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Consumer Willingness-to-Pay for Green Energy:

Results from Focus Groups

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Abstract

To find out if consumers are willing to pay a surcharge for "green energy," the Alabama Department of Agriculture and Industries hosted consumer focus groups at four locations in Alabama. Results showed that consumers were willing to pay a premium in line with the costs, but that most did not have much prior information about green energy options.

Introduction

Co-firing biomass with coal to produce electricity offers multiple benefits, including reduction of emissions such as CO2, NOx, SOx and mercury, and generation of new markets for agriculture. These benefits could be particularly helpful in southeastern states where most of the electricity produced is from coal fired power plants, and where rural economies are in crisis. Alabama serves as a good example. About 70% of the electricity in this state is produced from coal. Ten years ago all the coal used for this purpose was mined in Alabama, but because local coal is high in sulfur by 2002 the state imported 62% of the coal it needs from other states.

Even though there are many benefits of co-firing biomass with coal to produce electricity in the southeastern USA, on an energy basis the cost of the energy in biomass typically is considerably higher than that of coal. Bituminous coal at $50 a ton amounts to a cost of around $1.92 per MMBtu. By contrast, hay, at a price of $50 per ton, translates to a cost of $3.57 per MMBtu.

Currently, Alabama Power offers residential consumers the option to purchase 100 kilowatt-hour blocks generated from renewable sources (switchgrass) for an additional $6 a month. However, the great majority of consumers in the state have not opted to pay the

additional fee for renewable energy. For market success, either the energy produced must be economically competitive with traditional energy sources or consumers must be willing to pay more for "green energy." Given the current discrepancy in energy costs between biomass and coal, consumers' willingness to pay extra for bioenergy is an important consideration. The purpose of this research was, therefore, to investigate Alabama consumers' willingness to pay (WTP) for green energy and also to discover what factors may be impediments to subscription to green energy programs in Alabama.

Background

Co-firing involves burning a biomass feedstock simultaneously with coal to produce electric power. Co-firing replaces a portion of the coal used to produce energy, typically 2 to 20 percent (Robinson, Rhodes, and Keith). Existing power plants can be retrofitted to allow co-firing, and the technical feasibility of co-firing biomass and coal has been well demonstrated (see for example Aerts and Ragland or Tillman and Hughes, among others). Although there are many potential sources of biomass feedstocks including wood chips and poutry litter, the Department of Energy's Bioenegy Feedstock Development Program (BFDP), has focused on switchgrass (*Panicum virgatum*), a high-yielding perennial grass species with a broad geographic distribution and positive environmental attributes (McLaughlin and Walsh).

Although market research has been conducted on consumer WTP for renewable energy, much of the research is proprietary and not released to the public. Fahrar provides a review of the findings of market research in this area, summarizing reports provided by utility companies to the U.S. Department of Energy. She concluded that while consumers favor renewable energy programs, most knew little about them. Of consumers surveyed, 52 to 95 percent reported being willing to pay at least a small amount for increased renewable energy and

that WTP increased with knowledge. The work she reviewed also indicated that offering renewable energy programs may increase positive attitudes of consumers toward their utility companies.

Methods

Because our research was exploratory in nature, focus groups were the primary method used in the project. The concept for the focus group methodology was introduced into the sociology literature by Merton and Kendall (1946), and has since gained broad acceptance as a research tool by a wide range of social scientists (Gibbs, 1997; Goss and Leinbach, 1996). Focus groups consist of a small group of a targeted audience (in our case, electricity consumers), and a moderator, who steers a discussion around the topic under consideration.

Between May 24 and June 25, 2005, four focus groups were conducted for the project in different Alabama cities: Opelika, Montgomery, Huntsville and Mobile. The focus groups were conducted after researchers obtained input from industry and government officials. The Auburn University Center for Government Studies (CGS) was engaged to scientifically recruit participants for the groups. To augment the information typically garnered from a focus group, questionnaires were administered to participants both before and after the sessions.

Industry Group Meeting

Before the focus groups were conducted, an industry meeting was held in Montgomery at the Beard Federal Building. In attendance were representatives from the state Department of Agriculture and Industries, Alabama Power, and the Utility Commissioner's office. The purpose of the meeting was to narrow down the types of questions that would be asked at the focus groups, and to obtain input from these representatives as to any questions they might think appropriate.

After the industry meeting was conducted a presentation was developed to be used by the focus group moderator to guide the focus group discussion. The presentation provided factual information on energy use in Alabama and about the use and costs of green energy alternatives.

Recruiting of Focus Group Participants

To recruit participants, the Center for Government Services (CGS) purchased random phone number lists. Individuals on the lists were called at random by a team of phone survey specialists. Calls were made in the early evening hours, and an attempt was made to obtain a representative mix of citizens of each of the counties where the groups were to take place, including those living in unincorporated surrounding areas.

In the initial calls, participants were tentatively recruited. A short questionnaire was used in this first contact. Potential participants were asked their age category, their racial identification, their gender and how far they lived from the host city. In addition, a screening question was used to eliminate employees of public utilities, cooperative extension, newspapers, the Auburn University College of Agriculture, and their family members. Because of unbalanced acceptance rates, it was necessary to over-recruit, then to make a second call in which the desired individuals were confirmed. On average, the CGS tentatively recruited about 25 individuals for each group, of whom 20 were ultimately invited to participate. Potential participants were offered a $25 payment, along with either a meal for the two evening groups (Auburn-Opelika and Montgomery), or snacks for the morning groups (Huntsville and Mobile).

Although the participants were randomly recruited, it is a stylized fact that certain types of people are generally more likely to agree to participate in focus groups, creating a potential for selection bias. This is true even when participants receive compensation.

Generally, individuals willing to participate in focus groups may be considered to be more publicly aware, or they may be seeking social interaction. Nonetheless, focus groups are still the norm in exploratory analysis of potential policies or for market research, and the random, scientific, recruiting method used should help mitigate selection bias in the groups conducted for this project.

Focus Groups

Two questionnaires were used at the focus groups. The purpose of the questionnaires was to elicit knowledge about alternative energy sources of the focus group participants both before and after the PowerPoint presentation and the group discussion (see Appendix A and Appendix B for full text of the questionnaires). Demographic information was also collected. Participant demographics were well balanced, consisting of individuals from a wide variety of social backgrounds. Fourteen people participated in Opelika, 8 in Huntsville, 13 in Montgomery and 12 in Mobile for a total of 47 participants.

Statistical Results

The data from each of the focus groups was ultimately combined and used to examine statistical properties of the focus groups. The combined data included responses from sufficiently many individuals (47) to perform some simple analyses.

Tables 1-5 contain means and standard errors summarizing certain key responses from the initial and follow-up questionnaires. Tables 1 to 4 are for individual groups, and Table 5 includes statistics from the 4 groups overall.

Participants: The group participants were fairly old, in their late 40's overall (49.5 years on average). This is to be expected, as we had a fairly high rate of participation by retired individuals (10%), whose schedules would be more flexible. In addition, slightly less than half

of participants were employed full time, and average education levels fell between 'some college' and 'associate degree'.

Willingness to Pay: Two responses that are of considerable interest to the project are those to the question:

> How much additional on your electric bill do you think it should cost a month to have 10% of your electric come from renewable, environmentally friendly sources? $_____

The above question was asked at the beginning and the end of the survey, to try to assess the way that information received, and interactions with group members, affected basic WTP for green energy. The responses were unguided and open-ended. Two interesting results emerged. First, willingness to pay for the Auburn-Opelika and Montgomery groups decreased from the initial questionnaire to the follow up. Second, the dispersion of answers (as measured by standard error) significantly decreased in the follow up questionnaires for all four groups. The lowering of dispersion suggests that during the group, the participants obtained enough information to help them make better informed responses. The fact that WTP decreased in two groups is not of concern, as it is clear from the standard errors from those responses that individuals initially lacked knowledge to make reasonable guesses about the worth of green electric power. By the end of the group, participants had more knowledge on which to base their valuations. Overall, post-session WTP is calculated to be $5.73/month to have 10% of electricity coming from alternative energy sources.

A second question on WTP, to which participants could respond 'yes/no' was considerably more stable across groups and across the pre and post session questionnaires. This type of question has been shown to elicit less biased estimates of WTP than do open ended questions as above. Precise wording of the question follows:

Do you think that it would be worth it to pay $6 additional on your electric bill per month to have about 6-7% of your electricity come from renewable, environmentally friendly sources? □ Yes □ No

Positive response to the yes/no question increased in each group as compared to the open-ended question, with a majority of respondents overall responding that they think it is worth it to pay an additional $6/month for green power. Note that the question was designed to track with information provided to us on average KWh usage per household. We wanted to match fairly realistically the amount of electricity Alabama Power's green subscribers are purchasing. The weighted average proportion of yes votes for all participants is 0.7021; as is common in valuation methods using yes/no responses to a fixed price, we can calculate the expected WTP for 6-7% of household electricity to $4.21. Note that the implied amount for 10% of energy from green sources is proportionately somewhat higher than estimated from the open-ended WTP question: using the mid-point of percentage range (6.5%) results in WTP of $6.48 for 10% green power (i.e. 10%/6.5% X $4.21=$6.48).

Attitudes: We probed participants' attitudes on energy-related issues. Several key questions were asked on our questionnaires to enable us to examine answers statistically. We found that the majority of participants (63.8%) believe that global warming is a real phenomenon. We asked who the participants felt should be responsible for paying for excess costs of green power. A majority felt that electric companies alone should pay (44.7%) followed by 27.8% who felt the federal government should help electric companies pay, and 14.9% who felt that only those who wanted to buy green power should pay. These attitudes were borne out in group discussions. Participants exhibited a strong distrust of the electric companies, expressing doubt that if individuals were to pay that the companies would actually deliver green energy. In the Montgomery group, especially, these attitudes were prevalent, and the participants felt strongly

that the electric companies need to work with the government to educate the public about biopower and other alternative energy sources.

We found that there was a significant misunderstanding of energy delivery—many participants throughout the state expressed concerns that the electric company would not be able to deliver the green power *they* paid for to *their* house. This misunderstanding perhaps gave rise to the expressed distrust of power companies. Clearly, there is an opportunity for electric companies to educate the public about electric usage and potential benefits of alternative sources.

Though our research shows that a majority of Alabama's electric customers believe that it is worth purchasing green energy, the reality is that Alabama Power's program for green power is undersubscribed, as is likely the case with TVA's program. We were able to use the focus groups to probe reasons why the green program is not more successful. Clearly, our findings show that it is primarily lack of consumer awareness about the existing programs that is hampering their success. Almost none of the participants had ever heard of biopower, and not one was familiar with Alabama Power's program. All participants were surprised to find out such a possibility exists. This suggests that a much greater effort must be made to educate the public about alternative energy sources, and to make them aware of existing programs.

Regression analysis: In addition to the mean statistics reported in Tables 1-5, we wanted to explore statistical relationships between WTP and a number of different respondent characteristics and attitudes. To this end, we used multivariate regression analysis to see which of these factors might contribute positively and negatively to WTP for green energy. As above, we examined answers to the pre and post session open ended WTP. We were especially interested to see if a given characteristic had a different influence before and after the session. In

Table 6 we report results from two models. It should be noted that because of non-response to certain questions, the results are based on only 41 surveys.

The regression models are of the form

$$WTP = \alpha_0 + \alpha_1 X + \alpha_2 Z + \varepsilon$$

where X represents beliefs and attitudes of respondents and Z represents participant demographic characteristics (see Table 6). ε represents an error for factors unaccounted for by variables included in the model. The α's are parameters that tell which way, if any the variables affect WTP stated by participants.

As in the raw statistics, we found that the estimated WTP range was considerably better understood by participants after they were exposed to our presentation. The models can be used to predict values of WTP for each respondent; the predicted values of WTP can then be compared to the actual WTP respondents filled in on their questionnaires. The ability of a regression to predict values is thus a measure of goodness of fit, or R^2. As can be seen in Table 4, the R^2 value for the post-session WTP is 40 times higher than the pre-session WTP, suggesting that attitudes and demographics contributed more to explaining variations in WTP after participants received information about biopower.

In the pre-session surveys, the only variable that had a nonzero effect on WTP was a dummy variable (1=yes, 0=no) for people who thought it worth a $6.00/ month payment for biopower amounting to about 6-7% of a household's total monthly electric usage; a yes response is positively related to WTP. After the session, the number of variables having a significant effect on stated WTP increased from one to four: variables indicating retired individuals and individuals responsible for paying household bills, along with the dummy variable for 'worth $6 per month' question above all positively contributed to stated WTP for biopower. Surprisingly,

the coefficient for the variable representing individuals who were aware of alternative energy programs was negative, meaning that these individuals were associated with lower than average WTP. It should be noted, however, that so few individuals had ever heard of the programs that the net negative effect is very small.

Another important result of the regression analysis is that there is no difference in WTP among different ethnic and socioeconomic groups. This suggests that alternative energy programs may be widely accepted across the state's population, if properly promoted.

Conclusions

In all, the results of the focus groups demonstrate a few key points. First, citizens have not been made aware of the potential for alternative energy. Some individuals in the focus group with K-12 age children had gotten some secondhand information from their children, who had learned about it in school. This indicates that the next generation of Alabamians may be better educated in environmental and sustainability issues. However, the lack of knowledge of adults was surprising. Second, it is clear that Alabama Power's and TVA's efforts to promote sales of green energy appear inadequate, given the widespread lack of knowledge of current programs available to consumers. The final point to be made is that once the respondents received some information, they became interested in biopower's possibilities. In addition, they made the clear point that they believe the government, industry and educators should act quickly to bring the public information about alternative energy.

Table 1: Summary of Questionnaires, Opelika (N=14)

Survey Questions	Mean	Std Error
Pre group WTP/mo for 10% of electric from biopower ($)	9.7857	11.7223
Post Group WTP/mo for 10% of electric from biopower ($)	5.7500	3.9515
Worth $6/Mo more for 6-7% monthly electric bill to be biopower (pre-group; 0,1)	0.4286	0.5135
Worth $6/Mo more for 6-7% monthly electric bill to be biopower (post-group; 0,1)	0.5000	0.5189
Believe global warming is real (0,1)	0.4286	0.5135
Believe only individuals who want biopower should pay excess cost (0,1)	0.1429	0.3631
Believe electric companies alone should pay excess cost (0,1)	0.4286	0.5135
Believe federal government should help electric companies pay excess cost (0,1)	0.2143	0.4258
Age	48.8929	14.7142
Employed full time (0,1)	0.5000	0.5189
Retired/disabled (0,1)	0.0714	0.2673
Education level of household head (3=some college, 4=associate	3.2857	1.7289
White (0,1)	0.5000	0.5189
Black (0,1)	0.4286	0.5135
White (0,1)	0.5000	0.5345
Black (0,1)	0.2500	0.4629

Table 2. Summary of Questionnaires, Huntsville (N=8)

Pre group WTP/mo for 10% of electric from biopower ($)	4.8125	4.1743
Post Group WTP/mo for 10% of electric from biopower ($)	4.9375	3.4479
Worth $6/Mo more for 6-7% monthly electric bill to be biopower (pre-group; 0,1)	0.5000	0.5345
Worth $6/Mo more for 6-7% monthly electric bill to be biopower (post-group; 0,1)	0.6250	0.5175
Believe global warming is real (0,1)	0.7500	0.4629
Believe only individuals who want biopower should pay excess cost (0,1)	0.1250	0.3536
Believe electric companies alone should pay excess cost (0,1)	0.6250	0.5175
Believe federal government should help electric companies pay excess cost (0,1)	0.1250	0.3536
Age	46.6250	14.9445
Employed full time (0,1)	0.7500	0.4629
Retired/disabled (0,1)	0	0
Education level of household head (3=some college, 4=associate	5.0000	1.3093
White (0,1)	0.5000	0.5345
Black (0,1)	0.2500	0.4629

Table 3: Summary of Questionnaires, Mobile (N=12)

Survey Questions	Mean	Std Error
Pre group WTP/mo for 10% of electric from biopower ($)	5.8500	4.8879
Post Group WTP/mo for 10% of electric from biopower ($)	6.4444	4.1642
Worth $6/Mo more for 6-7% monthly electric bill to be biopower (pre-group; 0,1)	0.6667	0.4924
Worth $6/Mo more for 6-7% monthly electric bill to be biopower (post-group; 0,1)	0.6667	0.4924
Believe global warming is real (0,1)	0.7500	0.4523
Believe only individuals who want biopower should pay excess cost (0,1)	0.0833	0.2887
Believe electric companies alone should pay excess cost (0,1)	0.41667	0.5149
Believe federal government should help electric companies pay excess cost (0,1)	0.3333	0.4924
Age	49.4167	14.1435
Employed full time (0,1)	0.3333	0.4924
Retired/disabled (0,1)	0.2500	0.4523
Education level of household head (3=some college, 4=associate	3.6667	0.7785
White (0,1)	0.2500	0.4523
Black (0,1)	0.7500	0.4523

Table 4: Summary of Questionnaires, Montgomery (N=13)

Pre group WTP/mo for 10% of electric from biopower ($)	8.4444	8.7050
Post Group WTP/mo for 10% of electric from biopower ($)	5.5417	3.4076
Worth $6/Mo more for 6-7% monthly electric bill to be biopower (pre-group; 0,1)	0.5385	0.5189
Worth $6/Mo more for 6-7% monthly electric bill to be biopower (post-group; 0,1)	1.0000	0
Believe global warming is real (0,1)	0.6923	0.4804
Believe only individuals who want biopower should pay excess cost (0,1)	0.2308	0.4385
Believe electric companies alone should pay excess cost (0,1)	0.3846	0.5064
Believe federal government should help electric companies pay excess cost (0,1)	0.3846	0.5064
Age	52.1538	14.6321
Employed full time (0,1)	0.3077	0.4804
Retired/disabled (0,1)	0.0769	0.2773
Education level of household head (3=some college, 4=associate	4.0769	1.4979
White (0,1)	0.4615	0.5189
Black (0,1)	0.4615	0.5189

Table 5: Summary of Questionnaires, All Groups

Survey Questions	Mean	Std Error
Pre group WTP/mo for 10% of electric from biopower ($)	7.5633	7.8580
Post Group WTP/mo for 10% of electric from biopower ($)	5.7314	3.7696
Worth $6/Mo more for 6-7% monthly electric bill to be biopower (pre-group; 0,1)	0.5319	0.5132
Worth $6/Mo more for 6-7% monthly electric bill to be biopower (post-group; 0,1)	0.7021	0.3684
Believe global warming is real (0,1)	0.6383	0.4801
Believe only individuals who want biopower should pay excess cost (0,1)	0.1489	0.3633
Believe electric companies alone should pay excess cost (0,1)	0.4468	0.5126
Believe federal government should help electric companies pay excess cost (0,1)	0.2766	0.4528
Age	49.5426	14.5850
Employed full time (0,1)	0.4468	0.4920
Retired/disabled (0,1)	0.1064	0.2718
Education level of household head (3=some college, 4=associate	3.8936	1.3509
White (0,1)	0.4255	0.5046
Black (0,1)	0.4894	0.4908

Table 6: Regression Analysis

	Dependent Variable is Pre-Group WTP Dependent Mean=7.5610			**Dependent Variable is Post-Group WTP** Dependent Mean=5.68293		
Variable	Parameter Estimate	Standard Error	P Value	Parameter Estimate	Standard Error	P Value
Intercept	4.8866	13.33485	0.7171	-2.8458	4.4933	0.5323
Beliefs/Attitudes						
Believe Global Warming is Real (1,0)	-4.5462	3.39077	0.1921	-0.6000	1.1464	0.6053
Believe only those who want biopower should pay all for it (1,0)	-6.9181	6.38077	0.2886	-1.2932	2.3526	0.5874
Believe electric companies should pay all for biopower (1,0)	-6.2938	5.30986	0.2470	0.9855	2.1156	0.6454
Believe fed government should help electric companies pay for biopower (1,0)	-1.7499	4.83873	0.7206	-2.4309	1.9188	0.2169
Believe it's worth $6/mo to have 6-7% of electric come from biopower (1,0)	9.0200	3.29885	**0.0113***	5.4998	1.1992	**0.0001***
Participant was aware of green power electric programs in AL (1,0)	3.9799	5.44642	0.4717	-4.5407	1.8012	**0.0185***
Participant had ever heard of Green Power (1,0)	-3.0744	4.53051	0.5036	-0.5485	1.3435	0.6866
Participant Demographics						
# Persons in Household	53928	1.05013	0.1552	0.2329	0.3367	0.4954
Age of respondent	-0.0485	0.15368	0.7551	0.0322	0.0476	0.5045
Race=Asian or Other (1,0)	1.6609	5.94712	0.7823	0.7892	1.9024	0.6818
Education level of household head (1-5)	0.4426	1.25389	0.7271	0.1920	0.3963	0.6323
Full time worker (1,0)	-3.2828	4.53984	0.4763	1.2267	1.4322	0.3998
Retired or disabled (1,0)	-4.0563	6.08055	0.5108	3.7750	1.9079	**0.0590***
Participant pays for electric bills (1,0)	0.5724	4.88824	0.9077	2.6829	1.4805	**0.0820***
AL Power is participant's electric provider (1,0)	4.2570	3.07876	0.1790	-0.3609	1.0334	0.7299
	Adj R-Sq 0.0117; _N_=41			Adj R-Sq 0.4030; _N_=41		

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Appendix A: Green Power Focus Group Questionnaire

Thank you for participating in this group discussion. Remember, all information from this group will be held in strictest confidence. To get an idea how much you are aware of the topics we will discuss, we would appreciate your filling in the brief questionnaire below.

1. Are you the person who usually pays the electric bills in your house
□ Yes □ No

2. Which utility provides electricity to your house?
_____ (Company or public utility) ***or*** □ Don't Know

3. Have you ever heard of 'Green Energy' or 'Biopower'? □ Yes □ No

4. Are you aware of electric company programs in Alabama that offer alternative energy sources for sale for an additional fee? □ Yes □ No

5. Do you believe that Global Warming is real? □ Yes □ No □ Don't Know

6. A number of members of society contribute to air pollution, and lots of money is spent every year to clean it up. Please rank the groups below for whom you think should be most responsible for clean air (1=most responsible,… 4=least responsible)

	Federal government	State/Local government	Individuals who use energy (i.e. society at large)	Corporations that sell and market energy
Rank—please fill in at right				

7. Do you think that it would be worth it to pay $6 additional on your electric bill per month to have about 6-7% of your electricity come from renewable, environmentally friendly sources? □ Yes □ No

8. How much additional on your electric bill do you think it should cost a month to have 10% of your electric come from renewable, environmentally friendly sources? $_____

9. How many people live in your household?_____

10. What is the highest level of education of the head of your household?
Not a high school graduate □ High school graduate □ Some College □
Associate/technical degree □ Bachelor's degree □ Post-graduate □

11. What is your employment status?
Working fulltime □ Working part time □ Unemployed □ Retired or disabled □

Appendix B: Green Power Focus Group Follow-Up Questionnaire

Now that you have participated in this group discussion, we would like to ask you a few more questions. Some of the questions are the same as we asked at the beginning. If you changed your mind after participating in the discussion, that's fine. Just answer according to how you feel about the topic nos.

1. Do you think that it would be worth it to pay $6 additional on your electric bill per month to have about 6-7% of your electricity come from renewable, environmentally friendly sources? □ Yes □ No

2. How much additional on your electric bill do you think it should cost a month to have 10% of your electric come from renewable, environmentally friendly sources? $_____

3. Do you think that most of the cost of providing alternative energy should be paid by (choose one):

Only people who want to buy it from the electric utility □
Everyone who buys and uses electricity □
Electric companies □
Electric companies with help from Government □
Other (explain)_____

4. If everyone who buys electric from one company had to accept having 6-7% of their electric provided by biopower, do you think it would be worth it for everyone in the company (except for very poor people) to pay an additional $2.50/month for their electric? □ Yes □ No □ Don't Know

5. What would be the main reason you would support paying for use of biopower by electric companies?

Helps farmers by providing a new crop □
I care about the environment in general □
I am worried about the health effects of pollution □
Helps Alabama's economy □
Helps eliminate dependence on foreign oil □
Other _____

6. What would be the main reason you would ***not*** support paying for use of biopower?

It's too expensive □
I don't think there are energy problems at present □
I think it's the government's responsibility □
It doesn't help Alabama's economy enough □
Other _____

7. Did you learn a lot □, a little □, or nothing □ in today's group?

8. Do you think you will now discuss biopower with friends/family? □ Yes □ No □ Don't Know