The Cheap-talk Protocol and the Estimation of the Benefits of Wind Power

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I. Introduction

The contingent valuation method (CVM) is used to assign monetary values to the perceived benefits of air quality improvements in the western North Carolina mountains. Air quality improvements can arise from relative increases in wind generated energy or other green energy sources (e.g., solar, biomass, etc.). Since the benefits of improved air quality are independent of the source, the study generalizes the cause of air quality improvements as green energy. To measure the value of improved air quality, the CVM employs hypothetical willingness to pay questions. In order to develop realistic willingness to pay scenarios the CVM presents a hypothetical market in which survey respondents are first described the good to be valued, in this case air quality. Next, the change in air quality is described. After the payment mechanism and policy implementation rules are described the willingness to pay question is presented. Follow-up questions are then used to further define willingness to pay. The phone survey was conducted by Appalachian Regional Development Institute at Appalachian State University and randomly administered to all 100 North Carolina counties during the fall of 2002. (sample survey instrument provided in appendix)

This report proceeds as follows. First the theoretical and empirical models are developed. Next the survey data are described with univariate statistics. Then the steps taken to develop the data for empirical analysis are described and a bivariate data summary is presented. Finally, the probit regression and willingness to pay results are presented.

II. The Model

Respondents are assumed to possess the utility function, $u = u(x, q)$, where x is a composite commodity of all goods and q is air quality. Households are constrained by income, $y = px$,

where y is income and p is the price of the composite commodity. Minimization of income subject to a utility constraint yields the expenditure function, $e = e(p,q,u)$. The expenditure function is increasing in price, decreasing in quality, and increasing in utility. Willingness to pay is the difference in expenditure functions, $WTP = e(p,q,u) - e(p,q+\Delta q,u)$, where Δq is the increase in air quality. Willingness to pay is positive since expenditures fall with improved air quality, $q + \Delta q$.

The yes/no responses to the willingness to pay question depends on whether willingness to pay is greater than the monthly fee

$$Y_i = \begin{cases} 1 & \text{if } \log WTP_i > \log F \\ 0 & \text{otherwise} \end{cases}$$

The probability of a yes response is estimated with the probit model

$$\begin{aligned} \Pr(Y_i = 1) &= \Pr(\log WTP_i \geq \log F\ ) \\ &= \Pr\left(\beta' X_i + e_i \geq \log F\ \right) \\ &= \Pr\left(\frac{\beta' X_i - \log F}{\sigma_\upsilon} \geq -\frac{e_i}{\sigma_\upsilon}\right) \\ &= \Phi\left(\frac{\beta' X_i - \log F}{\sigma_\upsilon}\right) \end{aligned}$$

where β is a vector of coefficients, X_i is a vector of variables, e_i is a mean zero error term and i = *1, ... , n* respondents.

Willingness to pay is estimated from the censored probit coefficients. Since the dollar amount is varied across respondents, σ_υ can be identified and median willingness to pay can be recovered from the estimated coefficients

$$E(WTP) = \exp(\beta_0 + \beta_X' \overline{X})$$

When the natural log of the dollar amount is used in the regression, WTP is the median of the willingness to pay distribution. Median willingness to pay is calculated from the estimates of the regression coefficients at the mean of the independent variables, $\overline{X}$. The standard errors are obtained from the asymptotic covariance matrix by the Delta method.

III. Attitude Questions

The first few questions in the survey elicit knowledge, importance and concern about air quality. These questions are primarily used to define air quality and threats to air quality. Respondents are first told: "Current sources of energy used by power plants are leading causes of air pollution. Coal and oil create more negative impacts on the environment and human health than renewable energy sources like wind and solar." Nine percent of the sample knows a lot, 41% knows some, 38% knows a little and 11% knows nothing about energy sources, uses, and problems (n = 364).

Respondents are told: "Air quality in the western North Carolina mountains has experienced problems caused by power plants. Air quality is important for outdoor recreation, visibility, forest and stream health, and human health." Outdoor recreation is very important to 71% of the sample, somewhat important to 23% of the sample, and not important to 6% of the sample (n = 362). Eighty percent, 16%, and 5% of the sample state that visibility is very important, somewhat important and not important (n = 363). Forest and stream health is very important, somewhat important and not important to 86%, 12%, and 2% (n = 363). The health of the people who live in the western North Carolina mountains is very important to 91%, somewhat important to 7%,

and not important to 2% (n = 363).

Respondents are asked about their concern for different problems caused by air pollution after being told: “Air quality in the western North Carolina mountains is expected to get worse in the future because of population growth.” Sixty-three percent, 32%, and 4% are very concerned, somewhat concerned, and not concerned about increased air pollution in the western North Carolina mountains (n = 364). Sixty-six percent, 28%, and 6% are very concerned, somewhat concerned, and not concerned about ozone pollution in the western North Carolina mountains (n = 363).

Two other types of pollution are described. First, respondents are told: “Acid rain can kill fish in sensitive streams and kill trees.” Seventy percent, 26%, and 4% are very concerned, somewhat concerned, and not concerned about acid rain pollution in the western North Carolina mountains (n = 363). Second: “Small particles in the air make visibility worse and breathing more difficult.” Seventy-one percent, 23%, and 5% are very concerned, somewhat concerned, and not concerned about small particle pollution in the western North Carolina mountains (n = 363).

IV. Contingent Market Questions

The contingent market is designed to elicit willingness to pay for the green energy program. Two issues are addressed. The first is the issue of scope. As suggested by the National Oceanic and Atmospheric Administration (NOAA) panel, contingent valuation studies should vary the scope of the policy to determine if willingness to pay is increasing with scope. This is a test of the theoretical validity of the willingness to pay data.

The second issue is hypothetical bias. Since contingent valuation questions are hypothetical,

respondents who state that they would pay to improve environmental quality are not required to do so. In the hopes of influencing policy or pleasing the interviewer, some respondents may state that they would pay for the policy when, in fact, they would not if placed in the real situation. Hypothetical bias leads to upwardly biased willingness to pay estimates. We compare two methods to minimize hypothetical bias currently in vogue in the CVM literature: "cheap talk" and the certainty scale. These are described below.

The hypothetical portion of the survey begins with a question introducing a "Green Energy" program. Respondents are told that the hypothetical program is based on a real program called the North Carolina Green Power program. Two percent had heard a lot, 5% had heard some, 16% had heard a little and 77% had heard nothing about this program (n = 363). The next question states that the green energy program would offer all North Carolina utility customers power generated from renewable energy sources such as wind and solar. Forty-seven percent are very interested, 41% are somewhat interested and 12% are not interested in this program (n = 363). Respondents are told that the goal of the program is to get 10% of all North Carolina utility customers to sign up. Twenty-two percent think it is very likely, 53% think it is somewhat likely, 16% think it is somewhat likely and 9% think that it is not likely at all that 10% would sign up (n = 361).

The next question defines the scope of the program based on the dimensions of air quality described earlier. Respondents are told that if 10% of all North Carolina utility customers sign up, air quality in the western North Carolina mountains would improve. Visibility would increase by about Δq miles, the number of streams and acres of forests impacted by acid rain would decrease by about Δq percent, and the number of people who get sick because of

breathing problems would decrease by about Δq percent. There are three scope versions that are randomly assigned to respondents: Δq = 2, 10, and 20.

Respondents are asked for their opinion about the likelihood of achieving the air pollution goal. Eighteen percent think that it is very likely, 60% think that it is somewhat likely, 16% think that it is somewhat not likely, and 7% think it is not likely at all that the goal will be reached (n = 361). The frequencies do not vary significantly by the scope of the program.

The magnitude and rationale for the green energy program payment vehicle, a monthly fee, is described: "In a voluntary Green Energy program, households that choose to participate would pay an extra *F* dollar fee each month with their power bills. This fee would be fixed and not tax-deductible. The fee would cover the higher production costs of green energy." The fee was randomly assigned to respondents and took on one of four values: *F* = 5, 15, 30, and 50. Respondents were then asked for their average monthly power bill in order to get them to assess the impact the monthly fee would have. The average monthly power bill is $113 (n = 344). The average fee is $24 (n = 364).

Respondents were then described the policy implementation rule: "If you signed up for the green energy program and were not satisfied you could cancel the program at any time. But if less than 10% signed up, the green energy program would not have enough customers to make it cost effective. The program would stop and you would owe no money." A split-sample survey design is used in which one-third of all respondents were reminded that: "Now please think about the next question just like it was a real decision. If you signed up for the program you would have *F* dollars less each month to spend on other things." We refer to this as the "cheap talk" version.

The willingness to pay question is then presented: “Suppose you were given the opportunity to participate in the green energy program for an extra fee of *F* dollars each month. Would you sign up for the green energy program?” Forty-two percent would sign up, 34% would not sign up, and 24% did not know whether they would sign up (n = 362).

Respondents were then asked follow-up questions about their willingness to pay response. These questions dealt with the certainty of their willingness to pay responses, changes in their response with monthly fee changes, and the most important reason for their response. The certainty questions were: “We would like to know how sure you are that you would (would not) sign up. On a scale of 1 to 10 where 1 is very uncertain and 10 is very certain, how certain are you that you would not sign up?” The average certainty rating for those would sign up for the green energy program is 7.58 (n = 154). The average certainty rating for those would not sign up is 7.57 (n = 123).

Respondents who would sign up are asked to suppose that “the cost of the program was underestimated and the extra monthly fee increased” and asked: “If the extra fee were *F* + 10 dollars each month would you cancel the green energy program?” Thirty-eight percent would cancel the program, 34% would not cancel the program and 24% did not know whether they would cancel the program (n = 154). Those who would not cancel the program were then asked the same question at a cost of $90 per month. Sixty-six would cancel the program, 9% would not cancel the program and 25% did not know (n = 92).

Respondents who would not initially sign up are asked to suppose that “the cost of the program was overestimated and the extra monthly fee decreased” and asked: “If the extra fee were *F* - 10 dollars each month would you sign up for the green energy program?” Twenty-two percent

would sign up for the program, 44% would not sign up, and 35% did not know (n = 213). Those who would not sign up for the program were then asked the same question at a cost of $1 per month. Fifty-three percent would sign up, 25% would not sign up, and 22% did not know (n = 161).

Respondents who would (would not) sign up at the first monthly fee are asked for the most important reason why. The most popular reasons for signing up are for a better environment (42%), better human health (15%), for future generations (13%), and because "it is the right thing to do" (13%) (n = 141). The most popular reasons for not signing up are the cost is too high (40%), not enough income (13%), and I don't trust the power companies (8%) (n = 203).

V. Data

Demographic and other information is elicited from respondents. These questions include the standard demographics: household size (2.83 people, n = 364), number of children (0.89 children, n = 331), marital status (71% married, n = 336), sex (42% male, n = 364)), and age (45 years, n = 358). Questions are asked about whether the respondent is the person who usually pays the power bill (71% yes, = 363), whether the respondent has contributed to any environmental groups in the last two years (29% yes, n = 363), and a self assessment of their health status. Forty-five percent, 49%, 5% and 1% consider their health to be very good, good, poor, or very poor (n = 362).

Questions about the highest education level completed and household total annual income before taxes follow. Forty-two percent are high school graduates, 12% have an associates degree, 25% have a bachelors degree, and 15% have a postgraduate degree (n = 363). The median income is

between $45 thousand and $55 thousand. Ten percent have income less than $15 thousand. Nine percent have incomes greater than $15 thousand but less than $25 thousand, between $50 thousand and $60 thousand, and between $60 thousand and $75 thousand. Fourteen percent have incomes between $75 thousand and $100 thousand. Fifteen percent have incomes greater than $100 thousand (n = 318).

Complete case analysis is used. We delete any observation that has missing values on demographic and willingness to pay variables. One exception is the income variable. Missing income values are imputed with a regression model. The conditional mean income value is used to assign an income category for the respondent with missing income. We delete several respondents under the age of 18. We also delete those respondents that did not report an average monthly utility bill or an unrealistically low utility bill (e.g., $0, $2.50). This reduces the useable sample size to 311.

A continuous education variable is constructed by assigning years of schooling to each degree. If the respondent did not finish high school they are assigned 10 years of schooling. If the respondent finished high school they are assigned 12 years. Those who attended some college but did not graduate are assigned 13 years. Those with an associates degree are assigned 14 years. Those who achieved bachelor's degrees, masters degrees, and Ph.D. degrees are assigned 14, 16, and 20 years. Law and medical degrees are assigned 19 years. A continuous income variable is created with the midpoint method. In other words the midpoint of the income interval is used as the estimate of income. A dummy variable for health status is created in which the health variable is equal to one if the respondent considers their health to be very good and zero otherwise.

The complete case analysis demographic variables are summarized in Table 1. The average age is 46. Twenty-eight percent has donated to an environmental charity in the past two years. The average number of children is 0.78. The average number of years of education is 14. Forty-six percent considers their health to be very good. The average household size is 2.81. Average household income is $52,700. Sixty-eight percent are married. Seventy-five percent pays the utility bill. Forty-two percent are male.

The cheap talk and scope treatments were randomly assigned to respondents (Table 2). Roughly one-third of the sample received each of the three scope treatments. About one-third of the sample received the cheap talk treatment. Among those who did not receive the cheap talk treatment, roughly one-third received each of the three scope treatments. Among those who received the cheap talk treatment, roughly one-third received each of the three scope treatments.

Next we summarize the willingness to pay responses by survey version (Table 3). We focus on the first willingness to pay response in the remainder of this report. The "don't know" willingness to pay responses are coded as "no" responses. Willingness to pay is summarized by the randomly assigned monthly fee in Table 3. The percentage of "yes" responses falls from 59% to 27% as the fee rises from $5 to $30. The percentage of yes responses rises to 35% when the fee is $50.

Willingness to pay is summarized by the scope treatments in Table 4. Thirty-four percent of those who received the "two percent" version responded yes to the willingness to pay question. Forty-six percent of those who received the "ten percent" version responded yes to the willingness to pay question. Fifty-one percent of those who received the "twenty percent" version responded yes to the willingness to pay question.

The willingness to pay responses are broken down by monthly fee and cheap talk versions in Table 5. Without the cheap talk treatment the percentage of yes responses falls from 60% to 32% as the monthly fee rises from $5 to $30 and then rises to 42% when the monthly fee is $50. With the cheap talk treatment the percentage of yes responses falls from 58% to 19% as the monthly fee rises from $5 to $30 and then rises to 22% when the monthly fee is $50. Holding constant the monthly fee, the percentage yes responses is similar across cheap talk treatments when the fee is low. At the two higher fees, the cheap talk treatment leads to yes percentages that are substantially lower.

The certainty scale for yes respondents by monthly fee is presented in Table 6. Eighty percent of all yes respondents state that they are at least 50% sure that they would sign up for the green energy program. As in previous research, we define those who give a 7 or higher as those who are sure about their willingness to pay. Eighty-six percent, 74%, 70%, and 87% of those given the $5, $15, $30, and $50 monthly fees are sure about their willingness to pay.

Using the definition of certain willingness to pay from Table 6, we present the certain willingness to pay values by monthly fee and cheap talk version. Without the cheap talk treatment the percentage of certain yes responses falls from 50% to 23% as the monthly fee rises from $5 to $30 and then rises to 37% when the monthly fee is $50. With the cheap talk treatment the percentage of yes responses falls from 54% to 12% as the monthly fee rises from $5 to $30 and then rises to 22% when the monthly fee is $50. Holding constant the monthly fee, the percentage yes responses is similar across cheap talk treatments when the fee is $5. At the three higher fees, the cheap talk treatment leads to yes percentages that are substantially lower.

VI. Results

Eight probit models are estimated and presented in Tables 8 and 9. The dependent variable is the probability of a yes response to the willingness to pay question. The basic set of dependent variables includes the monthly fee, scope, a dummy variable for the cheap talk version (*CHEAP* = 1, 0 otherwise) and income (in thousands). The natural log of the monthly fee (*LNFEE*) performed significantly better according to likelihood ratio tests. Household income (*INCOME*) is in thousands.

The scope test is conducted in two ways. First we assume that the log of willingness to pay is linear in scope. The *SCOPE* variable is equal to Δq = 2, 10, or 20, depending on the scope version (Models 1, 3, 5, and 7). The alternative model includes two dummy variables for the Δq = 10 and 20 versions. *SCOPE10* is equal to 1 if the respondent received the Δq = 10 version and zero otherwise. *SCOPE20* is equal to 1 if the respondent received the Δq = 20 version and zero otherwise. Models are estimated with the raw yes variable (Models 1, 2, 5, and 6) and the yes variable adjusted by the certainty scale (Models 3, 4, 7, and 8). Finally, models are estimated with a basic set of variables (Models 1, 2, 3, and 4 in Table 8) and with an expanded set of variables (Models 5, 6, 7, and 8 in Table 9).

The most important result is that the probability that the respondent is willing to pay the monthly fee declines with the magnitude of the fee. The coefficient on *LNFEE* is statistically significant at the p = .01 level in each model. This result indicates that respondents behaved rationally with respect to cost and allows the estimation of the monthly willingness to pay for the green energy program.

Willingness to pay is also sensitive to the scope of the policy, at least when the change in scope is a large difference. In each of the models in which the raw yes responses are used, the

coefficients on the scope variables are significantly different from zero at, at least, the p = .05 level. In the models in which the yes responses are adjusted by the certainty scale, the coefficients on the scope variables are significantly different from zero at, at least, the p = .10 level.

When considering the models with dummy variables for the different scope versions, the differences in the coefficients on *SCOPE10* and *SCOPE20* are not statistically significant at normal levels. This is suggestive for interpretation of previous contingent valuation results. A number of split-sample studies have found that willingness to pay estimates are insensitive to scope. The current study would have reached the same conclusion if only the $\Delta q = 10$ and $\Delta q = 20$ versions were included. In other words, willingness to pay is larger when $\Delta q = 20$ relative to $\Delta q = 10$ but the difference is not statistically significant. Theory predicts that willingness to pay should be nondecreasing in scope. In this study willingness to pay increases from $\Delta q = 2$ to $\Delta q = 10$ and then begins to flatten out. In many studies, the failure to find sensitivity to scope may be a survey design flaw due to the lack of a range of scopes presented to respondents and not a flaw in the contingent valuation method.

The coefficient on the cheap talk dummy variable is not statistically significant in any of the models. This suggests that the cheap talk script does not reduce willingness to pay as in past research. However, the current models constrain the effect of the cheap talk script to be direct. In other words, cheap talk is a shifter of willingness to pay. An alternative modeling approach is to allow the cheap talk script to affect willingness to pay indirectly through the other coefficients. This can be accomplished by (1) a switching regression with interaction variables between the cheap talk variable with other variables or (2) estimating separate models for the different

versions of the survey. Since these models are beyond the scope of the current report, we do not present the results here. But preliminary models confirm that there is an indirect effect of cheap talk on willingness to pay. Specifically, cheap talk makes it more likely for willingness to pay to be affected by the scope of the policy and household income.

The effect of income on willingness to pay is positive in each of the basic models indicating that the air quality improvements resulting from the green energy program are normal goods (Table 8). The income elasticity of willingness to pay from Model 1 is 1.62 when evaluated at the mean of all variables. This indicates that willingness to pay is sensitive to income. When demographic variables are included, the effect of income on willingness to pay is not significantly different from zero (Table 9). This result is due to the correlation of income with age, education, health, household size, marital status and sex due to the correlation. This result does not lead to the conclusion that willingness to pay is not constrained by the ability to pay.

When demographic variables are included only two additional coefficients are statistically different from zero. Willingness to pay declines with age and is higher for those respondents who have donated money to environmental charities in the past two years. The likelihood ratio tests comparing the models from Table 9 to the equivalent models of Table 8 indicate that the vector of coefficients is significantly different from zero in each of the four comparisons. This indicates that the models in Table 9 are preferred. The paucity of significant coefficients is most likely due to the correlation of income and other demographic variables.

There are no major differences in the models with the raw yes responses and adjusted yes responses as dependent variables. Past research that uses the certainty scale adjustment finds that the adjusted willingness to pay values are not theoretically valid. In other words, some expected

signs on coefficients are not found and/or are not statistically significant. This is not a problem with the current application.

Willingness to pay estimates from the four models of Table 8 are presented in Table 10. The equivalent willingness to pay estimates from Table 9 are similar and are not presented for simplicity. Six different estimates are presented for each model: willingness to pay at each of the three scope levels and with and without the cheap talk version. We assess the effect of the cheap talk script due to its potential for indirect effects as discussed earlier.

The willingness to pay estimates without the cheap talk script are all statistically significant at, at least, the p = .10 level. With the cheap talk script, three of the four $\Delta q = 2$ willingness to pay estimates are not statistically significant. All six willingness to pay estimates are statistically insignificant when both techniques used to minimize hypothetical bias are invoked. This leads to one of two conclusions: (1) using both techniques in the same study is overkill or (2) willingness to pay in this study is not statistically different from zero. We are persuaded by the preponderance of theoretically consistent results in this study that the first conclusion is more compelling.

Models 1 and 2 without cheap talk are likely to be prone to hypothetical bias. Willingness to pay ranges from $6 to $27 when the log of willingness to pay is linear in scope. When the assumption of linearity is relaxed, willingness to pay ranges from $5 to $24. Willingness to pay falls by 50% when either of the techniques commonly used to minimize hypothetical bias are employed. With the cheap talk script and the linearity of scope, willingness to pay estimates range from $3 to $14. When the dependent variable is adjusted by the certainty scale, willingness to pay estimates range from $3 to $12. With the dummy variable models, willingness to pay

varies from $0 to $13 and $3 to $11 with Models 2 and 4, respectively. A striking result is the similarity of the willingness to pay estimates across the two techniques used to minimized hypothetical bias.

Table 1. Data Summary

Variable	Description	Mean	Std Dev	Min	Max
AGE	Age of respondent	45.8	15.97	18	86
CHARITY	1 = contributes to environmental charity	0.28	0.45	0	1
CHILD	Number of children	0.78	1.15	0	6
EDUC	Education in years	14.41	2.48	10	20
HEALTH	1 = health is "very good"	0.46	0.5	0	1
HOUSE	Household size	2.81	1.39	1	10
INCOME	Household income	52.77	29.4	10	100
MARRIED	1 = married	0.68	0.47	0	1
PAYSBILL	1 = pays utility bill	0.75	0.43	0	1
SEX	1 = male	0.42	0.49	0	1

Sample Size = 332

Table 2. Experimental Design

	Scope			
Cheap Talk	2	10	20	Total
No	74	69	63	206
Yes	47	33	32	105
Total	119	99	93	311

Table 3. Willingness to Pay Responses by Monthly Fee

	Monthly Fee				
	5	15	30	50	Total
No	35	47	53	43	178
Yes	51	39	20	23	133
Total	86	86	73	66	332
%YES	59.30	45.35	27.40	34.85	40.06

Table 4. Willingness to Pay Responses by Scope

	Scope			
	2	10	20	Total
No	79	53	46	178
Yes	40	46	47	133
Total	119	99	93	311
%YES	33.61	46.46	50.54	42.77

Table 5. Willingness to Pay Responses

No "Cheap Talk"

	Monthly Fee				
	5	15	30	50	Total
No	24	30	32	25	111
Yes	36	26	15	18	95
Total	60	56	47	43	206
%YES	60.00	46.43	31.91	41.86	46.12

"Cheap Talk"

	Monthly Fee				
	5	15	30	50	Total
No	11	17	21	18	67
Yes	15	13	5	5	38
Total	26	30	26	23	112
%YES	57.69	43.33	19.23	21.74	33.93

Table 6. Certainty Scale for "Yes" Responses

	Monthly Fee				
Certain	5	15	30	50	Total
1	1	0	0	0	1
2	1	1	0	1	3
3	0	1	0	0	1
4	1	1	0	1	3
5	3	1	5	1	10
6	1	6	1	0	8
7	10	8	3	2	23
8	17	9	6	10	42
9	4	2	1	1	8
10	13	10	4	7	34
Total	51	39	20	23	143
% "Sure Yes"	86.27	74.36	70.00	86.96	74.83

Table 7. Willingness to Pay Responses: Adjusted by Certainty Scale

No "Cheap Talk"

	Monthly Fee				
	5	15	30	50	Total
No	30	34	36	27	127
Yes	30	22	11	16	79
Total	60	56	47	43	206
%YES	50.00	39.29	23.40	37.21	38.35

"Cheap Talk"

	Monthly Fee				
	5	15	30	50	Total
No	12	23	23	19	77
Yes	14	7	3	4	29
Total	26	30	26	23	112
%YES	53.85	23.33	11.54	17.39	25.89

Table 8. Probit Willingness to Pay Models

					Adjusted by Certainty Scale			
	Model 1		Model 2		Model 3		Model 4	
	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
Constant	0.13	0.41	0.14	0.48	-0.17	-0.53	-0.16	-0.53
LNFEE	-0.34	-3.97	-0.34	-3.97	-0.33	-3.69	-0.33	-3.70
SCOPE	0.03	2.84			0.02	2.37		
SCOPE10			0.36	2.01			0.35	1.88
SCOPE20			0.52	2.85			0.45	2.39
CHEAP	-0.22	-1.40	-0.22	-1.37	-0.31	-1.85	-0.30	-1.81
INCOME	0.01	3.21	0.01	3.18	0.01	3.64	0.01	3.62
LL(B)	-194.53		-194.21		-182.35		-181.94	
LL(0)	-212.30		-212.30		-200.19		-200.19	
χ^2	35.54		36.19		35.67		36.50	
Cases	311		311		311		311	

Table 9. Probit Willingness to Pay Models

					Adjusted by Certainty Scale			
	Model 1		Model 2		Model 3		Model 4	
	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
Constant	0.83	1.26	0.85	1.29	0.28	0.41	0.28	0.42
LNFEE	-0.38	-4.26	-0.38	-4.27	-0.39	-4.19	-0.39	-4.18
SCOPE	0.03	2.81			0.03	2.36		
SCOPE10			0.37	2.02			0.35	1.82
SCOPE20			0.53	2.81			0.46	2.37
CHEAP	-0.16	-1.01	-0.16	-0.97	-0.26	-1.51	-0.25	-1.46
INCOME	0.00	1.32	0.00	1.28	0.00	1.32	0.00	1.30
AGE	-0.01	-2.59	-0.01	-2.58	-0.02	-2.91	-0.02	-2.88
CHILD	0.01	0.07	0.01	0.08	0.03	0.22	0.03	0.23
EDUC	0.01	0.27	0.01	0.22	0.04	1.05	0.04	0.98
HOUSE	-0.09	-0.72	-0.08	-0.69	-0.08	-0.62	-0.08	-0.60
MARRIED	0.05	0.28	0.05	0.25	0.09	0.45	0.08	0.40
SEX	-0.10	-0.65	-0.09	-0.60	-0.01	-0.09	-0.01	-0.03
PAYSBILL	0.12	0.66	0.14	0.75	0.10	0.54	0.12	0.63
CHARITY	0.56	3.04	0.57	3.08	0.56	3.01	0.57	3.04
HEALTH	0.15	0.95	0.15	0.96	0.10	0.59	0.10	0.61
LL(B)	-185.12		-184.76		-172.13		-171.76	
LL(0)	-212.30		-212.30		-200.19		-200.19	
χ^2	57.98		55.08		56.11		56.84	
Cases	311		311		311		311	

Table 10. Willingness to Pay Estimates

Adjusted by Certainty Scale

		Model 1		Model 2		Model 3		Model 4	
Cheap Talk	Scope	WTP	t-ratio	WTP	t-ratio	WTP	t-ratio	WTP	t-ratio
No	2	5.99	2.34	5.27	2.12	3.25	1.79	2.77	1.62
No	10	11.73	3.63	15.02	2.48	5.96	2.62	8.05	2.14
No	20	27.21	2.48	24.05	2.36	12.73	2.39	11.02	2.19
Yes	2	3.14	1.67	0.81	1.04	1.27	1.21	0.24	0.77
Yes	10	6.16	2.21	8.00	1.89	2.34	1.50	3.22	1.44
Yes	20	14.29	2.06	12.81	1.97	4.99	1.59	4.41	1.51

Appendix: Example Survey

North Carolina Green Energy Program
Willingness to Pay Survey Questionnaire
Version 1: Scope=2, Cheap Talk=no, Fee=5

Hello, my name is _____. I am calling from Appalachian State University to ask some questions about windmills in the North Carolina mountains. This is part of a research project to determine whether putting windmills in the mountains is a good idea. All of the responses will be confidential and the survey will only take about 10 minutes. May I begin with a few general questions about energy and the environment? **(If respondent refuses, ask if there is a better time to call and make a callback appointment, if possible. Otherwise, mark the call sheet as a refusal and go on to the next interview.)**

1. Current sources of energy used by power plants are leading causes of air pollution. Coal and oil create more negative impacts on the environment and human health than renewable energy sources like wind and solar. In general, how much do you know about energy sources, uses, and problems? Do you know a lot, some, a little or nothing?

____ A lot
____ Some
____ A little
____ Nothing

2. Air quality in the western North Carolina mountains has experienced problems caused by power plants. Air quality is important for outdoor recreation, visibility, forest and stream health, and human health. How important is outdoor recreation in the western North Carolina mountains to you? Is it very important, somewhat important or not important?

____ Very important
____ Somewhat important
____ Not important

3. How important is visibility in the western North Carolina mountains to you? Is it very important, somewhat important or not important?

____ Very important
____ Somewhat important
____ Not important

4. How important is forest and stream health in the western North Carolina mountains to you? Is it very important, somewhat important or not important?

____ Very important
____ Somewhat important
____ Not important

5. How important is the health of people who live in the western North Carolina mountains to you? Is it very important, somewhat important or not important?

____ Very important
____ Somewhat important
____ Not important

6. Air quality in the western North Carolina mountains is expected to get worse in the future because of population growth. How concerned are you about increased air pollution in the western North Carolina mountains? Are you very concerned, somewhat concerned or not concerned?

____ Very concerned
____ Somewhat concerned
____ Not concerned

7. How concerned are you about increased ozone pollution in the western North Carolina mountains? Are you very concerned, somewhat concerned or not concerned?

____ Very concerned
____ Somewhat concerned
____ Not concerned

8. Acid rain can kill fish in sensitive streams and kill trees. How concerned are you about increased acid rain pollution in the western North Carolina mountains? Are you very concerned, somewhat concerned or not concerned?

____ Very concerned
____ Somewhat concerned
____ Not concerned

9. Small particles in the air make visibility worse and breathing more difficult. How concerned are you about increased small particle pollution in the western North Carolina mountains? Are you very concerned, somewhat concerned or not concerned?

____ Very concerned
____ Somewhat concerned
____ Not concerned

10. Now consider a hypothetical Green Energy program. The hypothetical program is based on a real program that is being considered right now by power plants that affect air quality in North Carolina. How much have you heard about the real program, called the North Carolina Green Power program? Have you heard a lot, some, a little or nothing?

____ A lot
____ Some
____ A little
____ Nothing

11. With the hypothetical Green Energy Program all utility companies in North Carolina would offer their customers power generated from renewable energy sources such as wind and solar. How interested are you in the Green Energy program? Are you very interested, somewhat interested or not interested?

____ Very interested → ***Skip to 12***
____ Somewhat interested → ***Skip to 12***
____ Not interested

We would still like your opinions about the following questions.

12. The goal of this program would be to get 10% of all North Carolina utility customers to sign up. In your opinion, how likely do you think it is that 10% of all North Carolina utility customers would sign up? Do you think it is very likely, somewhat likely, somewhat not likely, or not likely at all?

____ Very likely
____ Somewhat likely
____ Somewhat not likely
____ Not likely at all

13. If 10% of all North Carolina utility customers sign up, air quality in the western North Carolina mountains would improve. Visibility would increase by about **2** miles, the number of streams and acres of forest impacted by acid rain would decrease by about **2** percent, and the number of people who get sick because of breathing problems would decrease by about **2** percent. In your opinion, how likely do you think it is that these goals would be reached? Do you think it is very likely, somewhat likely, somewhat not likely, or not likely at all?

____ Very likely
____ Somewhat likely
____ Somewhat not likely
____ Not likely at all

14. In a voluntary Green Energy program households that choose to participate would pay an extra **5** dollar fee each month with their power bills. This fee would be fixed and not tax-deductible. The fee would cover the higher production costs of green energy. Not including water, what is your average monthly power bill now?

$ _____

15. If you signed up for the green energy program and were not satisfied you could cancel the program at any time. But if less than 10% signed up, the green energy program would not have enough customers to make it cost effective. The program would stop and you would owe no money. Suppose you were given the opportunity to participate in the green energy program for an extra fee of **5** dollars each month. Would you sign up for the green energy program?

____ Yes
____ No → ***Skip to 20***
____ Don't know → ***Skip to 21***

16. We would like to know how sure you are that you would sign up. On a scale of 1 to 10 where 1 is very uncertain and 10 is very certain, how certain are you that you would sign up?

_____ **(Record response, 1 to 10.)**

17. Suppose the cost of the program was underestimated and the extra monthly fee increased. If the extra fee were **15** dollars each month would you cancel the green energy program?

____ Yes → ***Skip to 19***
____ No
____ Don't know

18. If the extra fee were **90** dollars each month would you cancel the green energy program?
____ Yes
____ No
____ Don't know

19. What is the most important reason why you would sign up when the fee is **5** dollars each month?
____ Better environment
____ Better recreation
____ Better visibility
____ Better forest and stream health
____ Better human health
____ For future generations
____ For friends and/or family
____ It is the right thing to do
____ I don't believe I'll have to pay
____ It sounds like a good cause
____ Other reason
____ Don't know

20. We would like to know how sure you are that you would not sign up. On a scale of 1 to 10 where 1 is very uncertain and 10 is very certain, how certain are you that you would not sign up?
_____ **(Record response, 1 to 10)**

21. Suppose the cost of the program was overestimated and the extra monthly fee decreased. If the extra fee were **3** dollars each month would you sign up for the green energy program?
____ Yes → ***Skip to 23***
____ No
____ Don't know

22. If the extra fee was **1** dollar each month would you sign up for the green energy program?
____ Yes
____ No
____ Don't know

23. What is the most important reason why you would not sign up when the fee is **5** dollars each month?
____ The cost is too high
____ I don't trust the power companies

____ I already pay enough for power
____ The environment is clean enough
____ I don't like hypothetical questions
____ I don't have enough income
____ I don't think the program will be effective
____ Other reason
____ Don't know

Now I need to ask a few demographic questions to assist with the analysis. I assure you again that your responses are confidential.

24. What is your zip code?

— — — — —

25. How many people, including yourself, normally live in your household?

_____ People → ***if less than 2, then skip to 28***

26. How many of these people are under 18 years of age?

_____ People

27. Are you married?
____ Yes
____ No

28. Are you male or female? **(Don't ask if the answer is obvious; just mark the appropriate category.)**
____ Male
____ Female

29. What is your age?

_____ Years

30. Some people consider the next few questions to be sensitive. I promise you that your name will never be associated with your answers. Are you the person who usually pays the power bill for your household?
____ Yes
____ No

31. In the last two years, have you contributed to any environmental groups like the Sierra Club, the Nature Conservancy, or any other groups like that?
____ Yes
____ No

32. Do you consider your health to be very good, good, poor, or very poor?
____ Very good
____ Good
____ Poor
____ Very poor

33. What is your highest level of education completed?
____ Less than high school graduate
____ High school graduate
____ Some college / not a college graduate
____ Associate degree / community college graduate
____ Bachelors degree / college graduate
____ Masters degree
____ PhD degree
____ Law school graduate
____ Medical school graduate

34. As close as you can recall, what is your household's total annual income before taxes? Is it less than 15 thousand dollars, between 15 and 25 thousand, between 25 and 30 thousand, between 30 and 35 thousand, between 35 and 40 thousand, between 40 and 45 thousand, between 45 and 50 thousand, between 50 and 60 thousand, between 60 and 75 thousand, between 75 and 100 thousand or more than 100 thousand?
____ Less than $15,000
____ Between $15,000 and $25,000
____ Between $25,000 and $30,000
____ Between $30,000 and $35,000
____ Between $35,000 and $40,000
____ Between $40,000 and $45,000
____ Between $45,000 and $50,000
____ Between $50,000 and $60,000
____ Between $60,000 and $75,000
____ Between $75,000 and $100,000
____ More than $100,000

This concludes our interview. Thank you very much for participating!