International Journal of Sustainable and Green Energy
2016; 5(5): 103-110
http://www.sciencepublishinggroup.com/j/ijsge
doi: 10.11648/j.ijrse.20160505.13

Social Attitudes of College Students Toward Wind Farm Development in South Texas

Qing Song[1], Jieming Chen[2], Adeshile Ajayi[1], Francisco Haces-Fernandez[1], Kai Jin[1], Hua Li[1, *]

[1]Department of Mechanical and Industrial Engineering, Texas A&M University-Kingsville, Kingsville, USA

[2]Department of Psychology and Sociology, Texas A&M University-Kingsville, Kingsville, USA

Email address:

qing.r.song@gmail.com (Qing Song), jieming.chen@tamuk.edu (Jieming Chen), adeshileajayi@yahoo.com (A. Ajayi), fr.haces@gmail.com (F. Haces-Fernandez), kai.jin@tamuk.edu (Kai Jin), hua.li@tamuk.edu (Hua Li)

[*]Corresponding author

To cite this article:

Qing Song, Jieming Chen, Adeshile Ajayi, Francisco Haces-Fernandez, Kai Jin, Hua Li. Social Attitudes of College Students toward Wind Farm Development in South Texas. *International Journal of Sustainable and Green Energy.* Vol. 5, No. 5, 2016, pp. 103-110.
doi: 10.11648/j.ijrse.20160505.13

Received: August 26, 2016; **Accepted**: September 8, 2016; **Published**: September 22, 2016

Abstract: In the last decades wind energy has enjoyed a rapid development and the endorsement from most of society. However, sometimes wind farms face skepticism from local residents and other stakeholders before and after installation. This paper reviews potential factor influencing public opinions on wind farms, and analyzes data from a survey carried out among college students in South Texas to search for empirical evidence of the opinion forming process about wind farms. The results show that it's important to analyze opposition to these installations and the reason that cause this rejection, because these factors could derail the projects despite wide general support even if the project is well developed. It also shows that people appear to be overwhelmingly supportive on the issue of whether to support wind farms in general. However, once the question is whether to support building a wind farm near one's home, the overriding concern is economic.

Keywords: Wind Energy, Wind Farm Development, Social Attitudes

1. Introduction

Wind energy, a clean and renewable form of energy, is gaining momentum across the world. It does not contribute to the greenhouse effect, does not consume water resources, and is in ample supply, making it a viable alternative to traditional fossil fuels. During the last decade, the net generation of wind energy in the United States has increased more than 15 times. In comparison, during the same period of time, the growth rate is 163% for solar, thermal and photovoltaic energy sources, 1% for wood fuels, and 11% for geothermal energy [1-3]. Wind energy industry is particularly significant in Texas, which has the largest installed capacity of wind farms in the United States, with an increase in wind energy generation on the past decade from 184 megawatts to 10,089 megawatts [4].

However, wind energy development has met with suspicion and even opposition from some sectors of the public, especially among those residents whose houses, properties or communities are near the planned new wind farms [5-6]. For instance, Pasqualetti [7] relates four cases of opposition to the installation of wind farms in very different locations: Palm Springs, California; Cape Cod, Massachusetts; Isle of Lewis, Scotland and the lowlands of Oaxaca in Mexico. In Palm Springs and Cape Cod the opposition steamed from the perception of local population that these installations would interfere with the natural beauty of the area and decrease its value as a tourist resort. In particular in Nantucket the legal battle on the implementation of the offshore wind farm lasted for nearly a decade before the U.S. government finally approved the project in 2010.

In the case of Isle of Lewis, in the United Kingdom, the opposition arose from local population fears that their very conservative and traditional way of living would be negatively impacted. The remoteness of the location of these islands has created a very particular and enclosed way of living. This distant island is a very good location for wind energy generation and it was assumed incorrectly that local population would have no problem accepting this new

economic activity in the area. However the treat of change combined with the fact that local population saw little economic benefit to them in this endeavor generated great local opposition for the project. In the end the project was not authorized by the authorities but it has not gone away definitively, because additional applications for a project in this area have been submitted.

Oaxaca is a very traditional area of Mexico, where historically local population has subsisted on agricultural production and where many of the social and political movements in the country have originated. When the first stages of wind energy projects were implemented there was little awareness on local population of the implications of this new activity. However, when realization came to the fact that they were receiving as rent for their agricultural properties less than 1/30 of the amount paid in the US and to the lack of general benefits for local towns, opposition grew, arguing that changing traditional economic activities was detrimental for the area. Some clashes with local population have taken place, even becoming physically violent. One of the opposition reasons more frequently cited is related to the lack of consultation and trust with wind developers and government [7].

Swofford [1] conducted a study in northern Texas related to the attitude of the public towards wind energy and found out general support for these projects. However, certain segments of the public indicated a negative opinion of wind farms, depending on the closeness of their home to the installation. Historically, there has been a tendency on public opinion and even on academic research to consider this opposition as part of the Not-In-My-Backyard (NIMBY) phenomenon, even though this concept has been considered discredited and unproductive by some researchers in past years. Swofford, on its part considers that the results point to a more complex phenomenon that requires further analysis and future research [8].

The NIMBY concept has been widely utilized over the last three decades and has modelled the debate related to opposition by local groups on new projects. Its use has become a pejorative to the opposing groups, indicating that their negative opinion stems from two possible sources: ignorance or selfishness. From this starting point the aim of researchers and developers is twofold, to educate the opposing party to make them change their erroneous opinion or to make them realize that they must abandon their egoism and allow the proposed project to develop for the public good [8].

Due to this negative connotation some researchers have proposed that the use of the term NIMBY be completely abandoned while other group has proposed expanding the term not to circumscribe it to the negative connotation. However, this could prove difficult due to the fact that when a local group oposes a new project they try to avoid at all cost to be labeled NIMBY going to the extreme of proposing a new label NIABY Not-In-Anybody's-Backyard, trying to prove that their motives are neither ignorant or selfish [8-11].

2. Factors Affecting Social Attitudes Toward Wind Farms

In light of previous research it has generally been agreed by existing literature that the perception of the public on wind farms is clearly an important issue that may facilitate or hinder the building of wind farms. In many countries wind farm projects are part of the national energy strategy, but at the time of implementation is necessary to consider each potential location, were meteorological and topological conditions are appropriate for this kind of installations, in addition to deciding how many of these facilities are needed all across very different geographical locations to achieve the national goal [12-14].

In this stage many factors come into play that could decide the fate of each particular wind farm project and in the end of the national strategy on renewable energy. Of particular importance is the regulatory process and permits for each location, issued in many cases by local or state authorities. These authorities are particularly susceptible to public opinion in their decision making process and when opposition manifest itself the issuance of an authorization or permit will have a negative prognosis [12-15].

When the land considered for these kinds of projects needs to be changed from agricultural or suburban use to wind turbine farm a modification of zoning regulations is required, with a favorable vote from local or state authorities. On these situations if opposition to the project exists it's very unlikely that changes be approved [12].

Local opinion is therefore relevant for these projects and the use of appropriate factors to measure possible opposition should be a part of all planned wind farm projects to increase the probability of success for the endeavor.

As previously indicated the growth of wind energy industry is very important for Texas, the largest state in the contiguous United States, with the largest installed capacity of wind farms, as previously indicated. Figure 1 shows the increase in wind energy generation on the past decade [2-4].

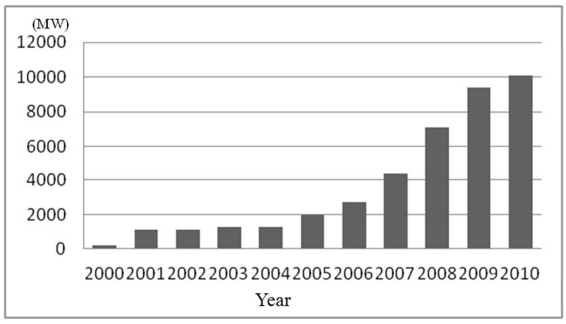

Figure 1. *Installed wind farm capacity in Texas (megawatts).*

Since Texas holds great potentials for further development of wind energy industry it is very important to perform additional research on attitudes of the public toward wind farms in Texas. Of great relevance is the opinion of local people in this state, which will be directly affected by future wind farm installations. Local characteristic make this state

unique and therefore it is necessary to perform research to ascertain the most relevant possible opposing opinions on this topic specific for this area [16].

One of the most important criteria that existing literature applies to measure public opposition on this topic is identifying the subjective evaluations of factors that causes people to oppose the installation of wind farms, as it can help wind energy companies prevent fierce and sometimes unproductive debates when selecting wind farm locations, and find the most effective way to negotiate with residents who do not support wind farms near their residence [1, 7].

The purpose of this paper is to conduct a preliminary analysis of social attitudes toward new wind farms using data from a social survey conducted in the region of South Texas and applying statistical analysis to examine the significance of these factors in the perceptions of the general public on wind farms. The research is guided by three major questions [17-20]:

1) What are the factors, either environmental or social and economic, or both, that influence people's perception of wind farms?
2) Are there significant differences among people's acceptance in general and acceptance of a wind farm if it were built near their home?
3) Are there social-demographic differences between those who support the wind farm and those who oppose it?

There have been ongoing debates on the social impacts of wind farms, including noise, visual impact, property value depreciation, employment and safety [2, 9]. Some studies consider these factors of no substantial significance [19-21], while others consider them having very negative impacts on people's acceptance of wind farms [9, 22-25]. The possible impacts of these factors to the public are reviewed in this section.

2.1. Noise Impact

Noise is defined by The Ontario Ministry of Environment as "unwanted sound" [14]. The noise impact of wind turbines affects its immediate neighbors and can be a major annoyance on people's lives [26]. Modern wind turbines are designed to keep the noise levels below 45dB at a distance of 350 meters, and the noise level is expected to drop to 35dB to 40dB at a distance of over 1000 meters [22]. However, atmospheric conditions, topographical effects, and ambient noise could complicate the above sound level with the possibility of a situation where a wind turbine generates less noise at its base than some distance away from the turbine [27].

Wind turbine noise is classified in two categories: mechanical noise and aerodynamic noise. Mechanical noise is generated by the moving components. Poor design or lack of maintenance may produce more noise [28]. Aerodynamic noise is caused by the flow air passing the blades of wind turbines, which is considered a major cause of noise impact although there is considerable controversy on existing literature about the actual consequences of this noise [9, 21, 26]. It has been argued that the low frequency of this noise or its periodicity may cause annoyance by disturbing normal sleep or causing degrading on normal daily life [21-22, 26-32]. It has been argued that the LFN is transmitted through the auditory nerves to the brain, and the brain interprets it as rumbling noise that irritates the people in that environment [24]. Pedersen studied the relationship between noise of wind turbines and its impact, claiming that people suffering the noise had medical symptoms such as headaches [18].

In terms of the health effect of the noises generated by wind turbines, annoyance is considered a primary health impact, although extensive controversy exist in literature about if this condition could be considered a disease and if so what would be the seriousness of this health condition [21, 25-26]. Because of these potential health impacts, people who live near a wind farm may feel uncomfortable and some authors have proposed to call this condition "Wind Turbine Syndrome." In order to prevent these impacts, many countries set guidance for wind farms from residence premises [25].

2.2. Visual Impact

Visual impact refers to the effect that the moving blades of wind turbines may produce to local residents sometimes called wind turbine shadow flicker, which is generated when the sun casts the shadow of the rotating blades on people outside their houses or on their windows [33]. The continuous movement of the shadow over the windows or their vicinity appears like a light bulb in the surrounding area has been covered and uncovered periodically, and this could be disturbing. Some opponents of wind farms believe that the shadow flicker may cause annoyance, headaches, and it may cause seizures in individuals who are epileptic [34]. However, the advocates of wind turbines argue that the statement that the above mentioned health problems are caused by wind turbines is baseless [34].

2.3. Depreciation of Property Value

Depreciation of properties close to wind farms has been cited by opponents of wind farms as another negative influence of the wind farm [17]. However, others argue that this is not always the case. Property prices rose in areas where the same piece of land can be used for both agriculture and wind farm. A study [17] carried out in 2003, which involved over 24000 properties; found out that there is no credible evidence that wind turbines have a negative impact on the value of any property when the distance between a property and the nearest wind turbine is at least 8km or 5miles. Although home owners who oppose wind turbines claim that wind farms have a negative impact on their livelihood and property value, it has been observed in some European countries that the perception of these home owners quickly changed from being negative to positive when they realized that they would benefit financially from the introduction of wind farms near their houses or community [17].

Hoen [35] conducted research which included data from almost 7,500 sales of homes located within ten miles of twenty four existing wind facilities in 9 states, using different models, finding out that there was no evidence of property value impacts due to the proximity to wind farms. This information would be very useful when locally promoting a wind farm in a community, because this is one of the most conspicuous misunderstandings about wind energy, and serious data obtained from rigorous research would be a great advantage [35-36].

2.4. Safety Impact

Although wind energy is much safer compared with other energy sources, there has been argued that wind turbines do pose some safety risks to those who work on these installations and those who find themselves near them. Some of the hazards that current literature attribute to wind turbines are listed as follows [39-45]: 1) Fall, 2) Electrocution, 3) Hazard of Moving Parts, 4) Ice Ball Throw, 5) Fire Hazards, 6) Structural Failure, and 7) Electromagnetic interference.

2.5. Landscape Beauty

One of the most frequent complains about wind farms is that these industrial installations degrade the natural beauty of the location, by interfering or completely blocking the view, which could be a major annoyance in tourist areas. In the opposition cases in Palm Springs, California and Cape Cod, Massachusetts, related on previous part of this paper, the main argument trying to challenge the projects rested in the degradation of the enjoyment of the natural area by visitors.

Nevertheless, there is also the opinion that wind turbines possess an intrinsic beauty akin to a sculpture or an artistic installation and that their presence and movement have a pleasant effect on the environment. Some studies have indicated that the color in which wind turbines are painted, the size of the wind farm, the layout and mitigation measures can improve negative visual perception on these installations and improving their acceptance by local community [19-20]. However, it's important to highlight that the support of the local community, related to visual impact, is related to the information provided to the local community, the opportunity to provide feedback and to organize in a way that the perception of local participation on the decision making process is enhanced thru community groups and collaboration [9]. However, due the large size of modern wind turbines these installations are perceived by some people to have a negative impact on the beauty of the landscape.

2.6. Damage to Wildlife

One of the most frequently cited opposition causes for wind turbine installation is the possible damage to wildlife. Many reports have been published about bats and birds, some of them protected species, which are hurt or killed by the moving blades or about interference with migratory patterns of some species due to the blockage of wind farms. Great controversy exits in this topic and certainly more research is needed to evaluate the real impact of wind energy on wildlife [43-45]. Some studies indicate that its necessary to take into account not only the damage from direct hits to wildlife but also the injuries that they receive caused by the turbulence from the wind turbines. There is also important to consider how wind farms cause changes on migrating patters that could disrupt the reproduction cycle of some species.

3. Research Methodology

Based on the literature review, all the impacts from wind turbines are either weak or can be prevented. Therefore, it is important inform the public. However, what is clear that perceptions of the public do matter, and there is no well-established consensus regarding the positive and negative impacts of wind farms [43-45].

The experimental design has been developed to meet three main objectives: 1) to investigate the attitudes of college students toward new wind farms in South Texas; 2) to find the significant factors that affect college students' attitude toward new wind farms; and 3) to examine whether college students of different social, cultural, and economic backgrounds differ in their attitudes toward wind farms in general, and any possible new wind farm near their homes.

3.1. Survey Design

Data used in this report are from a social survey conducted in the region of South Texas. The survey instrument consists of multiple questions regarding people's opinion about wind farms in general and the wind farm near one's home in particular. More specifically, the respondents are asked whether they support the building of wind farms in general, if so, whether they support the building of wind farms near their homes. For those who express an opinion on the wind farm, they will be asked of whether a number of factors, including noise, visual impact, health impact, safety impact, depreciation of property value, depreciation of landscape beauty, and electromagnetic interference, are the reason they develop their opinion. A short description has also been provided to explain each factor in the questionnaire in case the respondent is not very familiar with the factor. In addition, a number of questions are developed to gauge the socioeconomic background of the respondents, such as age, gender, marital status, education. The sampling design is largely accidental sampling, and the results convenience sample. Most of the respondents are college students and staffs at a 4-year university in South Texas. Since most of the students and staffs in this university actually come from South Texas, the authors believes that the survey responses could be used to represent the college students from South Texas. The resulting sample, after removing invalid answers and missing cases, is 300. The subject justification for the respondents on this test is related to the advantages of using students in pilot empirical studies before they are conducted in wider environments [46-47].

3.2. Data Analysis

Two sets of analyses were carried out and are reported in this paper. First, factors that influence people opinion on the wind farm in general are investigated. Both socio-demographic factors and perceived impacts of wind farms were included in logistic regression of whether the respondents support the wind farm. The second set of analysis included the same sets of independent variables in the analysis, with the support of the wind farm near home as the dependent variables. The results would reveal the extent these different factors influence people's opinion on the wind farm, and whether people's opinion changes when the hypothetical wind farm is to be built near the respondent's home.

4. Results and Discussion

4.1. Sample Description

The basic characteristics of respondents are presented in Table 1. Of the 300 respondents, 56.8% are male and 43.2% are female. As the survey was carried out in South Texas, more than 70% of the respondents were of Hispanic descent. As since most of the respondents were college students and university staffs in physical plant department, the average age is 23.8. For the same reason, 80.6% are not married, and the highest education level for 63.3% is high school.

4.2. Attitudes Toward Wind Farms

According to the survey, most people hold positive attitude toward wind farms. Of all the respondents, 76% support building wind farms, while only 3% express negative viewpoint. However, when the questions become whether the respondents support wind farms if they are to be built near their homes, there is substantial decline of support. Only 39% are positive about building a wind farm near their homes. This pattern is similar to the so-called NIMBY syndrome. In other words, people support for new wind farms in general. However, if the wind farms are to be built near one's home, much of the support vanishes.

Table 1. *Basic Characteristics of Respondents.*

Gender		**Ethnicity**			**Education (degree received)**			
Male	Female	Hispanic	Others		High school	Associate	Bachelor	Master or higher
56.8%	43.2%	71.5%	28.5%		63.3%	13.9%	10.4%	12.4%
Annual Household Income							**Average Age**	
<$1K	$1k-$10K	$10K-$30K	$30K-$50K	$50K-70K	$70K-$90K	>$90K	23.8	
11.6%	11.3%	24.1%	17.8%	12.5%	10.6%	12.1%		

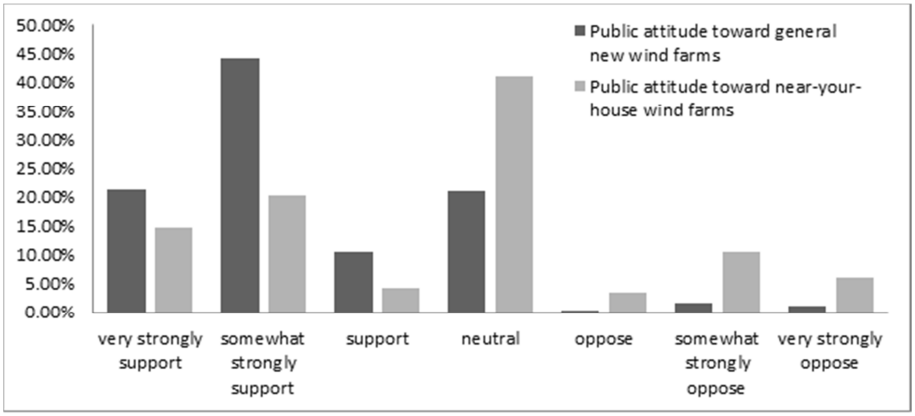

Figure 2. *Public attitude toward installation of new wind farms.*

4.3. Factors that Affect Opinion About Wind Farms in General

Do socio-demographic variables explain people's opinion on wind farms in general? What impacts of the wind farms, real or perceived, determine whether people support or oppose wind farms? To answer these questions, logistic regression analysis with three different models were conducted. In the first model, demographic variables were used as predictors in the logistic model in which the binary dependent variable is whether the respondent supports building wind farms in general. In the second logistic regression model, only perceived wind farm impact factors were put into the equation. In the third model, both demographic variables and impact factors were added in the equation. The first model investigates whether people of different background differ in their opinion on wind farm in general. The second model helps to determine what perceived impacts of the wind farm influence people's opinion. The last model examines the relative importance of these two sets of factors in explaining people's opinion on wind farms. The results of the analyses are presented in Table 2.

The socio-demographic variables included in model 1 are: household income, level of educational attainment, marital status, age, and gender. Of all the variables in the model, not single one is statistically significant. The results suggest that the support for wind energy industry in general cuts across age, gender, marital status, and socioeconomic status. For

model 2, the potential impact variables included are: noise, visual impact, health concern, safety concern, property value change, landscape impact, and electromagnetic impact. Of all these variables, only health concern variable is statistically significant, suggesting that the major reason for opposition of the wind farm is the concern of negative impact, either real or imagined, that wind turbines may produce [48].

Table 2. *Effects of factors determining support for general wind farm logistic regression.*

Variable	Odds Ratio		
	1st model	2nd model	3rd model
Demography			
House income	1.01		1.01
Education	1.29		1.31
Marital	0.97		0.79
Age	1.17		1.18
Hispanic	1.33		1.44
Male	1.64		1.56
Wind farm impacts			
Noise		0.86	0.82
Visual		0.92	0.97
Health		0.47**	0.47*
Safety		1.47	1.87
Property		1.37	1.23
Landscape		0.71	0.67
Electromagnetic		1.31	1.09
LR chi2	8.53	7.07	14.78

* p < 0.1, ** p < 0.05, *** p < 0.01

For health concern variable, the odds ratio of 0.47 indicates that those who harbor health concern about the wind farm are only about half as likely to support the wind farm as those who do not have such concern. The effect of health concern persists even after the socio-demographic variables are put into the equation, as shown in model 3.

4.4. Factors that Affect Opinion About Wind Farms Near Home

As revealed in the descriptive analysis, whereas the support for the wind far industry in general is strong among the respondents, such support for building wind farms near one's home drops substantially. If assuming that the support (or non-support) of wind farm in general is based on some abstract principles, it stands to reason that different sets of factors are play when express their opinion on whether they support the building of wind farms at their "back yard." The results of logistic regression on support on wind farms near one's home (Table 3) provide strong support for the reasoning.

Similar to what we did on support of wind farms in general, we generated three logistic regression models to investigate whether socio-demographic variables and perceived impacts of wind farms can any explanatory power on wind farm near home. For socio-demographic variables, household income becomes a statistically significant ($p < 0.05$). The odds ratio of 0.85 suggests that the higher the income, the less likely the respondent support building a wind farm near his or her home. In other words, people of higher income are less willing than those of lower income to see a wind farm built near their homes.

Economic logic also seems to be the most salient factor among perceived impacts of wind farms near home [49]. The results in model 2 show that those who are concerned about the property value are always twice as much likely (odds ration = 1.83, $p < 0.05$)

Table 3. *Effects of factors determining support for near-your-house wind farm logistic regression.*

Variable	Odds Ratio		
	1st model	2nd model	3rd model
Demography			
House income	0.85**		0.82**
Education	0.92		0.94
Marital	1.16		1.08
Age	1.08		1.07
Hispanic	1.09		1.27
Gender	1.27		1.22
Wind farm impacts			
Noise		0.80	0.77
Visual		0.78	0.64
Health		0.84	0.84
Safety		0.68	0.76
Property		1.83**	2.25**
Landscape		0.65	0.56*
Electromagnetic		0.95	0.90
LR chi2	6.64	10.48	18.33

* p < 0.1, ** p < 0.05, *** p < 0.01

as those who not concerned about property value to support the wind farm near their homes, which means they don't think building wind farm near their home will decrease the property value.

In the third model, both variables of household income and property value continue to be statistically significant. In addition, concern about landscape also becomes significant, in that the more concerned about landscape beauty, the less likely one would lend support for building a wind farm near home (odds ratio = 0.56, $p < 0.05$).

5. Conclusion

A survey of pilot study nature was conducted on the attitudes of college students toward new wind farms in South Texas. Potential wind farm impacts factors were listed in the survey instrument to gauge whether the potential impacts of wind farms, some are and some are perceived, change people's opinion on wind farms. In addition, the survey instrument also records the socio-demographic background information of the respondents. Through both descriptive and multivariate analyses, our results can be summarized as follows.

1) Most respondents in the sample hold positive opinions on wind farms. The proportion of those who support wind farms in general is substantially higher than the proportion of those who support wind farm near one's home. Furthermore, even for the hypothetical question of whether they support wind farms near their homes, the opponents account for only about

20% of the whole sample.

2) Multivariate analysis of effects of socio-demographic and wind farm impacts variables on the binary variable of whether the respondent supports wind farms in general indicates that only health concern is a significant factor in affecting people's opinion on wind farms in general.
3) When the dependent variable is whether to support wind farm near one's home, the results of multivariate analysis suggest the overriding concern becomes economic. Those of higher income do not lend support to building a wind farm near home as much as those of lower income; among potential impact variables, those who are concerned about property value are twice as likely to support building a wind farm near their homes. Concern on landscape also appears to be significant predictor.

Given the relatively small sample size, and the way the data are collected, it should be cautioned that the results presented in this paper are preliminary. However, the results suggest some interesting patterns. On the issue of whether to support wind farms in general, people appear to be overwhelmingly supportive. The only concern is the potential health impacts. However, once the question is whether to support building a wind farm near one's home, the overriding concern is economic in nature [50]. The results reported in this paper can serve as pilot study to for future research of larger scale and more rigorous methodology.

Acknowledgements

The authors are grateful to the financial support from an internal funding provided by Frank H. Dotterweich College of Engineering at Texas A&M University-Kingsville.

References

[1] J. Swofford and M. Slattery, Public attitudes of wind energy in Texas: Local communities in close proximity to wind farms and their effect on decision-making. Energy policy, 38(5), 2508-2519, (2010).

[2] M. Wolsink, Wind power implementation: the nature of public attitudes: equity and fairness instead of 'backyard motives'. Renewable and sustainable energy reviews, 11(6), 1188-1207, (2007).

[3] United States Energy Information Administration. Electric Power Monthly. 2011. http://www.eia.gov/cneaf/electricity/epm/epm_sum.html, retrieved on October 2013.

[4] U. S. Department of Energy. Wind Powering America: Installed U.S. Wind Capacity and Wind Project Locations. 2011. Retrieved on October 2013, http://www.windpoweringamerica.gov/wind_installed_capacity.asp.

[5] T. M. Groth and C.A. Vogt, Rural wind farm development: Social, environmental and economic features important to local residents. Renewable Energy, 63, 1-8, (2014).

[6] N. Hall, P. Ashworth, and P. Devine-Wright, Societal acceptance of wind farms: Analysis of four common themes across Australian case studies. Energy Policy, 58, 200-208, (2013).

[7] M. J. Pasqualetti, Opposing wind energy landscapes: a search for common cause. Annals of the Association of American Geographers, 101(4), 907-917, (2011).

[8] K. Burningham, 'Using the language of NIMBY: A topic for research, not an activity for researchers', Local Environment, 5 (1), 55-67, (2000).

[9] P. Devine‐Wright, Beyond NIMBYism: towards an integrated framework for understanding public perceptions of wind energy. Wind energy, 8(2), 125-139, (2005).

[10] P. Devine-Wright, 'Explaining "NIMBY" Objections to a Power Line: The Role of Personal, Place Attachment and Project-Related Factors', Environment and Behavior, 45 (6), 761-81, (2013).

[11] M. Aitken, 'Why we still don't understand the social aspects of wind power: A critique of key assumptions within the literature', Energy Policy, 38 (4), 1834-41, (2010).

[12] S. Agterbosch, P. Glasbergen, and W. J. V. Vermeulen, 'Social barriers in wind power implementation in The Netherlands: Perceptions of wind power entrepreneurs and local civil servants of institutional and social conditions in realizing wind power projects', Renewable and Sustainable Energy Reviews, 11 (6), 1025-55, (2007).

[13] S. Breukers and M. Wolsink, 'Wind power implementation in changing institutional landscapes: An international comparison', Energy Policy, 35 (5), 2737-50, (2007).

[14] J. B. Graham, J. R. Stephenson and I. J. Smith, 'Public perceptions of wind energy developments: Case studies from New Zealand', Energy Policy, 37 (9), 3348-57, (2009).

[15] C. Gross, 'Community perspectives of wind energy in Australia: The application of a justice and community fairness framework to increase social acceptance', Energy Policy, 35 (5), 2727-36 (2007).

[16] R. S. Erikson, J. P. McIver and G. C. Wright Jr, State political culture and public opinion. The American Political Science Review, 797-813 (1987).

[17] G. Sterzinger, F. Beck and D. Kostiuk. The effect of wind development on local property value. (2003). Retrieved on October 2013, http://www.repp.org/articles/static/1/binaries/wind_online_final.pdf.

[18] E. Pedersen, Health aspects associated with wind turbine noise - Results from three field studies. Noise Control Engineering Journal; 59 (1): 47–53 (2011).

[19] I. D. Bishop, What do we really know? A meta-analysis of studies into public responses to wind energy. In World Renewable Energy Congress, Linköping University Electronic Press, Linköping, Sweden (pp. 4161-4169) (2011).

[20] R. Wüstenhagen, M. Wolsink and M. J. Bürer, Social acceptance of renewable energy innovation: An introduction to the concept. Energy policy, 35(5), 2683-2691, (2007).

[21] Ministry of the Environment of Ontario. Interpretation for Applying MOE NPC Technical Publications to Wind Turbine Generators. (2004). Retrieved on October 2013, http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/std01_079435.pdf.

[22] D. J. Alberts. Addressing wind turbine noise. (2006). Retrieved on October 2013, http://www.maine.gov/doc/mfs/windpower/pubs/pdf/AddressingWindTurbineNoise.pdf.

[23] D. Colby, R. Dobie, G. Leventhall, D. M. Lipscomb, R. J. McCunney, M. T. Seilo and B. Sondergaard, Wind turbine sound and health effects: An expert panel review. Prepared by American Wind Energy Association and Canadian Wind Energy Association (2009)/

[24] British Wind Energy Association. Low Frequency Noise and Wind Turbines Technical Annex. 2005. http://www.bwea.com/pdf/lfn-annex.pdf, retrieved on October 2013.

[25] J. M. Ellenbogen Jeffrey, Wind Turbine Health Impact Study: Report of Independent Expert Panel. (2012). http://www.mass.gov/dep/energy/wind/turbine_impact_study.pdf, retrieved on October 2013.

[26] L. S. Kim, W. Choi, Annoyance caused by amplitude modulation of wind turbine noise. Noise Control Engineering Journal; 59 (1): 38–46 (2011).

[27] Acoustic Ecology Institute. Wind energy noise impacts. 2009. Retrieved on October 2013, http://www.acousticecology.org/docs/AEI%20Wind%20Turbine%20Noise%20FactSheet.pdf.

[28] DBSM Jane, R. H. Davis, Noise pollution from wind turbine, living with amplitude modulation, lower frequency emissions and sleep deprivation. Second International Meeting on Wind Turbine Noise (2007).

[29] B. Horner, R. D. Jeffery and C. M. Krogh, Literature Reviews on Wind Turbines and Health Are They Enough?. Bulletin of Science, Technology & Society, 31(5), 399-413, (2011).

[30] D. Shepherd, D. McBride, D. Welch, K. N. Dirks and E. M. Hill, Evaluating the impact of wind turbine noise on health-related quality of life. Noise and Health, 13(54), 333 (2011).

[31] E. P. Torrance and K. Goff, A quiet revolution. Engineering and Technology; 10:44-7 (2009).

[32] R. Asfahl, C. Ray, D. W. Rieske, Industrial safety and health management (6th edition). Upper Saddle River, New Jersey: Prentice Hall; (2010).

[33] R. G. Sullivan, B. L. Kirchler, T. Lahti, S. Roché, K. Beckman, B. Cantwell, B. and P. Richmond, Wind Turbine Visibility and Visual Impact Threshold Distances in Western Landscapes. Argonne National Laboratory, USA, 1-47 (2011).

[34] Thomas Priestley. An introduction to shadow flicker and its analysis. 2011. http://www.windpoweringamerica.gov/pdfs/workshops/2011/webinar_shadow_flicker_priestley.pdf, retrieved on October 2013.

[35] B. Hoen, The impact of wind power projects on residential property values in the United States: A multi-site hedonic analysis. Lawrence Berkeley National Laboratory (2010).

[36] B. Hoen, B, A spatial hedonic analysis of the effects of wind energy facilities on surrounding property values in the United States. Lawrence Berkeley National Laboratory, (2014).

[37] M. Ragheb, Safety of wind systems (2011).

[38] P. Atkinson, Securing the safety of offshore wind workers. Renewable Energy Focus, 11(3), 34-36 (2010).

[39] S. Uadiale, E. Urbán, R. Carvel, D. Lange and G. Rein, Overview Of Problems And Solutions In Fire Protection Engineering Of Wind Turbines (2014).

[40] C. Morgan, E. Bossanyi and H. Seifert, Assessment of safety risks arising from wind turbine icing. In EWEC-Conference-(Pp. 141-144). Bookshop for Scientific Publications (1997).

[41] Confederation of Fire Protection Associations in Europe (CFPA E). Wind Turbines fire protection guidelines. Guideline CFPA E 22:2010 F. April 2010, (2010).

[42] F. Krug, B. Lewke, Electromagnetic Interference on Large Wind Turbines. Energies 2009; 2: 1118-1129 (2009).

[43] A. L. Drewitt and R. H. Langston, Assessing the impacts of wind farms on birds. Ibis, 148(s1), 29-42 (2006).

[44] E. Binopoulos, P. Haviaropoulos, Environmental impacts of wind farms: myth and reality. Centre for Renewable Energy Sources, (2006). http://www.cres.gr/kape/publications/papers/dimosieyseis/ CRESTRANSWIND ENVIRONMENT.doc, retrieved on October 2013.

[45] D. Y. Leung and Y. Yang, Wind energy development and its environmental impact: A review. Renewable and Sustainable Energy Reviews, 16(1), 1031-1039, (2012).

[46] J. Carver, L. Jaccheri, S. Morasca, S. and F. Shull, Issues in using students in empirical studies in software engineering education. In Software Metrics Symposium, September 2003. Proceedings. Ninth International. IEEE. (pp. 239-249), (2003).

[47] M. Höst, B. Regnell and C. Wohlin, C. Using students as subjects-a comparative study of students and professionals in lead-time impact assessment. Empirical Software Engineering, 5 (3), 201-214, (2000).

[48] J. B. Jacquet, Landowner attitudes toward natural gas and wind farm development in northern Pennsylvania. Energy Policy, 50, 677-688, (2012).

[49] J. K. Kaldellis, et al., Comparing recent views of public attitude on wind energy, photovoltaic and small hydro applications. Renewable energy, 52, 197-208, (2013).

[50] Renewable Energies and European Landscapes. Lessons from Southern European Cases. Editors: Frolova, Marina; Prados, María-José; Nadaï, Alain (Eds.). Springer (2015).