

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

By

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# Introduction

The development of utility scale wind energy in western North Carolina is as much a legal, political, and economic question as it is an engineering or climatic one. In 1983, following the erection of an obtrusive high rise development on top of a prominent mountain in northwestern North Carolina, a statute was enacted by the NC General Assembly known as the Ridge Law (G.S. 113A-205) to prevent large structures (exceeding 40 feet) from being erected along ridge tops exceeding 3,000 feet. More recently, during the fall of 2001, the Tennessee Valley Authority attempted to establish a wind farm in eastern Tennessee near the North Carolina border and was met with significant political opposition by residents in North Carolina. A February 4, 2002 letter from the NC Attorney General to the TVA asserted that utility scale wind turbines would fall under the Ridge Law and would, therefore, be prohibited in North Carolina. Perhaps even more chilling to the development of a wind industry in the state was the perception that the political resistance of local residents prevented even the consideration of the potential. This was due to a well organized and funded opposition campaign mounted against the TVA initiative that received statewide media attention.

While it was clear that some local residents were opposed to the TVA project, it was not clear how broad-based the opposition actually was. To determine the breadth of attitudes toward wind turbines, the Appalachian State University Energy Center undertook a scientifically valid and reliable public opinion survey of the residents of the 24 western North Carolina counties with utility scale wind potential. Three general issues guided the survey: 1) attitudes about energy issues in general; 2) attitudes about specific turbine placement options; and 3) perceptions of barriers in developing a wind industry in the region.

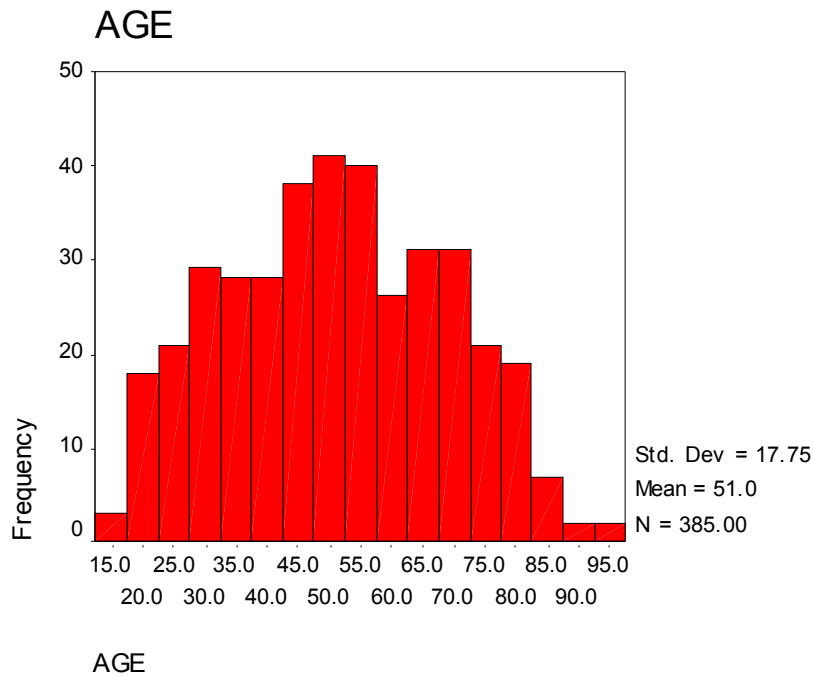
## Sampling Procedures and Survey Mechanics

The survey instrument may be found at the end of this report. It contains three parts. First are forced choice questions on attitudes toward general energy issues, this is followed by specific wind energy questions, and finally demographic information from the respondents is obtained. The population of interest is all residents of the 24 wind counties in western North Carolina. This is approximately one million residents. Using the most comprehensive and current source of residential telephone numbers available on the market (InfoUSA), a systematic, proportional sample from each of the 24 counties was selected. This yielded a sample frame of 2,300 residential telephone numbers from which 400 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 a four-week period extending from mid-September to mid-October 2002. Calls were conducted from 5:30 pm to 9:30 pm 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

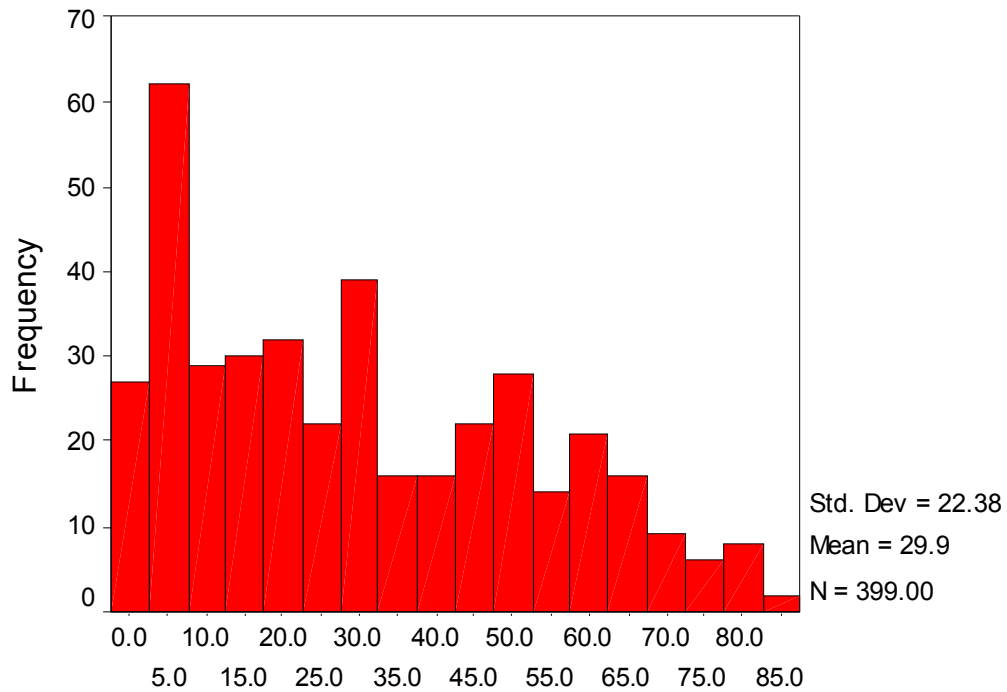
Appendix 2 lists the number of respondents by county. In this section of the report we will examine the profile of the individuals providing opinions on developing wind potential in the NC mountains.

Figure 1



As the histogram shows, the average age of 385 respondents willing to divulge this information is 51 years old with a fairly normal distribution ranging from one respondent at 15 to one at 95. These are primarily middle-aged respondents generally reflective of the age distribution of the overall population.

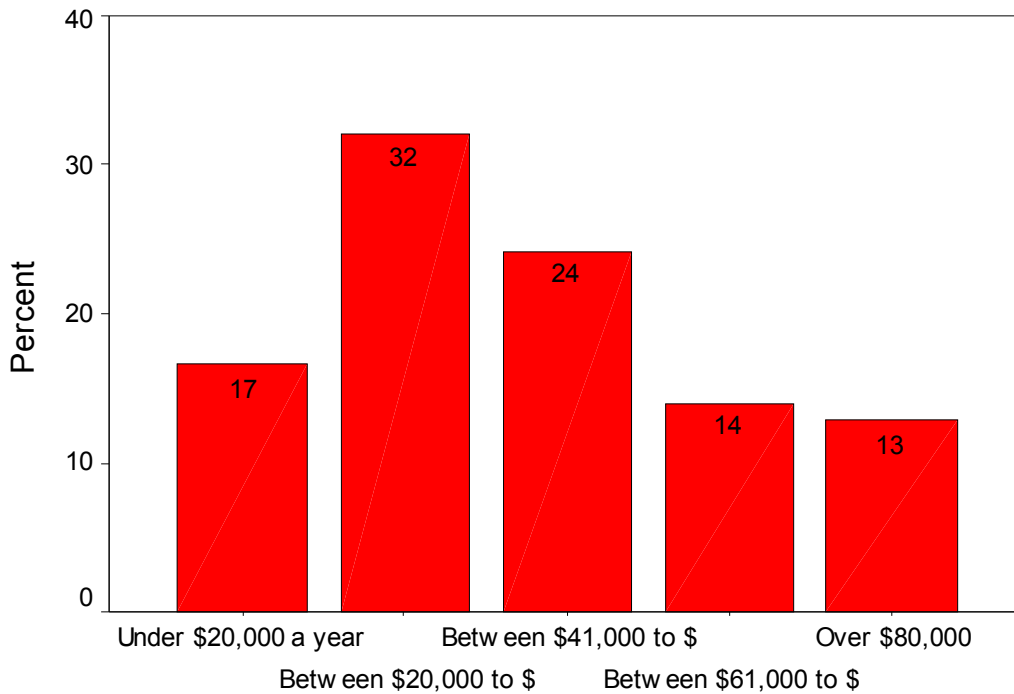
## Years Living in Western NC



How long have you lived in western NC

While many of the respondents have lived in western NC for a relatively brief period, the overall average of the respondents is close to 30 years. This is largely due to the number of respondents who are natives never having left the region.

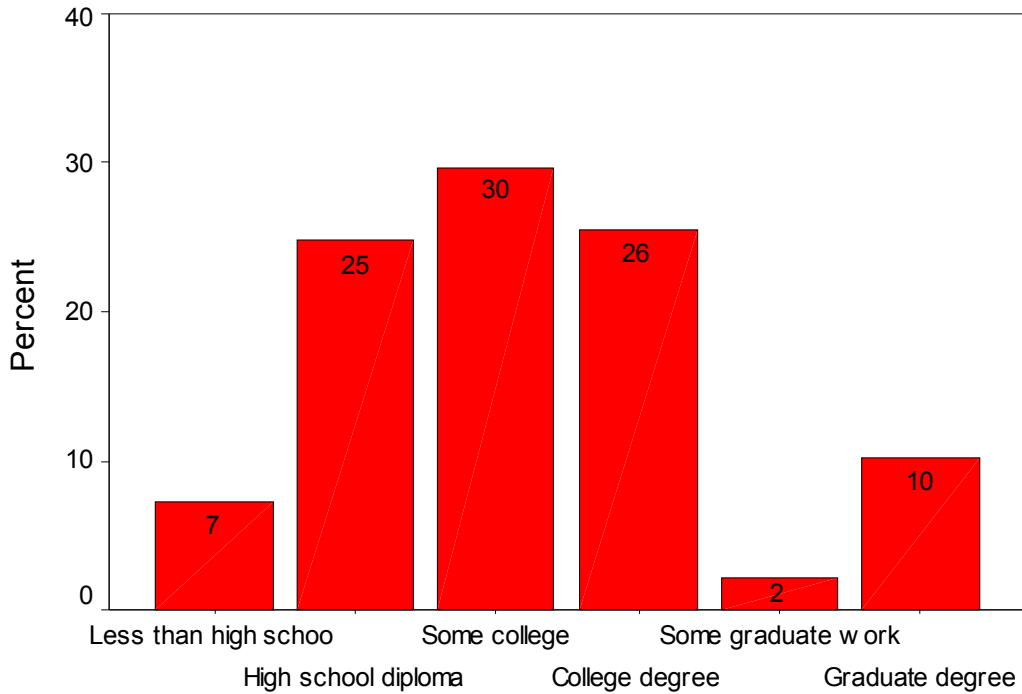
## Average Annual Family Income



How much money does your family make each year

Over eighty-five percent of the respondents reported on their annual family incomes. Of these, the modal response was an income between \$20,000 to \$40,000 a year. Overall, almost half (48.8%) of the respondents reported family incomes under \$40,000 a year. Fewer than 13% of the respondents reported incomes in the highest bracket. Examining these data indicates a middle to lower-middle income respondent pool much like the overall population for the region.

## Highest Level of Education



### What is your highest level of education

This chart indicates that the sample is fairly well educated with close to 70 percent (68%) with some education beyond high school.

### Other Pertinent Characteristics of Respondents

Percent Female	53.4
Percent Homeowners	81.5
Percent NC Voters	84.5
Percent Permanent Residents	93.5
Percent Having Seen Utility Turbine	29.4

Taken together the demographic data indicate a largely permanent group of homeowners, middle aged, with educational experiences beyond high school, three of ten having seen a utility scale wind turbine, and mostly middle income.

### Attitudes Toward Energy Issues

As a method for getting respondents to focus on the primary question of concern, attitudes toward wind energy development, 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. They were first asked their level of interest in a number of energy/environment/economic issues.

<b>Issue</b>	<b>% No Interest</b>	<b>% Some Interest</b>	<b>% Great Interest</b>
<b>Effects of burning fossil fuels on the environment</b>	<b>18.5</b>	<b>48.0</b>	<b>33.5</b>
<b>The cost of electricity to you as a consumer</b>	<b>3.8</b>	<b>23.8</b>	<b>72.5</b>
<b>The reliability of your energy supply</b>	<b>7.3</b>	<b>23.5</b>	<b>69.0</b>
<b>The importation of foreign oil</b>	<b>12.8</b>	<b>32.5</b>	<b>54.8</b>
<b>Nuclear plant safety and waste disposal</b>	<b>11.3</b>	<b>24.3</b>	<b>64.5</b>

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 question concerned the desired fuels for the 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.

<b>Energy Source</b>	<b>% Wanting less</b>	<b>% Same</b>	<b>% Wanting more</b>	<b>% Don't know</b>
<b>Coal</b>	<b>52.5</b>	<b>12.8</b>	<b>22.5</b>	<b>12.3</b>
<b>Nuclear</b>	<b>34.3</b>	<b>19.8</b>	<b>32.5</b>	<b>13.5</b>
<b>Hydroelectric</b>	<b>6.3</b>	<b>12.0</b>	<b>72.8</b>	<b>9.0</b>
<b>Natural Gas</b>	<b>16.0</b>	<b>23.0</b>	<b>50.5</b>	<b>10.5</b>
<b>Solar</b>	<b>4.3</b>	<b>6.3</b>	<b>85.3</b>	<b>4.3</b>
<b>Wind</b>	<b>5.8</b>	<b>8.5</b>	<b>75.3</b>	<b>10.3</b>

Clearly, this group did not want to see an expansion of coal as the primary fuel for future electricity production with over half wanting less future generation from that source. Nuclear power presents a more interesting and ambiguous case. Almost as many respondents want more future production as want less and it attains the highest “Don’t know” response than any of the others. It has been over a quarter of century since a new nuclear power plant was built in North Carolina and the memory of Three Mile Island appears to be receding. Ironically, the fastest growing fuel for electricity production in the state, natural gas, was not embraced enthusiastically by the respondents with barely half wanting more use in the future. Clearly, renewable fuels are the fuels of choice for this group with solar leading the way at 85.3%, wind at 75.3, and hydroelectric at 72.8% as desirable fuels for the future. Granted, costs for developing these sources were not discussed nor were technical barriers raised. Nonetheless, it is clear in the abstract, renewable energy development is highly desired by this sample even though the previous

question did not indicate that this group were particularly concerned about the environment.

### Attitudes Toward Turbine Placement

The next series of questions pertained specifically to the placement of wind turbines in various locations. The respondents were probed as to whether or not turbines should be allowed on ridge tops, in national forests, near their home, clustered together, on ridges with other preexisting towers, and on a person’s personal property for personal use. Their responses are as follows:

<b>Placement</b>	<b>Prohibited</b>	<b>Not Prohibited</b>	<b>Don't Know</b>
<b>On Ridge Tops</b>	<b>19.3</b>	<b>63.5</b>	<b>17.0</b>
<b>In National Forests</b>	<b>36.0</b>	<b>50.5</b>	<b>13.5</b>
<b>Near Your Home</b>	<b>21.5</b>	<b>66.0</b>	<b>12.5</b>
<b>Clustered on Ridge Tops</b>	<b>27.5</b>	<b>57.3</b>	<b>15.0</b>
<b>With Existing Towers</b>	<b>15.8</b>	<b>74.5</b>	<b>9.8</b>
<b>Single Turbine on Own Land</b>	<b>9.0</b>	<b>79.0</b>	<b>12.2*</b>

\* combines depends and no opinion

The impression derived from these data is that there is general support for the placement of turbines on ridges especially if placed with preexisting structures or on one’s own land for personal use. Support drops significantly for placement in national forests or when clustered with other turbines.

It might 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, we can control for the respondents’ experience in actually seeing a modern turbine in operation. When asked this question, almost 50% of the respondents replied that they had. When asked where, slightly less than 30% mentioned sites such as Germany, California or Texas where large scale turbine farms actually exist. Essentially, the other 20% claiming to have seen a turbine either saw the one placed in Boone two decades ago or mentioned locales where modern turbines are not located. The table below reports on those with experience of seeing an actual modern turbine in operation.

### Experience with Turbines and Ridge Top Placement Attitude



		Placing turbines on ridge tops should be prohibited or not					
		Yes, prohibited		Not prohibited		Don't know	
		Count	Row %	Count	Row %	Count	Row %
Modern Turbine	Yes	27	22.9%	69	58.5%	22	18.6%
	No	51	18.1%	185	65.6%	46	16.3%

These results are instructive. While the approval of ridge top placement does, in fact, drop, the reduction is only five percentage points (from 63.5% to 58.5%) and the percentage approval is still well beyond the margin of error of the poll. Thus, even those with experience seeing modern turbines in operation, are not opposed to ridge top placement. As a footnote, when asked what was their impression of the utility scale turbine they had seen, 77.1% responded that they liked its appearance.

Another variable that could affect the attitude of respondents toward turbine placement is the wealth of the respondent. The argument put forward is that the wealthiest residents would resent their views from being impaired by the sight of the turbine. We can assess this by controlling for the income category of the respondent as is done below.

### Income and Ridge Top Placement Attitude

	Placing turbines on ridge tops should be prohibited or not					
	Yes, prohibited		Not prohibited		Don't know	
	Count	Row %	Count	Row %	Count	Row %
Under \$20,000	10	17.5%	36	63.2%	11	19.3%
\$20,000 to \$40,000	16	14.5%	83	75.5%	11	10.0%
\$41,000 to \$60,000	20	24.1%	47	56.6%	16	19.3%
\$61,000 to \$80,000	10	20.8%	29	60.4%	9	18.8%
Over \$80,000	8	18.2%	28	63.6%	8	18.2%

The group most opposed to the placement of turbines on ridge tops is the income group of \$41,000 to \$60,000. Those least opposed is the \$20,000 to \$40,000 group. The highest income category has a similar perception as the lowest category. So, while there is an increasing bias against ridge top placement as one moves into the upper middle income categories, it would not be accurate to say that a negative attitude toward ridge top placement goes hand in hand with income growth. In fact, positive support for ridge top placement is found across all income categories.

Another variable assessed in this analysis is the relationship between level of education and attitude toward turbine placement.

## Education and Turbine Placement

		Placing turbines on ridge tops should be prohibited or not					
		Yes, prohibited		Not prohibited		Don't know	
		Count	Row %	Count	Row %	Count	Row %
<b>What is your highest level of education</b>	<b>Less than high school</b>	6	20.7%	19	65.5%	4	13.8%
	<b>High school diploma</b>	20	20.2%	60	60.6%	19	19.2%
	<b>Some college</b>	21	17.6%	83	69.7%	15	12.6%
	<b>College degree</b>	21	20.6%	60	58.8%	21	20.6%
	<b>Some graduate work</b>	2	22.2%	5	55.6%	2	22.2%
	<b>Graduate degree</b>	8	19.5%	26	63.4%	7	17.1%

These results indicate absolutely no relationship between one's level of education and attitude toward ridge top placement. Thus, any impression that tolerance for turbines on ridges is a matter of a more sophisticated understanding of the role of renewable energy in the nation's energy mix is not supported by these data.

The final variable assessed to determine if turbine placement opinion is affected in any systematic fashion is the familiarity the respondent has with energy issues. We control for this below.

## Energy Awareness and Turbine Placement

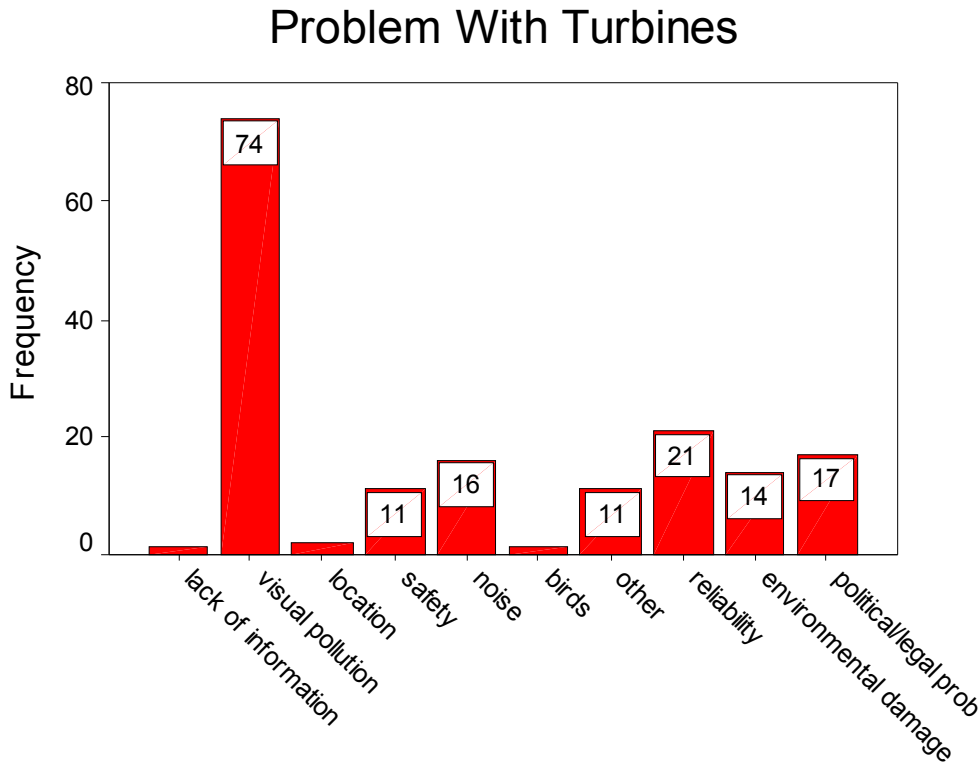
		Placing turbines on ridge tops should be prohibited or not					
		Yes, prohibited		Not prohibited		Don't know	
		Count	Row %	Count	Row %	Count	Row %
<b>How closely you follow energy issues</b>	<b>Follow Very Closely</b>	24	23.8%	60	59.4%	17	16.8%
	<b>Sometimes Follow</b>	36	17.3%	139	66.8%	33	15.9%
	<b>Rarely Follow</b>	13	19.1%	40	58.8%	15	22.1%
	<b>Never Follow</b>	5	22.7%	15	68.2%	2	9.1%

Using a person's stated behavior in following energy issues as a proxy measure of how informed they are about energy issues, we can see that those with the most amount of information and those with the least are the most resistant to placing turbines on ridge tops. Nonetheless, both groups are still in favor of ridge top placement by large margins.

## Problems with Developing a Wind Industry in the Mountains

The final general issue addressed in the survey was the question of barriers to the development of a wind industry in the NC mountains. Respondents were asked an open-ended question and interviewers wrote responses verbatim. Two different coders examined these responses and categorized the responses into ten different categories. Intercoder reliability exceeded 90%.

The first noteworthy result is that the majority (58%) did not see a problem or could not think of a problem with developing a wind industry in the state. It is important to note that this question followed the ones concerning placement issues, so the respondent had already been cued as to potential issues with location of turbines. Of the 168 respondents who did respond to this probe, their replies are displayed below.



PROBLEM1

The major problem identified by the respondents was aesthetics or visual pollution. This came across in different ways but fundamentally concerned a negative perception of what a turbine would look like on top of a mountain ridge. Forty-four percent of those responding to this question and 18.5% of all respondents identified some variation of visual pollution as a barrier to turbine placement. The second most mentioned barrier

was the perception that the wind is insufficient to support utility scale turbines. Other issues raised at approximately the same level of concern were noise (4%), political opposition (4.2%), and environmental damage during construction and with transmission lines (3.5%).

If we separate out those who would prohibit turbines on ridge tops (78 respondents) and look at their response to this question, we see a similar response pattern. Fifty-three percent of the opponents to ridge top placement responded to this probe and, of those, 43% mentioned visual pollution as the greatest barrier to developing a wind industry. Wind reliability was mentioned by 19% and environmental damage by 12%.

## Summary

To the extent one has confidence in telephone survey results from a proportional sample of western North Carolina residents, the following findings are offered.

- Western North Carolinians are favorably disposed toward the development of a wind energy industry in the Appalachian Mountains. They want more of their future electricity derived from renewable sources and less from fossil fuels. They are ambivalent toward nuclear energy.
- By over 2 to 1, western North Carolinians do not believe that ridge top turbines should be prohibited. They are less favorably disposed to placing turbines in national forests and clustering them together. However, if a ridge top already has existing cell towers, 3 out of 4 would not mind adding a wind turbine to the clutter. An even higher ratio believes a person should be allowed to erect a turbine on his/her own property for residential use.
- Support for ridge top placement is not systematically affected by experience with seeing a modern turbine in operation, awareness of energy issues, income, or education.
- Most western North Carolinians do not foresee or cannot articulate a problem with developing a wind industry in the state. For those that do, the overwhelming problem noted is aesthetics. The concern raised is that the visual pollution of ridge top turbine would hurt the tourist trade and could decrease property values. To a much lesser extent, people who do foresee problems identify the consistency of the wind, environmental hazards, and political/legal issues as potential barriers.

# Appendix 1

## Survey Instrument

Survey # \_\_\_\_\_

Surveyor \_\_\_\_\_

Hello, my name is \_\_\_\_\_. I am calling from Appalachian State University to ask your opinions on energy issues for the United States Department of Energy. 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

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

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

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

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

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

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

**The next several questions are specific to wind energy.**

4) Have you ever seen an actual wind turbine in operation?

1. Yes, where:

? go to 5

2. No, go to 6

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) Wind speeds are usually higher on the top of mountain ridges. The most effective place to put wind turbines to generate electricity is typically near the ridge top. In general, do you think placing wind turbines on ridge tops should be prohibited or not prohibited?

- 1) yes, prohibited(go to 7)
- 2) not prohibited (go to 7)
- 9) don't know (go to 7)

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

- 1) prohibited (go to 8)
- 2) not prohibited (go to 8)
- 9) don't know (go to 8)

8) Would you approve of wind turbines if they were near your home?

1. Yes, I would approve (go to 11)
2. No, I would not approve (go to 9)
9. Don't know (go to 9)

9) If the development of wind turbines in your area provided your household a one-time payment of \$250 as compensation, would you still object to having turbines near your home?

1. yes, I would object (go to 10)
- 2) no, I would not object (go to 11 )
- 9) don't know (go to 10)

10) If the compensation was \$1000, would you still object?

- 1) yes. I would object (go to 12)
- 2) no, I would not object (go to 11)
- 9) don't know (go to 11)

11) 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 ridge tops if there were ten or more clustered together?

- 1) yes, I would approve (go to 14)
- 2) no, I would not approve (go to 12)
- 9) don't know (go to 12)

12) Would you approve of wind turbines on ridge tops if there were already other structures like cell towers or transmission towers visible on the ridge tops?

- 1) Yes, approve (go to 13)
- 2) No, not approve (go to 13)
- 9) Don't know (go to 13)

13) Do you think that a person should be prohibited from erecting a single wind turbine on his or her own land to produce electricity for personal, residential use?

- 1) yes (go to 14)

- 2) No (go to 14)
- 3) Depends, \_\_\_\_\_
- 9) no opinion (go to 14)

14) A couple of months ago there were stories in some local papers when the Tennessee Valley Authority was talking about putting wind turbines on a mountain in east Tennessee near the North Carolina border. Did you hear or read about that story?

- 1)Yes (go to 15)
- 2)No (go to question 16)

15) Upon hearing or reading the story, did you think that ?

- 1)TVA should build the wind turbines
- 2)TVA should not build the turbines
- 9)I was undecided on what should happen
- 4)Other \_\_\_\_\_

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

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**In order for us to classify people's responses, we need a little information about you.**

17) What county do you reside in? \_\_\_\_\_

18) How long have you lived in western North Carolina? \_\_\_\_\_years

19) Do you live in western North Carolina all year long?

- 1)Yes
- 2)No, where else? \_\_\_\_\_

20) Are you registered to vote in North Carolina?

- 1)Yes
- 2)No

21)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

22)Do you own the home you live in?

- 1) yes
- 2) no

23) In what year were you born? \_\_\_\_\_

24) Approximately, how much money does you 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

25) 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

### What county do you reside in

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Alleghany	6	1.5	1.5	1.5
	Ashe	16	4.0	4.0	5.5
	Avery	15	3.8	3.8	9.3
	Buncombe	71	17.8	17.8	27.0
	Burke	17	4.3	4.3	31.3
	Caldwell	23	5.8	5.8	37.0
	Cherokee	10	2.5	2.5	39.5
	Clay	2	.5	.5	40.0
	Graham	6	1.5	1.5	41.5
	Haywood	34	8.5	8.5	50.0
	Henderson	30	7.5	7.5	57.5
	Jackson	9	2.3	2.3	59.8
	Macon	13	3.3	3.3	63.0
	McDowell	11	2.8	2.8	65.8
	Madison	10	2.5	2.5	68.3
	Mitchell	5	1.3	1.3	69.5
	Polk	10	2.5	2.5	72.0
	Rutherford	8	2.0	2.0	74.0
	Surry	21	5.3	5.3	79.3
	Swain	5	1.3	1.3	80.5
	Transylvani a	12	3.0	3.0	83.5
	Watauga	29	7.3	7.3	90.8
	Wilkes	34	8.5	8.5	99.3
	Yancey	3	.8	.8	100.0
	Total	400	100.0	100.0	