

Public Attitudes Toward Wind Energy in Coastal North Carolina:
A Systematic Survey

By

Dennis O. Grady, Ph.D.
and
Kelly A. Cousino
Appalachian State University Energy Center

February 26, 2004
North Carolina Energy Policy Council

The authors invite questions or comments and may be reached at gradydo@appstate.edu or 828-262-7515. The research was conducted under contract # 02-SPP-BLS for the NC State Energy Office. All errors in fact or interpretation belong solely with the authors.

Introduction

Within the last couple of years, wind analysis has discovered significant electricity generation potential along the eastern North Carolina coastal region. Just as in the mountainous western part of the state, public opinion will play a significant role in determining whether or not a wind industry can be established. To determine the breadth of attitudes toward coastal wind turbine placement, the Appalachian State University Energy Center undertook a scientifically valid and reliable public opinion survey of the residents of the eighteen coastal North Carolina counties with utility scale wind potential.

Sampling Procedures and Survey Mechanics

The survey instrument may be found in Appendix 1. It contains three sections. First are forced choice questions on attitudes toward general energy issues. This section is followed by specific wind turbine placement questions. The final section identifies demographic information of the respondents.

The population of interest is all residents of eastern North Carolina's 18 coastal counties. This is approximately 800,000 residences. Using the most comprehensive and current source of residential telephone numbers available on the market (InfoUSA), a systematic, proportional sample from each of the eighteen counties was selected. This yielded a sample frame of 3,716 residential telephone numbers, from which 404 completed surveys were obtained. This provided a 95% confidence interval with a degree of precision of +/- 4% for the region (inferring to individual counties would not be possible from this sample).

The survey was conducted during an eight-week period from mid-October to mid-December 2003. Calls were conducted from 6:00pm to 9:00pm on Monday through Thursday. The survey instrument was pre-tested, telephone interviewers were trained, and Spanish language translators were available if needed. All calls were made from the Appalachian Regional Development Institute under supervised conditions.

Demographics of Respondents

Appendix 2 lists the number of respondents by county. In this section of the report, we will examine the profile of the individuals providing opinions on developing wind potential in coastal North Carolina.

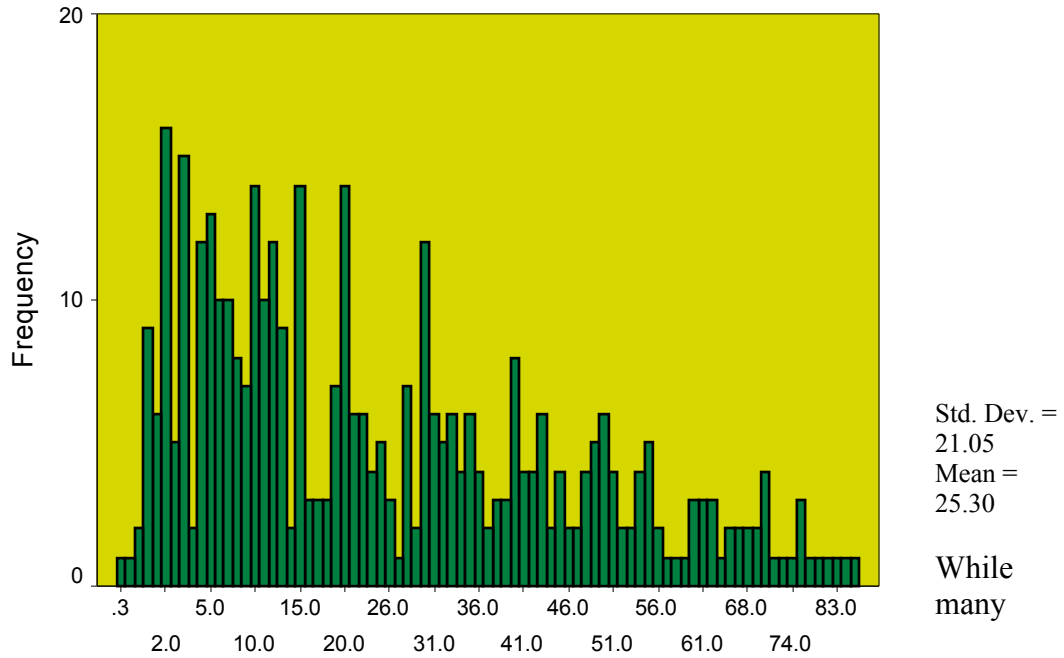
Figure 1



As the histogram shows, the average age of the 394 respondents willing to divulge this information is approximately fifty years old. The distribution is fairly normal, with ages ranging from eighteen to ninety-seven. The respondents are primarily middle-aged, which reflects a characteristic of the overall population.

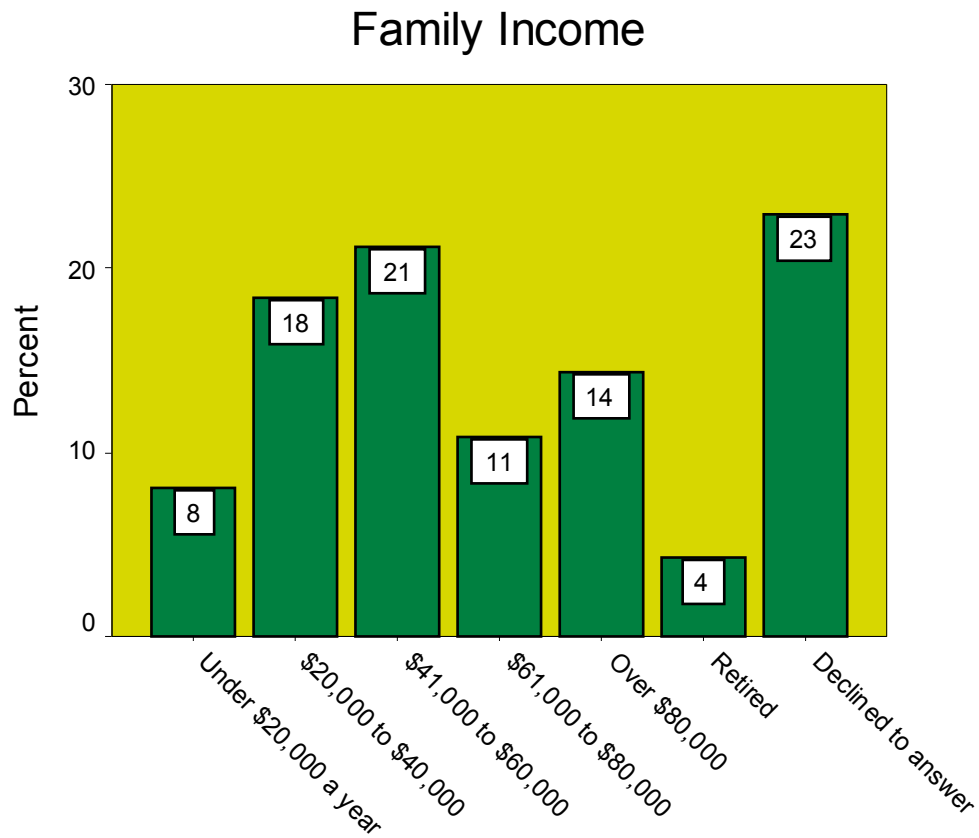
Figure 2

Years Living in Eastern NC



respondents have lived in eastern North Carolina for a relatively short amount of time, the overall average is approximately twenty-five years. Approximately half of the respondents are native to the area and have lived in the region their entire lives while the remainder have moved in relatively recently with a clustering under ten years of residency.

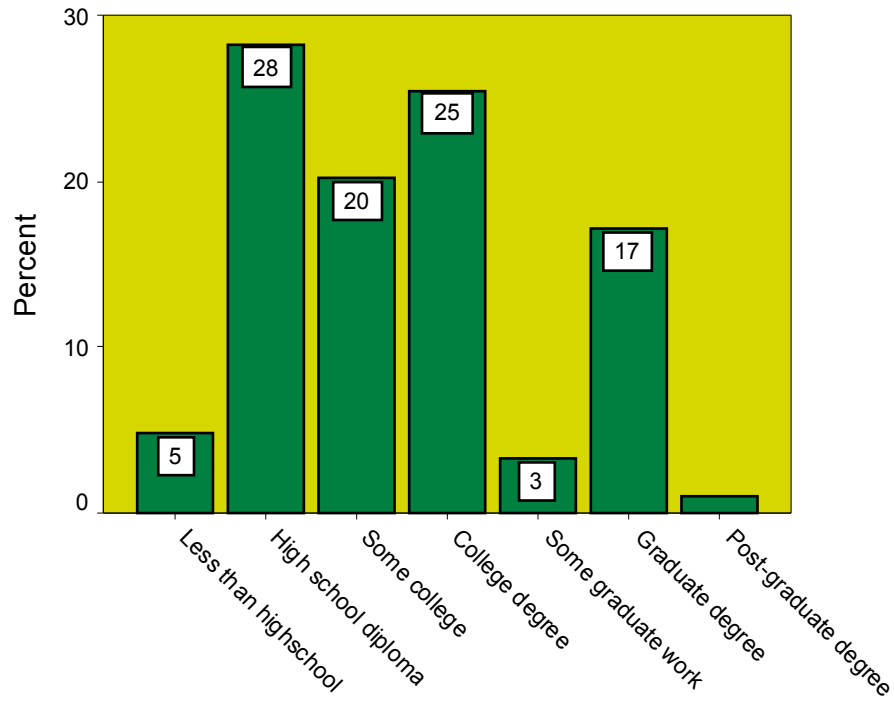
Figure 3



Approximately seventy-five percent of the respondents reported on their annual family income. Of these, the modal response was an income between \$41,000 and \$60,000 per year. Overall, nearly half (46.78%) of the respondents reported annual incomes of less than \$60,000 per year. Fewer than fifteen percent of respondents reported incomes in the highest bracket. In general, this distribution for family income is slightly higher than the regional average, which ranges between \$35,000 - \$40,000.

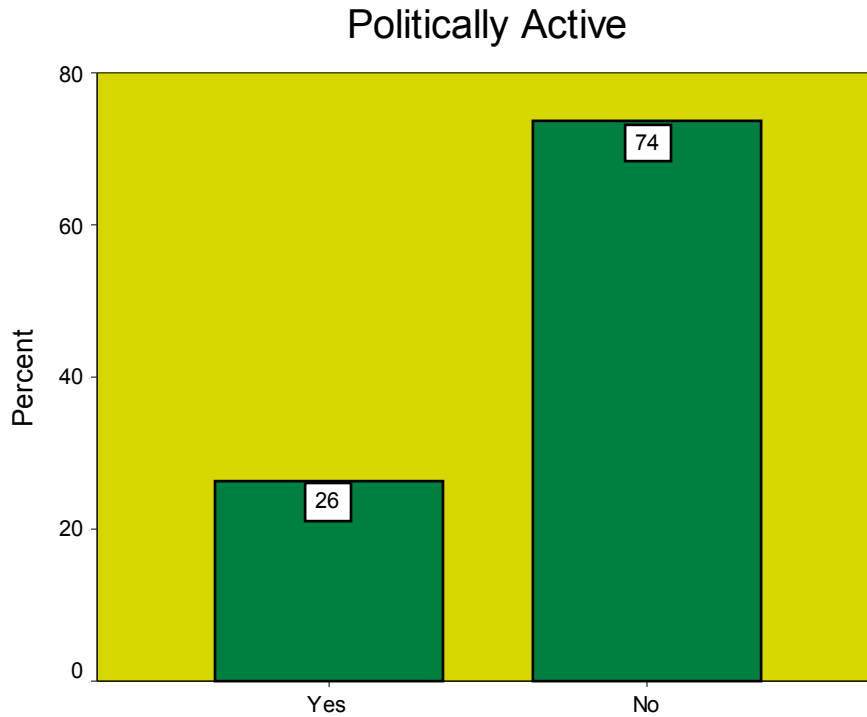
Figure 4

Highest Level of Education



This chart indicates that the sample is relatively well educated, with two out of three respondents (66%) having some education beyond high school.

Figure 5



In Figure 5, we report on the responses

to the question, “Have you ever attended a County Commission meeting to voice a concern over an issue?” If the respondent answered affirmatively, we then followed up with asking what issue they addressed. The purpose of this item was to assess how civically engaged the respondents were. As the Table indicates, approximately one in four reported appearing before their County Commission to address a specific concern.

Table 1

Other Pertinent Characteristics of Respondents	
Percent Female	53.7
Percent Homeowners	82.5
Percent NC Voters	83.6
Percent Permanent Residents	96.5
Percent Having Seen Utility Turbine	33.4

The demographic data indicate a largely permanent group of homeowners who are middle-aged, with middle incomes and educational experience beyond high school. One-third of the respondents have seen a modern, utility scale wind turbine.

Attitudes Toward Energy Issues

As a method for getting respondents to focus on the primary question of concern, attitudes toward wind energy development along the coast, the first series of questions request their opinions on a number of energy related topics. This allows the respondent to begin thinking in general terms about energy issues and also serves to assess their general attitudes toward energy/economy/environment tradeoffs.

Table 2

Issue	% No Interest	% Some Interest	% Great Interest
Effects of burning fossil fuels on the environment	16.6	52.5	30.9
The cost of electricity to you as a consumer	3.7	17.8	78.5
The reliability of your energy supply	4.0	21.5	75.0
The importation of foreign oil	10.9	33.7	55.4
Nuclear plant safety and waste disposal	7.4	26.5	66.1

As a group, the respondents expressed very practical, pragmatic views toward these tradeoffs. Their primary concern was the cost of electricity followed closely by its reliability. The third ranked issue was nuclear power safety, with importation of oil and environmental pollution relatively distant concerns.

The next series of questions concerned the desired fuels for the future generation of electricity in the future. They were probed as to whether more, the same, or less of our future electricity should come from the most common fuel options. Their responses are the following.

Table 3

Energy Source	%Wanting Less	% Same	% Wanting More	% Don't Know
Coal	44.8	18.1	17.8	19.3
Nuclear	27.2	23.5	36.1	13.1
Hydroelectric	4.7	14.9	71.8	8.7
Natural Gas	16.6	26.0	49.0	8.4
Solar	4.0	5.4	86.4	4.2
Wind	5.9	8.9	77.5	7.7

In general, these respondents did not wish to see a greater reliance on coal as the primary source of fuel for generating electricity in the future. Fewer than half wished to see an expansion of natural gas usage, which has been the primary fuel for new power generation plants in recent years. Clearly, these residents would like to see more reliance on renewable sources of electricity with solar leading the list at over 86%, followed by wind and hydroelectric. Granted, these opinions are not necessarily informed since neither price considerations nor technical issues were raised within the survey. Nonetheless, it is clear that in the abstract, renewable energy development is highly desired by this sample even though the previous question did not indicate that this group was particularly concerned about the environmental or foreign policy implications of fuel choices.

Attitudes Toward Coastal Turbine Placement

The next series of questions pertained specifically to the placement of wind turbines in various locations on or near the coast. The respondents were probed as to whether or not turbines should be prohibited on the coastal mainland, in the sounds, offshore, clustered together (defined as ten or more) in these locations, in national forests, near their own homes, and on an individual's personal property for his/her own use. Table 4 presents the results.

Table 4

Placement	% Prohibited	%Not Prohibited	%Don't Know
Mainland	11.9	72.8	15.3
Mainland Clustered	14.1	69.6	15.1
Sounds	16.6	63.6	19.8
Sounds Clustered	28.0	50.2	20.5
Offshore	13.9	68.6	17.6
Offshore Clustered	14.4	68.6	15.8
National Forests	36.6	45.8	17.6
Visible from Home	20.0	66.6	12.4
With Other Towers	17.3	69.3	12.1
A Residential Turbine	6.2	90.1	2.5

The results for the whole sample indicate, with the exception of national forests and clustered in the sounds, there is large support for placing turbines in all the coastal locations identified. It is clear that the respondents were overwhelmingly supportive of individuals erecting a turbine for residential use. Close to seven in ten supported

placements on the mainland, offshore, and with other preexisting towers. Somewhat surprisingly, this support does not diminish significantly when asked about clustering in these locations.

It could be argued that the respondents did not really understand the nature of the turbine being considered and, therefore, these opinions are not relevant to the reality of modern utility scale turbines. In an effort to address this potential threat to the validity of the data, respondents were asked prior to this series of questions, if they had seen a modern turbine in operation. If they responded affirmatively, they were then asked where this had been. Slightly over a third of the respondents identified locations where modern turbines can be found, places such as Texas, California, or Germany.

Informed Opinion

Tables 5 through 8 display the same results controlling for the respondents' experience with seeing a modern turbine in operation.

Table 5

		Placing turbines on coastal mainland should be prohibited or not		
		Prohibited	Not prohibited	Don't know
		Row %	Row %	Row %
Actually seen turbine	Not seen	12.6%	69.1%	18.2%
	Seen	10.4%	80.0%	9.6%

Table 6

		Should placing turbines in the Sounds be prohibited or not prohibited		
		Prohibited	Not prohibited	Don't know
		Row %	Row %	Row %
Actually seen turbine	Not seen	17.8%	60.2%	21.9%
	Seen	14.1%	70.4%	15.6%

Table 7

		Should placing turbines offshore be prohibited or not		
		Prohibited	Not prohibited	Don't know
		Row %	Row %	Row %
Actually seen turbine	Not seen	15.6%	63.6%	20.8%
	Seen	10.4%	78.5%	11.1%

Table 8

		Approve of turbines if they can be seen from your home		
		Yes, would approve	No, would not approve	Don't know
		Row %	Row %	Row %
Actually seen turbine	Not seen	63.8%	21.1%	15.1%
	Seen	74.1%	18.5%	7.4%

The results of Tables 5 through 8 are heartening to those who wish to see a wind industry develop in the coastal counties of North Carolina. Without exception, those who had actually seen a modern wind turbine were more supportive on all placement options than those who had not.

Concerned Opinion

Another way of viewing opinions is to assess how important or salient a person perceives the issue upon which he or she holds that opinion. Typically, the more salient the issue the more ardent or deeply felt the opinion is. One way of determining the issue saliency for these respondents is to recall the first item of the survey where the respondents were asked how closely they followed energy issues. Those who reported that they followed energy issues very closely would be assumed to have a greater interest and concern in that policy area. Tables 9 through 12 examine turbine placement controlling for the respondents' interest in energy policy.

Table 9

		Placing turbines on coastal mainland should be prohibited or not		
		Prohibited	Not prohibited	Don't know
		Row %	Row %	Row %
How closely you follow energy issues	Very closely	10.1%	77.5%	12.4%
	Sometimes	13.0%	73.9%	13.0%
	Rarely	10.6%	57.4%	31.9%
	Never	15.8%	68.4%	15.8%

Table 10

		Placing turbines in the Sounds should be prohibited or not		
		Prohibited	Not prohibited	Don't know
		Row %	Row %	Row %
How closely you follow energy issues	Very closely	16.3%	69.8%	14.0%
	Sometimes	17.4%	62.3%	20.3%
	Rarely	21.3%	59.6%	19.1%
	Never	.0%	52.6%	47.4%

Table 11

		Placing turbines offshore should be prohibited or not		
		Prohibited	Not prohibited	Don't know
		Row %	Row %	Row %
How closely you follow energy issues	Very closely	14.7%	72.1%	13.2%
	Sometimes	15.5%	67.6%	16.9%
	Rarely	10.6%	70.2%	19.1%
	Never	.0%	57.9%	42.1%

Table 12

		Approve of turbines if they can be seen from your home		
		Yes, would approve	No, would not approve	Don't know
		Row %	Row %	Row %
How closely you follow energy issues	Very closely	69.8%	22.5%	7.8%
	Sometimes	67.3%	20.5%	12.2%
	Rarely	66.7%	11.1%	22.2%
	Never	57.9%	21.1%	21.1%

Tables 9 through 12 reveal that those most interested in energy issues are the most supportive for placing turbines along coastal areas. With support percentages nearing or exceeding 70% for all locations, it is clear that the most attentive public is clearly the most supportive of wind energy development along the coast.

Civically Active Opinion

Another way of viewing the importance of a person’s opinions is how readily they affect what that person might do. In other words, will a person take action based upon what he or she believes? To get at that dimension of attitudes toward turbine placement, respondents were asked if they had appeared before their county commissions in the past and for what reason. Figure 5 shows that approximately 25% of the respondents reported a commission appearance. Tables 13 through 16 examine turbine placement controlling for civic activism.

Table 13

		Placing turbines on coastal mainland should be prohibited or not		
		Prohibited	Not prohibited	Don't know
		Row %	Row %	Row %
Actively Attended	Yes	11.3%	79.2%	9.4%
	No	12.2%	70.9%	16.9%

Table 14

		Placing turbines in the Sounds should be prohibited or not		
		Prohibited	Not prohibited	Don't know
		Row %	Row %	Row %
Actively Attended	Yes	16.0%	67.9%	16.0%
	No	16.9%	62.5%	20.6%

Table 15

		Placing turbines offshore should be prohibited or not		
		Prohibited	Not prohibited	Don't know
		Row %	Row %	Row %
Actively Attended	Yes	11.3%	74.5%	14.2%
	No	14.9%	66.9%	18.2%

Table 16

		Approve of turbines if they can be seen from your home		
		Yes, would approve	No, would not approve	Don't know
		Row %	Row %	Row %
Actively Attended	Yes	68.9%	22.6%	8.5%
	No	66.9%	19.5%	13.7%

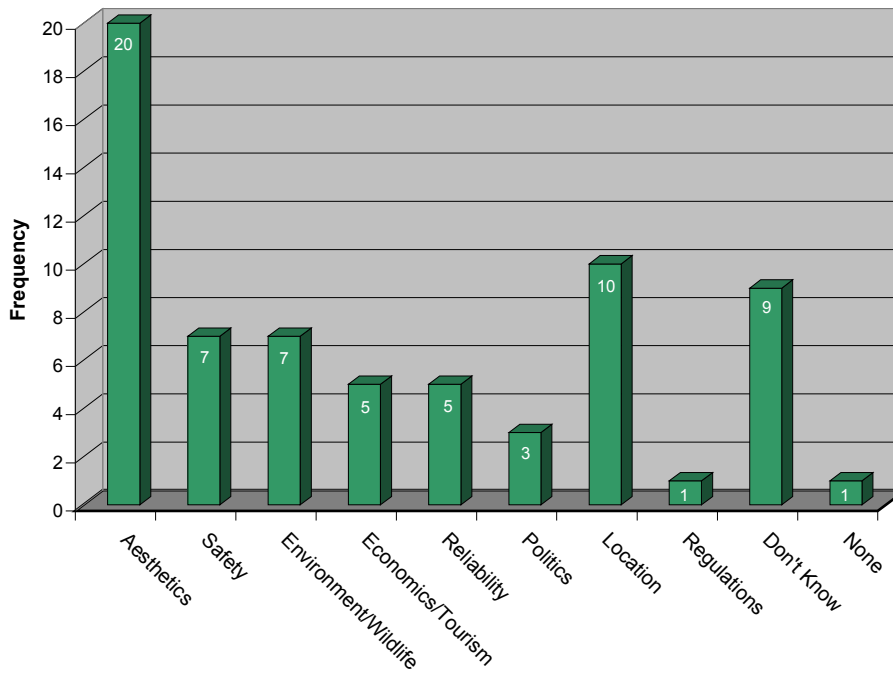
Again, in every placement category, the most civically active and engaged citizens had the most positive perception of turbine placement.

Problems with Developing a Wind Industry on the Coast

In order to get a more specific understanding of the problems the respondents would have with the placement of turbines along the coast, they were asked after every placement option to list in an open-ended fashion what those problems might be. Figures 6 through 9 display the categories of problems listed. Appendix 3 defines these problem categories.

Figure 6

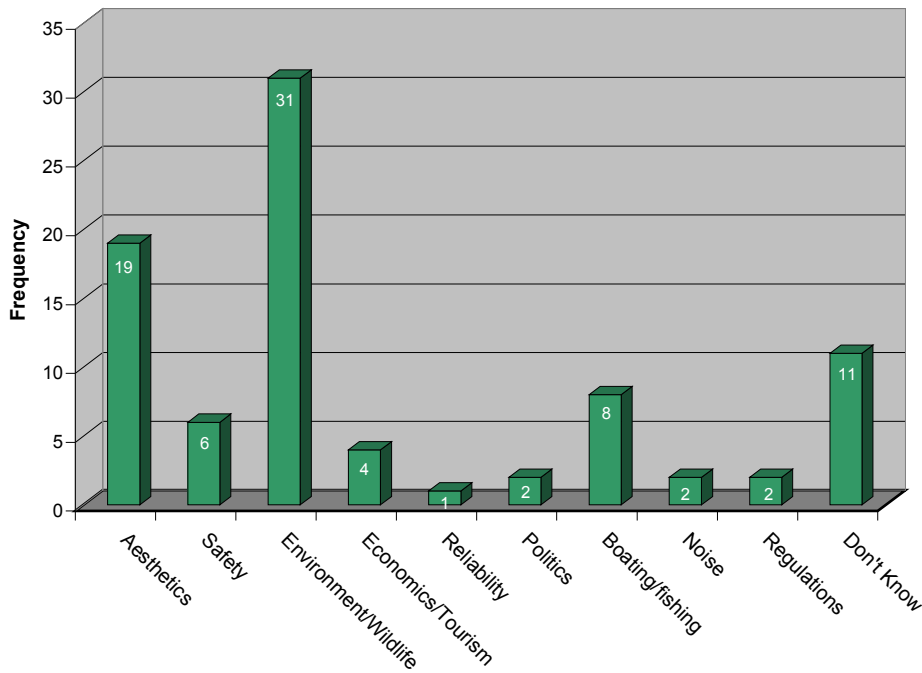
Mainland Problems



Of the 404 total respondents, 60 (approximately 15%) identified a problem with placing turbines on the mainland. As Figure 6 indicates, the major problems associated with placing turbines on the mainland are aesthetics and location, followed closely by safety and environment and wildlife. Of the minority of respondents who did articulate a problem with mainland placement, they expressed turbines marring their views of the landscape, and being built too closely to heavily populated areas.

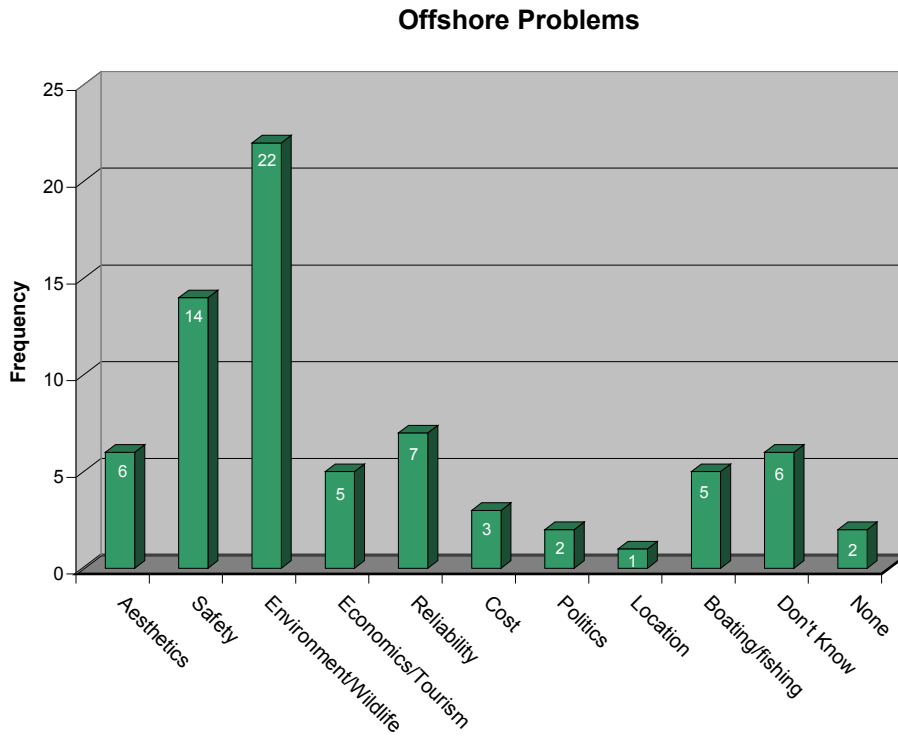
Figure 7

Sounds Problems



Eighty-two (just over 20%) of the 404 total respondents saw a problem with placing turbines in the sounds. As indicated in Figure 7, among the minority expressing a concern, the major concern with placing turbines in the sounds is for the environment and wildlife. People are also very concerned with turbines affecting their views of the landscape.

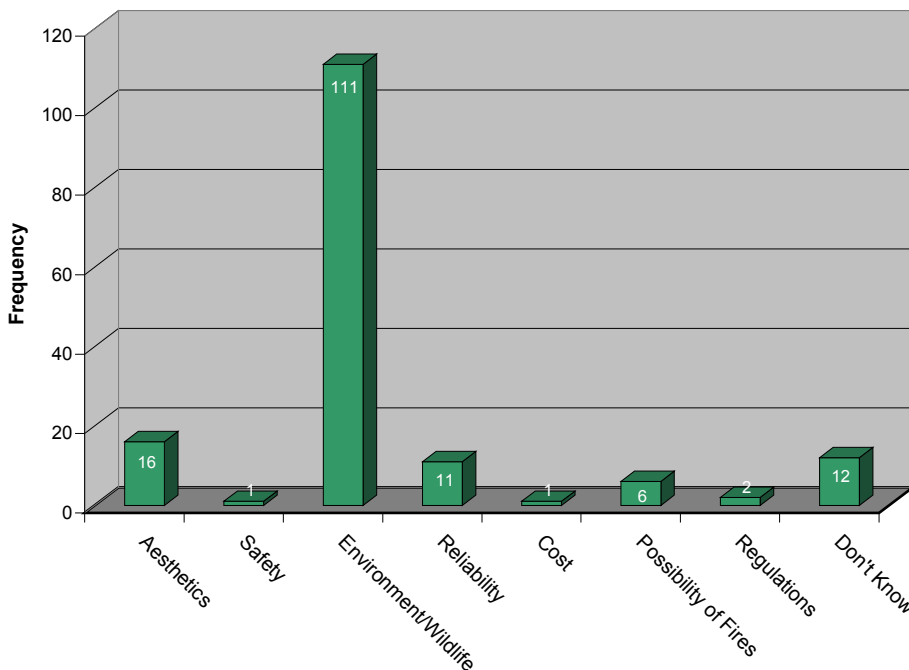
Figure 8



Seventy-one (17.57%) of the 404 total respondents identified problems with placing turbines offshore. As Figure 8 indicates, the environment and wildlife are a top concern when placing turbines offshore. Safety is also a considerable issue, as hurricanes and storms frequently threaten the coast.

Figure 9

Forests Problems



Of the 404 total respondents, 165 (nearly 41%) identified problems with placing turbines in national forests. As indicated in Figure 9, a concern for the environment and wildlife far outweighs any other issue involved in placing turbines in national forests. Many respondents believe national forests should be preserved in their current state and that building turbines would negatively affect habitats and forest-dwelling wildlife. Some are also afraid that building turbines may pave the way for other types of development.

Summary

Based upon a systematic, proportional sample of residents of the eighteen North Carolina coastal counties, a few findings are clear. **Among this group of middle aged, middle class, pragmatic, better than average educated, year round residents of the region there is support for developing renewable energy as a future source of fuel for electricity generation.**

- More than three out of four respondents would prefer to see more of their future electricity derived from solar and wind.
- Approximately seven out of ten support the placement of turbines on the coastal mainland, offshore, and with existing towers. When asked about ten or more turbines clustered together at these locations, support does not decline significantly.
- Two out of three expressed support for turbines even if they were visible from the respondents' home.
- There is less support for placing turbines in the sounds (either individually or in clusters) or in the national forests (less than majority support).
- Over 90% support erecting individual turbines for residential use.
- When controlling for experience with seeing modern turbines at work, knowledge of energy issues, and level of civic engagement, support for turbine placement increased for every location.
- The major problems expressed for placing turbines along the coast were with the National Forests. Over 40% volunteered a problem statement for this placement option with the vast majority associated with disrupting habitats and wildlife.
- Much smaller minorities expressed problems with other turbine placement options with aesthetics on the mainland and the environment/wildlife with sound and offshore options receiving the plurality for those locations.

Appendix 1

Survey # _____

Surveyor _____

Hello, my name is _____. I am calling to ask your opinions on energy issues for the North Carolina State Energy Office. The information will be used to help guide policy decisions. All of your responses will be confidential. The survey will take about ten minutes. May I begin with a couple of questions about your general interest in energy issues? **(If respondent refuses, ask if there is a better time to call and a make a callback appointment, if possible. Otherwise, mark the call sheet as a refusal and go on to the next interview.)**

1) Which of the following statements best describes how closely you follow energy issues?

- a) You follow energy issues very closely
- b) You sometimes pay attention to energy issues
- c) You rarely think about energy issues
- d) You never think about energy issues

2) For each of the following issues, please tell me whether you have no interest, some interest, or a great deal of interest .

a) The affects of burning fossil fuels on the environment _____

No interest (1), some interest (2), a great deal of interest (3).

b) The cost of electricity to you as a consumer _____

No interest (1), some interest (2), a great deal of interest (3).

c) The reliability of your energy supply _____

No interest (1), some interest (2), a great deal of interest (3).

d) The importation of foreign oil _____

No interest (1), some interest (2), a great deal of interest (3).

e) Nuclear plant safety and waste disposal _____

No interest (1), some interest (2), a great deal of interest (3).

3) Electricity can come from a number of sources

Appendix 1

Code; more=3, same=2, less=1, 9= don't know

Should we be getting more, the same, or less of our future electricity from burning coal _____

Should we be getting more, the same, or less of our future electricity from nuclear power _____

(At this point you may shift to, How about Hydroelectric power? Etc.)

Should we be getting more, the same, or less of our future electricity from hydroelectric power _____

Should we be getting more, the same, or less of our future electricity from natural gas _____

Should we be getting more, the same, or less of our future electricity from solar power _____

Should we be getting more, the same, or less of our future electricity from wind energy _____

The next several questions are specific to wind energy.

4) Have you seen a modern wind turbine in operation?

- 1) Yes, (go to 5):
- 2) No, (go to 6)

If Yes, Where? _____

5) What was your general impression? Did you like it or dislike it?

- 1) I liked it
- 2) I didn't like it
- 9) No opinion/don't remember

6) Preliminary studies indicate that wind speeds in many areas on and near the North Carolina coast could provide significant wind generated electricity. Do you believe that wind turbines should be prohibited from being developed on the coastal mainland, not including the Outer Banks?

- 1) Yes, prohibited (go to 7)
- 2) Not prohibited (go to 8)
- 9) Don't know (go to 8)

Appendix 1

7) What do you see as the major problems with placing turbines on the coastal mainland?

8) Do you think that placing wind turbines in the Pamlico or Albemarle Sounds should be prohibited or not prohibited?

- 1) Yes, prohibited (go to 9)
- 2) Not prohibited (go to 10)
- 9) Don't know (go to 10)

9) What do you see as the major problems with placing turbines in the Sounds?

10) Do you think that placing wind turbines off shore should be prohibited or not prohibited?

- 1) Yes, prohibited (go to 11)
- 2) Not prohibited (go to 12)
- 9) Don't know (go to 12)

11) What do you see as the major problems in placing turbines off shore?

12) Do you think that placing wind turbines in national forests should be prohibited or not prohibited?

- 1) Prohibited (go to 12b)
- 2) Not prohibited (go to 13)
- 9) Don't know (go to 13)

12b) What do you see as the major problems in placing turbines in national forests?

13) Would you approve of wind turbines if you could see them from your home?

- 1) Yes, I would approve
- 2) No, I would not approve
- 9) Don't know

14) The cost of wind produced electricity is normally significantly less expensive when more than one turbine is built on a site. Would you approve of wind turbines **on the mainland** if there were ten or more clustered together?

- 1) Yes, I would approve
- 2) No, I would not approve
- 9) Don't know

14b) Would you approve of wind turbines "**in the Sounds**" if ten or more were clustered together?

Appendix 1

- 1) Yes, I would approve
- 2) No, I would not approve
- 9) Don't know

14c) Would you approve of wind turbines “**off shore**” if ten or more were clustered together?

- 1) Yes, I would approve
- 2) No, I would not approve
- 9) Don't know

15) Would you approve of wind turbines in coastal areas if there were already other structures like cell towers or transmission towers visible in those areas?

- 1) Yes, I would approve
- 2) No, I would not approve
- 9) Don't know

16) Do you think that farmers should be prohibited from erecting a wind turbine on their own land to produce electricity for their own use?

- 1) Yes
- 2) No
- 3) Depends, _____
- 9) No opinion

17) For the past several months there have been stories of wind developers trying to place wind farms off the coast of Massachusetts, New York and Virginia. Have you heard or read about these stories?

- 1) Yes (go to 18)
- 2) No (go to 19)

18) Upon hearing or reading these stories, did you think:

- 1) The wind developers should be allowed to build the wind turbines
- 2) The wind developers should not be allowed to build the turbines
- 9) I'm undecided on what should happen
- 4) Other _____

19) What do you think would be the biggest problems with developing wind turbines as a source of energy in eastern North Carolina? (**do not lead the respondent, write down exactly what is said**).

In order for us to classify people's responses, we need a little information about you. All of this information is confidential.

Appendix 1

20) What county do you reside in? _____

21) How long have you lived in eastern North Carolina? _____ years

22) Do you live in eastern North Carolina all year long?

1) Yes

2) No, where else? _____

23) Are you registered to vote in North Carolina?

1) Yes

2) No

24) Have you ever attended a County Commissioners meeting to voice a concern over an issue?

1) Yes, do you recall the issue?

2) No

25) What is your highest level of education?

1) Less than high school

2) High school

3) Some college

4) College

5) Some graduate work

6) Graduate degree

26) Do you own the home you live in?

1) Yes

2) No

27) In what year were you born? _____

28) Approximately, how much money does your family make each year?

1) Under \$20,000 a year

2) Between \$20,000 to \$40,000

3) Between \$41,000 to \$60,000

4) Between \$61,000 to \$80,000

5) Over \$80,000 a year

29) Are you (don't ask if voice is obvious)

1) Male

2) Female

That is the end of the survey. Thank you for your participation.

Appendix 2

County of Residence

		Frequency	Percent	Valid Percent	Cumulative Percent	
Valid	Beaufort	30	7.4	7.5	7.5	
	Bertie	16	4.0	4.0	11.6	
	Brunswick	46	11.4	11.6	23.1	
	Camden	4	1.0	1.0	24.1	
	Carteret	37	9.2	9.3	33.4	
	Chowan	6	1.5	1.5	34.9	
	Craven	46	11.4	11.6	46.5	
	Currituck	12	3.0	3.0	49.5	
	Dare	30	7.4	7.5	57.0	
	Hyde	3	.7	.8	57.8	
	New Hanover	66	16.3	16.6	74.4	
	Onslow	53	13.1	13.3	87.7	
	Pamlico	8	2.0	2.0	89.7	
	Pasquotank	12	3.0	3.0	92.7	
	Pender	18	4.5	4.5	97.2	
	Perquimans	2	.5	.5	97.7	
	Tyrrell	2	.5	.5	98.2	
	Washington	7	1.7	1.8	100.0	
		Total	398	98.5	100.0	
	Missing	System	6	1.5		
Total		404	100.0			

Definitions of Problem Categories

Aesthetics	Disruption of views; overall appearance of turbines
Environment/Wildlife	Concern for damage to environment and wildlife; pollution; debris
Economics/Tourism	Concern that tourism will be negatively affected; decrease in property values
Location	Concern for where turbines are placed – should be in areas with very small human populations; putting them too close to the water/shore may interfere with use of the coastline; concern for the proximity of turbines to each other
Cost	Cost to taxpayers; amount of initial funding necessary
Reliability	Concern that turbines may not provide a consistent source of energy
Safety	Safety of people and property; includes damage to turbines as a result of hurricanes and storms
Politics	Public opinion; opinion of environmentalists
Possibility of Fires	Concern for the possibility of forest fires
Noise	Concern that turbines would produce a significant amount of noise
Boating/Fishing	Concern that turbines will decrease recreational opportunities and/or commercial fishing and shipping; concern that turbines in the water (sounds or offshore) would restrict access to waterways and cause navigational problems
Regulations	Strict laws/regulations are necessary to ensure a minimal number of problems from turbines