define these zones. These wind farm regions (Figure 1) were defined as the following:

- Zone A: 0 – 5 km
- Zone B: 5 – 10 km
- Zone C: 10 – 20 km

A database of addresses was obtained for households living within the 20 km wind farm study area. Addresses were then geocoded to associate their location with geographic coordinates. The purpose of this was 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.

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. Research was conducted by the use of a postal survey during February 2009 in the study location. Of the 1500 surveys mailed, 178 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.

Table 2
Survey statistics (n = 178)

Zone	Study Area Households	% of Study Area Household Population	Surveys Mailed
0-5 kilometers	127	6%	90
5-10 kilometers	891	42%	630
10-20 kilometers	1118	52%	780
All	2136	100%	1500

Zone	Survey Responses (n)	# Vacant or Undeliverable Households	Response Rate (%)*
0-5 kilometers	8	1	9.0%
5-10 kilometers	94	46	16.1%
10-20 kilometers	76	53	10.5%
All	178	100	12.7%

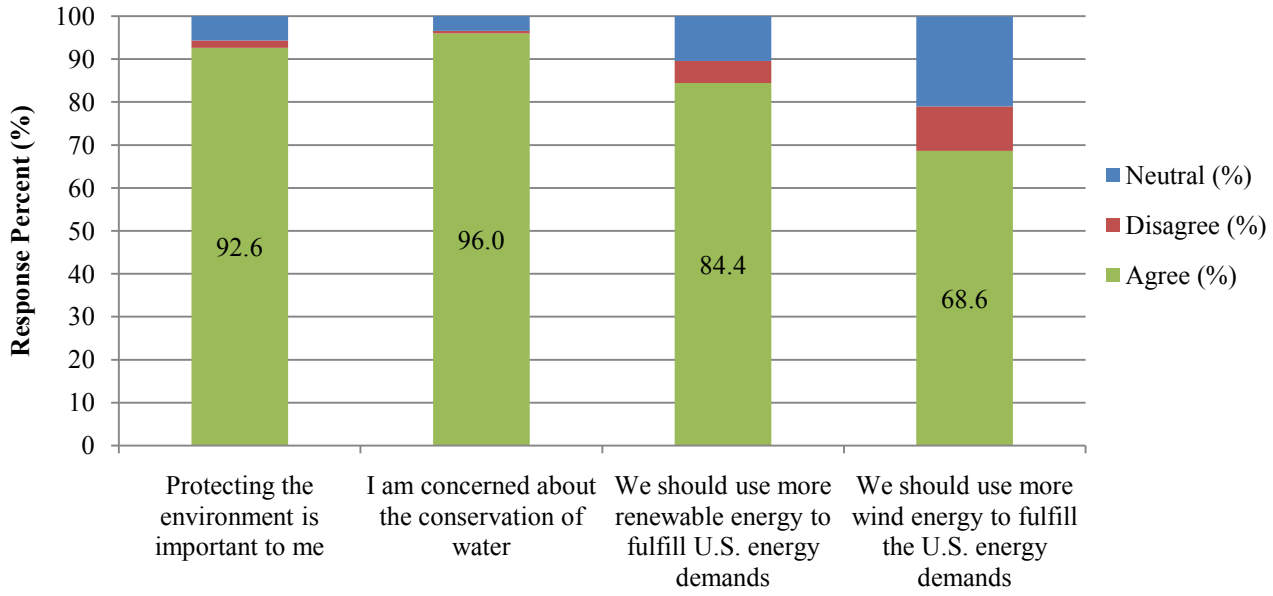
*Response rate calculation does not include surveys returned from vacant or undeliverable households

A relatively even distribution of males (54.4%) and females (45.6%) participated in the survey questionnaire. The majority of respondents (85.9%) were 45 years of age or older. Most respondents had at least some level of knowledge regarding renewable energy (87.1%) and wind energy (92.8%). A much smaller proportion of respondents (29.9%) 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 4 respondents (2.3%) indicated that they had wind turbines located on their property.

Environmental Attitudes

Several questions regarding attitudes towards key environmental issues were included in the survey questionnaire (Figure 2). General attitudes regarding the protection of the environment were largely positive. Protection of the environment was very important for most respondents (92.6%) as was the conservation of water (96.0%). When asked, on the other hand, about level of concern regarding global climate change, there was a significant decrease in those expressing concern (56.9%). This corresponds with a small percentage of respondents (31.4%) who believe that the use of fossil fuels for generating electricity is detrimental to the environment. Most respondents believe that the U.S. should use more renewable energy (84.4%) and wind energy (68.6%) to fulfill energy demands. On the other hand, a much smaller proportion of respondents (35.1%) 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 (65.3%) indicated positive support for wind energy. Of those who are not concerned about global climate change, a smaller amount of respondents (51.5%) indicated positive support for wind energy. Also of the number of respondents who agree that fossil fuels are detrimental to the environment, a large amount (71.1%) indicated support for wind energy. Of those who disagreed that fossil fuels are detrimental to the environment, a smaller amount (57.1%) indicated support for wind energy. A similar relationship between these topics is also found regarding negative attitudes towards wind energy (Table 3).

(a)



(b)

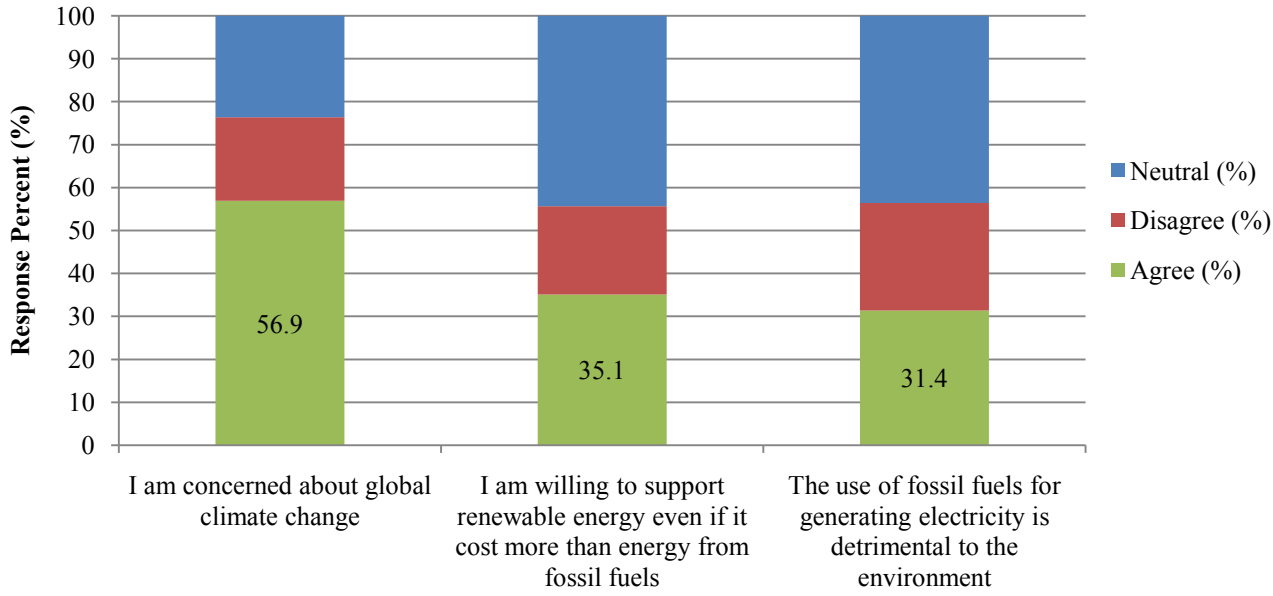


Fig. 2. General environmental attitudes (a) and climate change attitudes (b); respondents were asked if they agreed or disagreed with several statements.

Table 3

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

Response indicated	Positive support (%)	Negative support (%)
Concerned about global climate change	65.3	18.9
Not concerned about global climate change	51.5	27.2
Use of fossil fuels for generating electricity is detrimental to the environment	71.1	15.4
Use of fossil fuels for generating electricity is not detrimental to the environment	57.1	23.8

Wind Energy Attitudes

Several questions regarding wind energy attitudes were included in the survey questionnaire. 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 (58.9%) had positive attitudes towards wind energy while fewer (20.2%) held negative attitudes. The results of attitudes towards several key issues related to wind energy are summarized in Table 4.

Table 4

General wind energy attitudes; respondents were asked if they agreed or disagreed with several statements.

Wind energy…	Strongly Disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly Agree (%)
increases property values	26.5	21.8	33.5	15.3	2.9
causes TV interference	14.5	28.3	49.7	4.6	2.9
creates a disturbing noise from turbines	14.4	27.6	28.2	21.8	8.0
creates a strobe affect from turbine blades	13.3	24.9	39.9	15.0	6.9
requires too many number of turbines	13.2	28.7	34.5	13.2	10.3
allows land to be reverted to its natural state	16.1	20.7	29.3	28.2	5.7
allows multiple land uses	5.8	14.0	26.2	46.5	7.6
is an attractive feature of the landscape	23.3	25.6	22.7	22.1	6.4
is an unattractive feature of the landscape	12.6	19.5	21.8	24.1	21.8
is a danger to wildlife	19.9	36.8	22.2	12.3	8.8
is a safe energy source	4.0	5.1	18.9	44.6	27.4
is a clean energy source	4.1	4.1	12.8	48.8	30.2
is an unreliable output of electricity (not always windy)	9.2	28.2	30.5	20.1	12.1
is a renewable resource (limitless)	3.4	9.7	19.4	38.9	28.6

There are a number of noteworthy findings regarding noise and visual impact of the wind farm. A fairly small proportion of respondents (29.8%) indicated that wind energy creates a disturbing noise from turbines. Almost half of the respondents (45.9%) 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 (91.0%) see wind turbines when they are driving.

Table 5
Locations wind turbines are most often seen

	Response Percent (%)
When at home	35.0
When driving	91.0
When in town	25.4
When walking in the countryside	27.1
Never have seen them	1.7
Other	16.4

The survey questionnaire also included questions pertaining to the practicality of wind energy technology. A large number of respondents (79.0%) indicated that wind energy is a clean as well as a safe source of energy production (72.0%). Of particular interest, on the other hand, is the lower share of respondents (67.5%) who agreed that wind energy is a renewable resource. A large percentage of respondents (67.4%) 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 (37.4%), unreliable (32.2%), and those indicating a neutral stance (30.5%) were relatively equal.

Proximity Findings

Results applicable to the proximity hypothesis provide a number of notable 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 was separated by wind farm proximity zone and analyzed accordingly. Results indicate an inverse relationship between proximity and positive attitudes, whereby acceptance of wind energy declines moving closer to the wind farm (Figure 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.

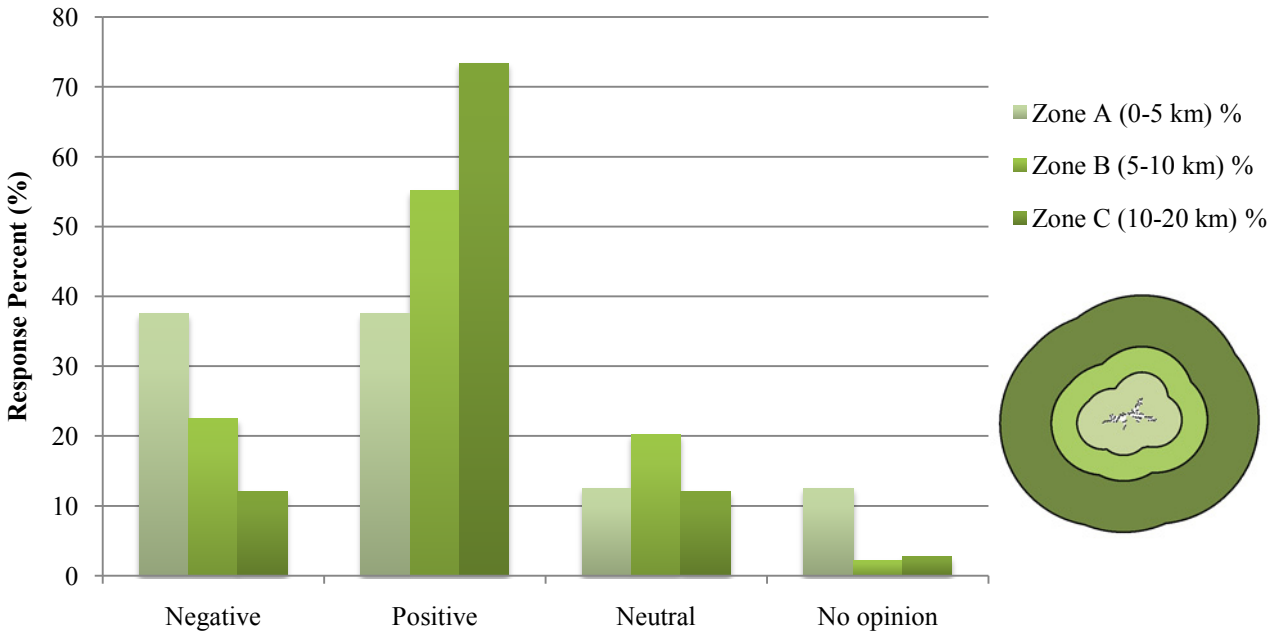


Fig. 3. General attitudes about wind energy after wind farm construction.

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	22.5	12.0	18.6
Positive	37.5	55.1	73.4	62.2
Neutral	12.5	20.2	12.0	16.3
No opinion	12.5	2.2	2.7	2.9

Similar findings were also discovered regarding respondents' willingness to support wind farms in various locales (Figure 4, 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 (56.8%). Comparable findings were also found regarding support for wind farms within sight of respondents' property, community, and within Texas.

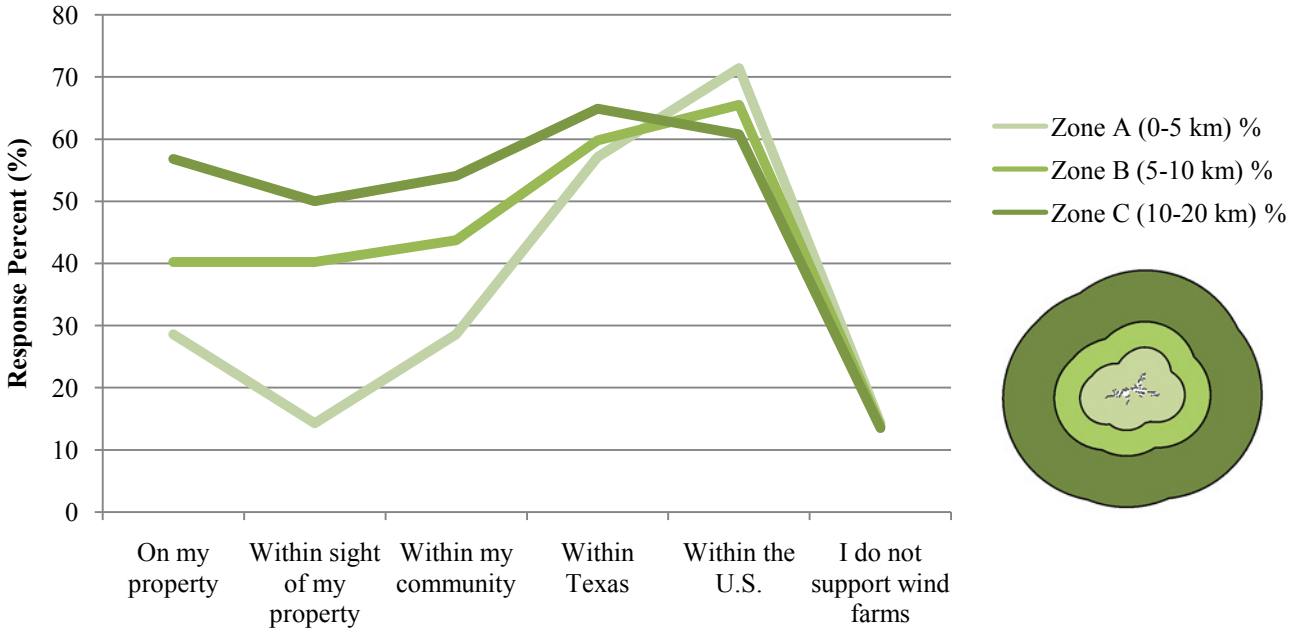


Fig. 4. Willingness to support wind farms; respondents were asked where they would be willing to support wind farms.

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	40.2	56.8	47.0
Within sight of my property	14.3	40.2	50.0	43.5
Within my community	28.6	43.7	54.1	47.6
Within Texas	57.1	59.8	64.9	61.9
Within the U.S.	71.4	65.5	60.8	63.7
I do not support wind farms	14.3	13.8	13.5	13.7

DISCUSSION

The present study was initiated to explore the following main research questions: (1) What are the wind energy and environmental attitudes of a population that is in close proximity to a wind farm development?, (2) What influence does proximity have on public perceptions of wind energy?, and (3) Does NIMBYism correctly explain wind energy attitudes in Texas?. The following begins the interpretations of these research questions based on results presented in this study. The planning implications, future study recommendations, and limitations of this study are also discussed.

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 only a moderate amount of respondents (45.9%) indicating that wind turbines are unattractive and a notable amount of respondents (28.5%) indicating that wind turbines are an attractive feature of the landscape. With no majority view present, these results support findings from a more rigorous visual perception study (Johansson and Laike, 2007) which

indicated that a landscape with wind turbines is viewed as neither pleasant nor very unpleasant. 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 (Vorkinn and Riese, 2001). These expected variations must be considered when evaluating data from different regions and countries.

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, these interactions have a significant

influence on the attitudes of landowners and non-landowners alike. This provides a unique opportunity for additional studies to explore the social interactions among various stakeholders, many of who have established some form of connection with the local wind farm development. 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 land use studies incorporating these interactions and the behavior of individual landowners are needed, especially for large-scale wind projects.

The present study attempts to relate wind energy attitudes to issues related to general protection of the environment, climate change, water conservation, and the current energy status of the U.S. 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 (67.4%) 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 the above mentioned topics. While the majority of respondents had a very high level of concern for the general environment (92.6%) and water conservation (96.0%), only a small proportion of respondents (31.4%) 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 educate the public on these issues to allow informed opinions to emerge.

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. 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 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 displayed as 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.

The Role of Proximity

The attitudes of those living in close proximity to a wind farm project have a strong effect on planning implications. 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 extent of this effect, on the other hand, has varied widely in the literature as previously discussed (Devine-Wright, 2005a). 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).

In the present study, it is clear that proximity has at least some effect on individual perceptions. Findings presented here related to the proximity hypothesis reveal several noteworthy patterns. 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 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.

The NIMBY Diagnosis

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; Wolsink, 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.

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 academia, an attempt to measure the theory across inconsistent methodologies is virtually impossible (van der Horst, 2007). Van der Horst (2007, p. 2706) provides useful commentary arguing that definitions of the phenomenon and attempting to measure it may vary with respect to:

(1) the spatial distance over which NIMBYism should be measured
(2) how long a specific wind farm and surrounding community should be studied
(3) whether or not to include both passive and active forms of opposition in the study
(4) how the study examines and studies both protest leaders and 'followers'
(5) the weight of public attitudes towards wind energy in principle
(6) 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). Many of these interactions are unique to wind energy developments when compared to other commonly opposed public facilities. Instead of

focusing on using terms such as a 'NIMBY' as weapons, groups should organize to foster more healthy forms of public participation.

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). Individuals will undoubtedly get information regarding wind energy from a variety of sources, some more reliable than others. Krohn and Damborg (1999) suggest that these channels of information and dialogue are the key for local wind projects being accepted. It is here where more studies should place a focus. There are unquestionably a wide range of complex factors that influence social attitudes towards wind farm developments.

Limitations and Considerations for Future Studies

The author would like to acknowledge that this study includes several inherit limitations that, although may appear obvious for some, should be noted here. 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. In addition, results regarding the proximity hypothesis were reported using the aggregate distances chosen (0-5 km, 5-10 km, and 10-20

km). As suggested by van der Horst (2007), results may differ if other distances were used instead. 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. 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.

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.

Wind energy is becoming an important electricity resource throughout the global community. 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.

APPENDIX A

The following is the survey questionnaire used for research. Additional copies are available from the author.

Greetings!
Your household has been selected through a random sampling to participate in an important survey addressing your opinions of the wind farm in your community. Your area has been chosen because you live in a 20-kilometer (12.4 mile) radius proximity to the Wolf Ridge wind farm facility located in Cooke County, Texas. **This survey is conducted by Texas Christian University's Wind Research Initiative and will assist in developing a broader and clearer understanding of key issues regarding wind farms such as public perception, environmental attitudes, and aesthetic concerns**. We acknowledge that this survey does not cover all issues related to wind energy. More information about TCU's Wind Research Initiative can be found at http://wind.tcu.edu/.

Your participation is strictly voluntary*. **Your consent to participate in the research will be recognized by your returning a completed survey**. Your survey response will be treated as strictly confidential and will only be used for research purposes. Your survey response will be grouped with other survey responses in the same geographic region. Please keep in mind that the results of this study depend on as many people as possible answering the questionnaire. We thank you greatly for participating in this research study. Please return your completed survey within the next ten business days. The **postage has been pre-paid** so there is no need to add postage. If you have questions about the research or survey, **please contact Jeffrey Swofford (817-257-6670, j.swofford@tcu.edu)**

Please complete and insert the completed survey in the enclosed business reply envelope to be mailed (postage pre-paid)

* Please contact either of the following regarding any rights of research subjects:
Dr. Meena Shah, Chairperson of the TCU Institutional Review Board (817-257-6871, m.shah@tcu.edu)
Dr. Janis Morey, Director, Sponsored Research at TCU (817-257-7516, j.morey@tcu.edu)

Wind Energy Public Perception Survey

1. How knowledgeable would you consider yourself about….

Check one answer for each characteristic below	**1 Not at all knowledgeable**	**2**	**3**	**4**	**5 Very knowledgeable**
Renewable energy	1☐	2☐	3☐	4☐	5☐
Wind energy	1☐	2☐	3☐	4☐	5☐

2. How many public meetings regarding wind energy have you attended prior to the construction of the wind farm?
1☐ One 2☐ Two 3☐ Three 4☐ Four 5☐ Five or more 6☐ None

3. What was your general attitude about wind energy before the wind farm in your community was built?
1☐ Very negative 2☐ Negative 3☐ Neutral 4☐ Positive 5☐ Very positive 6☐ No opinion

4. Do you currently have wind turbines on your property? 1☐ Yes 2☐ No

5. There are several positive and negative issues related to wind energy. How much do you agree or disagree with the following statements? *(Circle ONE answer for each statement)*

Wind Energy Attitudes	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
"Wind energy…					
increases property values"	1	2	3	4	5
causes TV interference"	1	2	3	4	5
creates a disturbing noise from turbines"	1	2	3	4	5
creates a strobe affect from turbine blades"	1	2	3	4	5
requires too many number of turbines"	1	2	3	4	5
allows land to be reverted to its natural state"	1	2	3	4	5
allows multiple land uses"	1	2	3	4	5
is an attractive feature of the landscape"	1	2	3	4	5
is an unattractive feature of the landscape"	1	2	3	4	5
is a danger to wildlife"	1	2	3	4	5
is a safe energy source"	1	2	3	4	5
is a clean energy source"	1	2	3	4	5
is an unreliable output of electricity (not always windy)"	1	2	3	4	5
is a renewable resource (limitless)"	1	2	3	4	5

6. The following are several statements regarding general environmental attitudes. How much do you agree or disagree with the following statements? *(Circle ONE answer for each statement)*

Environmental Attitudes	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Protecting the environment is important to me	1	2	3	4	5
I am concerned about the conservation of water	1	2	3	4	5
I am concerned about global climate change	1	2	3	4	5
We should use more renewable energy to fulfill U.S. energy demands	1	2	3	4	5
We should use more wind energy to fulfill the U.S. energy demands	1	2	3	4	5
I am willing to support renewable energy even if it cost more than energy from fossil fuels	1	2	3	4	5
The use of fossil fuels for generating electricity is detrimental to the environment	1	2	3	4	5

7. What is your general attitude about wind energy now that the wind farm in your community exists?

1☐ Very negative 2☐ Negative 3☐ Neutral 4☐ Positive 5☐ Very positive 6☐ No opinion

8. What is your age? 1☐ 18 to 24 2☐ 25 to 34 3☐ 35 to 44 4☐ 45 to 54 5☐ 55 to 64 6☐ 65 to 74 7☐ 75 or older

9. Are you: 1☐ Male 2☐ Female

10. When do you most often see wind turbines? *(Check all that apply)*

1☐ When at home 2☐ When driving 3☐ When in town
4☐ When walking in the countryside 5☐ Never have seen them 6☐ Other _____

11. How much do you agree or disagree with this statement? Wind turbines symbolize a sign of progress in our modern energy crisis.

1☐ Strongly disagree 2☐ Disagree 3☐ Neutral 4☐ Agree 5☐ Strongly agree

12. I would be willing to support wind farms. *(Check all that apply)*

1☐ On my property 2☐ Within sight of my property 3☐ Within my community
4☐ Within Texas 5☐ Within the U.S. 6☐ I do not support wind farms

Provide any additional comments you feel are important that have not been addressed in this survey

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ABSTRACT

SOCIAL PERCEPTIONS OF WIND ENERGY IN TEXAS: THE NIMBY PHENOMENON

By Jeffrey Alan Swofford, M.S., 2009

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Dr. Michael Slattery, Director and Chair, Department of Environmental Science

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 7,115.66 total megawatts and an additional 1,651.35 megawatts under construction. With this rapid growth of wind energy capacity, it is important to achieve a better understanding of how wind energy is being perceived. This paper examines the social perceptions of wind energy in Texas and its associated environmental attitudes. The paper explores three main research strands: (i) describing the environmental attitudes of a population that is 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 correctly explains human perceptions of wind energy.