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## Attitudes Concerning Wind Energy in Central Illinois

By Sophie Theron, J. Randy Winter, David G. Loomis, and Aslihan D. Spaulding

### Abstract

Energy consumption in the United States has been increasing and the cost of fossil fuels has been unstable in recent years. Expanding investment in renewable energy is one way to reduce the nation's dependence on fossil fuels. However, the Not-In-My-Back-Yard (NIMBY) opposition and various concerns raised at public hearings may inhibit the expansion of wind energy in Illinois. This study aims to characterize the public beliefs and opinions toward wind energy in central Illinois.

### Introduction

Today, the wind energy sector is part of the country's energy portfolio, but its contribution is still very low, under two percent, in comparison to coal and nuclear energy as shown on Figure 1. However, development of wind farms is expanding rapidly and in 2008 the United States became the number one producer of wind energy in the world with 35,159 megawatts of capacity which represents 22.3 percent of the world's capacity (*The Economist*, 2010). Witnessing the tremendous growth of commercial wind farms has caused the population to develop opinions about the wind farm phenomenon. The development of wind farms in a local community adds another source of real estate revenue for land owners and farm managers from the leasing of turbine construction sites. Lease payments from wind farms directly impact the value of rural property. Thus farm managers and rural appraisers are directly impacted by the acceptance and development of a wind farm in a specific community and the consequences of the development on the value of the rural property. This study evaluates the level of support for wind farm development in central Illinois and identifies issues of concerns for the affected rural residents.

### Wind Energy in Illinois

The production of electricity in Illinois comes primarily from coal and nuclear power. Renewable energy accounts for less than one percent in the production mix (Energy Information Administration, 2010). The wind energy resource potential in Illinois ranks sixteenth nationally with an estimated annual potential of 61 billion kWhs (American Wind Energy Association, 2009). Wind development in Illinois is ahead of its potential as Illinois is currently in the top ten states for installed wind energy. As of September, 2009, Illinois had nineteen wind projects online, ranking seventh in the U.S. with 1,547 MW installed (American Wind Energy Association, 2010).



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In 2007, the state of Illinois passed legislation that includes a Renewable Electricity Standard (RES) mandating that 25 percent of electricity delivered by the investor-owned utilities will be produced from renewable energy by 2025. Seventy-five percent of the renewable energy is mandated to come from wind power (Illinois General Assembly, 2007). Meeting this mandate implies that approximately 7,500 to 8,000 MW of renewable energy must be built in Illinois within the next fifteen years if all of the renewable energy is to be produced within the state. In addition, approximately 6,000 MW of installed wind capacity is implied to meet the 75 percent wind energy requirement (American Wind Energy Association, 2009). Public acceptance of wind farm developments will play a critical role in the state's ability to achieve this level of wind farm development.

### Developing a Wind Farm

The process of developing a wind farm spans several years and is comprised of numerous steps. First, the developer finds a location with sufficient wind resources using wind maps and available meteorological data. After identifying promising sites, the developer makes initial contact with landowners and local government officials to gauge the general level of support within the community. Then, they use a meteorological test tower to gather actual wind speed data. During this period, a check of existing transmission lines is necessary. If the interest in the location is maintained, the developer engages in negotiations with landowners to lease land for wind turbines, access roads, power lines, and substations. The draft of the site plan can then be developed. Negotiations of the leases are finalized and required impact studies are completed (environmental, archeological, wildlife including birds and bats, radar, and airport flight). Public hearings are also conducted during this phase. At this step in the development process, advantages of wind energy can be presented and objections can be raised.

Some of the key advantages of wind energy as identified by supporters are environmental (no waste products, no emission of greenhouse gases), economic (tax revenue, jobs, and landowner payments), energy portfolio diversification, and land conservation. Typical objections to wind farms are noise, shadow flicker (the intermittent shadow caused by rotating blades) interferences with telecommunications/radar, harm to wildlife and birds, negative impact on property value, use of agricultural land, hurdle to aerial application, and impediment to other development opportunities. If the project is approved by the county board, construction can begin resulting in a fully functioning wind farm.

A typical commercial wind turbine has a lifespan of 25 to 30 years (American Wind Energy Association, 2009). It measures approximately 120 meters (397 feet) from the base to the tip of the blade and requires about 0.38 acre on average for the turbine site and access road (National Renewable Energy Laboratory, 2009). Also, a typical 100 MW wind farm will support about 250 short-term construction jobs and ten long-term positions. Landowners receive compensation when a turbine is placed on their land. The typical lease payment varies within the approximate range of \$4,000 to \$6,000 annually per megawatt for fixed compensation contracts, or three to five percent of gross revenue for royalty-based compensation contracts.

### Objectives

The primary objective of the study was to characterize the population's attitudes, whether positive or negative, about commercial wind farm development in central Illinois. In some local hearings for the review of wind farm proposals, testimonies by opposition and support groups are fairly balanced in number. Thus, we wanted to determine if the opposition or support testimony presented at the hearings was representative of the overall population's opinions. The second objective was to examine responses from different groups within the population to ascertain similarities or disparities in attitudes and opinions. The survey was sent to four distinctly different communities: one with a wind farm (Area 1 on the map); one with a proposed wind farm (Area 2); one with no active proposal but with good wind potential (Area 3); and one with limited wind potential (Area 4) as shown on Figure 2. The final objective of the study was to explore the relationship between attitudes concerning wind farms and other renewable energy topics and issues.

### Research Method

The population of interest included individuals living in central Illinois between Interstate 64 and Interstate 80. These central counties have a total population of about 2.8 million people (U.S. Census estimate for 2007). Four specific areas in central Illinois were identified for the study based on their status with respect to large wind farms: Area 1 is in McLean County, close to the Twin Groves Wind Farm; Area 2 spans Mercer and Warren counties; Area 3 spans Morgan and Scott counties; and Area 4 is located in Marion County. Eight hundred surveys were sent (200 to each area) based on an anticipated minimum response rate of 15 percent, yielding at least 30 expected responses from each area. A randomly generated list of addressees was obtained from whitepages.com, a publicly available

database. A potential problem with this approach is the possibility of bias from missing addresses of people who are not listed. According to Iannacchione et al. (2003), an evaluation of mailing addresses conducted in Texas found only 46 missing addresses (1.9 percent) among the 2,380 randomly selected addresses. We discounted concerns about a biased sample based on this low incidence level of missing addresses.

Approximately 1,000 addresses from three adjacent zip codes were identified as the basis for each study area. From these 1,000 addresses, one out of five was randomly selected to obtain the sample size of 200. This process was repeated for each area to identify the 800 survey recipients. The final survey included the cover letter explaining the objectives of the survey and directions for the participants. The questionnaire consisted of a demographics section, an opinion section, and a comment section.

The questionnaires and the cover letters were sent by mail, and the recipients were asked to complete and return the survey within sixty days. After two weeks, a reminder postcard was sent to the addresses from which surveys had not been returned, and after a month a second mailing of the questionnaire was sent to remaining non-respondents. The data were analyzed using SPSS for Windows (2004).

## Results

### The Respondents

There were 313 surveys returned, representing a 39.9 percent return rate. Some of the surveys returned were incomplete and had to be eliminated from the sample. The final number of usable responses was 277, yielding an overall response rate of 35.3 percent. The majority of respondents were male (63%) Caucasian (99%), 56 years of age or older (51%), and married (73%). In addition, 69 percent of the households had two or fewer occupants. The majority of respondents (51%) were full-time employees but there was also a relatively high representation of retired persons (35%). Furthermore, 41 respondents noted their occupation as related to farming. This represented 14.8 percent of the respondents and was the most common occupation.

Household income was fairly diverse. Twenty percent of households earned \$25,000 or less; 32 percent earned between \$25,001 and \$50,000; 24 percent earned between \$50,001; and \$75,000 and 24

percent earned more than \$75,001. On average, the respondents had lived in their current residence for approximately 20 years, indicating a population with a strong vested interest in their communities. In addition, 34 percent reported that the highest level of education completed was high school, while 25 percent of the people had attended some college. The three primary sources of news information were television (47%), newspapers (23%), and radio (12%). The majority of the respondents (65%) use gas as their primary heating fuel followed by electricity (18%). Three percent of the respondents have a hybrid car and 19 percent own a flexible fuel car. The number of vehicles in each household varies from zero to six with an average of 2.4 vehicles per household. Also, 88 percent of the respondents who are currently employed usually drive a car, truck, or van to get to work. The participants were also asked if their county had an operating or a proposed wind farm. The majority of respondents correctly identified whether or not their area has a wind farm and/or an active proposal at the time of the survey.

### Attitude responses

Using a Likert-type scale, respondents' opinions were ascertained by asking if they agreed or disagreed with statements related to general energy issues, renewable energy issues, and government policies. No significant differences were found when comparing opinions about wind energy issues and any of the demographic information (age, sex, education).

Twenty-two percent indicated that they either disagreed or strongly disagreed with the statement that they supported construction of an ethanol plant in their community. This represents the highest level of disagreement with any statement in the survey. On the other hand, when asked if they support the construction of a wind farm in their community, respondents across all areas of the survey expressed the highest level of support with 82 percent indicating that they agree or strongly agree.

The survey item that reflected the highest degree of neutrality or lack of opinion was the statement regarding the availability of competitively priced ethanol produced from cellulosic materials within two years. Seventeen percent of respondents were neutral and 26 percent had no opinion. These responses likely reflect that fact that predictions about the ability to produce cellulosic ethanol have been repeatedly extended with much promise but little substance. Table 1 shows the response distribution for all statements.

When asked to identify the positive attributes of wind energy, the three characteristics that respondents identified as most important were: 1) wind energy reduces dependence on foreign energy sources; 2) wind energy represents an alternative source of energy; and 3) there is no emission of greenhouse gases with the production of wind energy. The three items related to wind farms that raised the greatest level of concern among respondents were that: 1) wind energy interferes with telecommunications (radio/TV/Internet service/cell phone); 2) the cost of power generated from wind energy is expensive; and 3) that “wind farms take farmland out of production.”

When asked about renewable energy standards, 51 percent of respondents supported a state mandate for renewable energy and 55 percent supported a federal mandate. Currently, Illinois has a state mandate that targets 25 percent of electricity provided by the investor-owned utilities from renewable sources by 2025 – and 75 percent of the renewable energy is to come from wind.

An essential aspect of renewable energy is the price to the consumer. The majority of the respondents is generally supportive of renewable energy technologies, but most are not willing to pay a substantial premium (defined as more than 5% of their electricity bill) for renewable energy. Concerning other energy issues, respondents expressed the strongest opposition to a proposed federal government program to reduce U.S. greenhouse gas emissions. On the other hand, the strongest support was expressed for the proposal that utility companies should be required to accept electricity generated by wind farms. Mixed opinions were expressed for expanding transmission lines (28.6% neither support nor oppose). Finally, 80.1 percent of respondents somewhat or strongly support further development of wind farms in the state of Illinois. To conclude the opinion questions, respondents were asked to rank their preferences of sources for expanding electricity production in the U.S. The most preferred source was wind energy followed by solar energy. Building more dams ranks third. Constructing more biomass burning plants came in fourth, and building more natural gas burning plants followed in fifth. The lowest ranked options were building additional coal burning plants and nuclear plants to expand electricity production.

### Area comparison

In order to test if the proximity of a wind farm impacts the residents' opinions, responses were compared by area on every item of the survey using ANOVA tests (Area 1 has the most proximity and familiarity to a wind farm and Area 4 has the least). Very few differences were

identified in opinions from the survey areas. There was a significant difference in responses related to the concern that cost of power generated by wind energy is expensive. The analysis revealed that respondents in Area 2 were less concerned about the cost of power generated by wind than respondents in Areas 3 and 4. Area 2 has a proposed wind farm. Respondents in this area of the state are more likely to have received current information about the impact of a wind farm in the community, including information about impacts on the cost of energy produced from wind farms, perhaps reducing some of their concerns compared to respondents in areas of the state without any active wind farm proposals. In addition, respondents from Area 2 are more supportive of the idea that utility companies should be required to accept electricity generated by wind farm than respondents from Area 1. Finally, the four areas differ when ranking their choices by source to expand electricity in the United States. Area 2 is statistically different from Areas 3 and 4 concerning their support for “building more coal-burning electrical power plants.” Respondents from Area 2 ranked this source lower (less desirable) than the other areas. In addition, Areas 1 and 2 ranked “build more biomass-burning electrical power plants” higher (more desirable) than Areas 3 and 4.

### Distribution comparisons

Chi-square tests for independence were used to compare distributions of frequencies between different questions. This test indicates whether responses to a particular statement are related to responses of another question. For example, you might think that respondents who believe humans have an impact on global warming might be more supportive of renewable energy than respondents who do not believe human activity impacts global warming. The first independence test compared responses to two statements about respondents' beliefs concerning general energy statements. Distributions of the support for wind farm versus the support for ethanol plants were compared and found to be statistically different so we can conclude that respondents have broader support for wind farms than for ethanol plants.

The second test compared responses related to the support for wind farms to the responses for the belief that human activity has a major impact on global warming. Distributions were statistically different indicating that the support for wind farms is greater for respondents who believe that human activity has a major impact on global warming. Sixty-eight percent of respondents agreed that human activities have a major impact on global warming. Although the

majority of respondents who disagreed supported local wind farm development, they were less likely to support development than those who agreed that human activities impact global warming. Twenty-five percent of the respondents who disagree that human activity impacts global warming also did not support local wind farm development while the other 75 percent did support development. In contrast, of the respondents who agreed that human activities impact global warming, only four percent did not support development of a local wind farm and 96 percent revealed support.

Another chi-square test for independence indicated that respondents who support a program to reduce U.S. greenhouse gas emissions and those who support a state or a federal mandate for renewable energy are also more likely to support the development of wind farms in their community and in the state of Illinois. These are not surprising results given that one of the touted benefits of wind energy is the reduction of greenhouse gas emissions compared to other forms of electrical generation.

### Summary and conclusions

This research revealed a predominance of positive attitudes and opinions about wind energy in central Illinois. The survey revealed that 82 percent of respondents support the development of a wind farm in their community. In addition, most respondents agree that wind farms are good for the environment, job creation, and rural economic development. Respondents identify the potential for reduction of dependence on foreign energy sources as the most important attribute of wind energy. Respondents who agree that human activity has a major impact on global warming are also more

likely to support wind energy. In addition, these individuals tend to support a government program that would reduce greenhouse gas emissions and support federal and state mandates for renewable energy. However, respondents are still reluctant to pay a substantial premium for renewable energy. The survey also found that in general, there was no significant difference in opinions concerning wind energy between the different survey areas indicating that the proximity of the respondents to a wind farm does not significantly impact their opinions about wind farms.

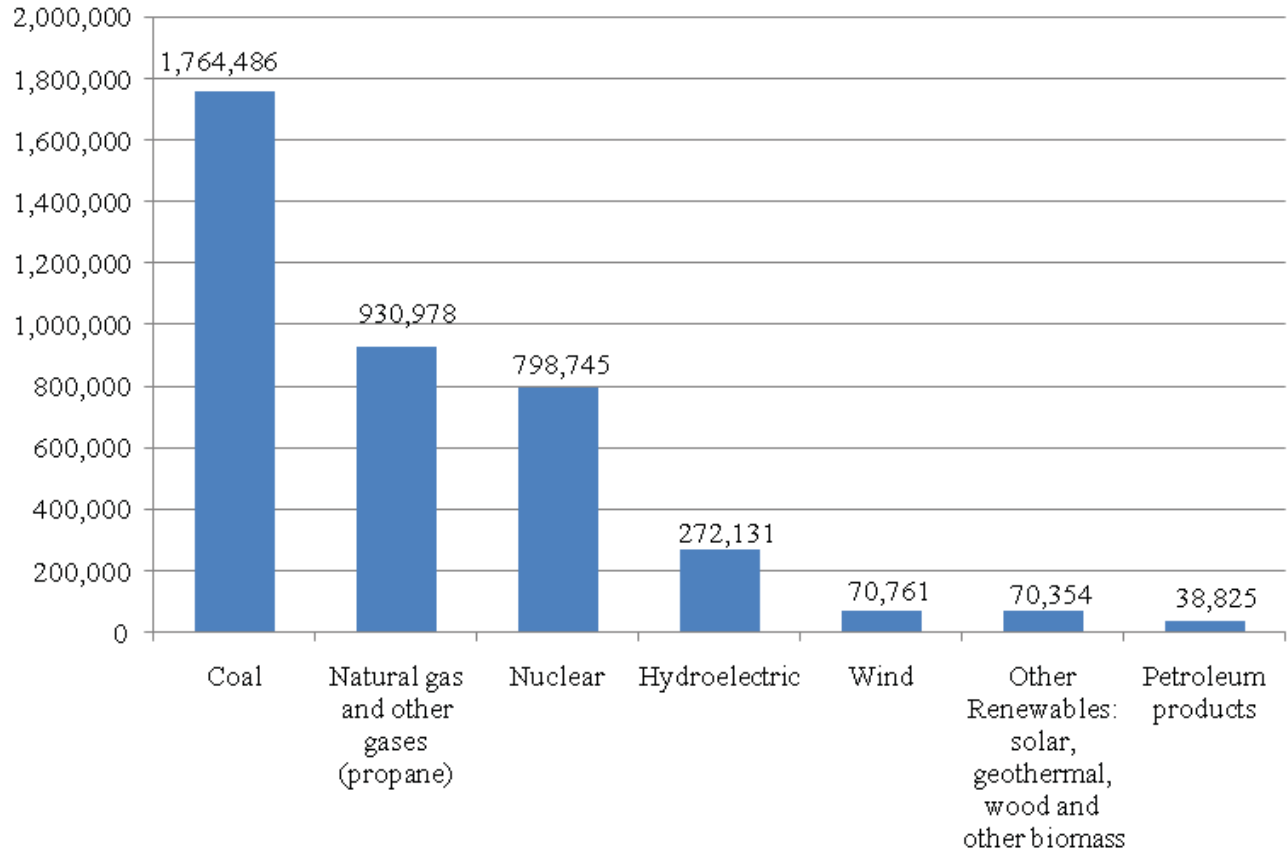
Introduction of a wind farm in the rural community affects both farm managers and rural appraisers. Farm managers frequently become involved in lease negotiations as the agent for rural land owners. Appraisers must account for the impact of the stream of lease payments on rural land values. Lease payments can represent a substantial portion of the total income from rural property when considering that compensation typically ranges from \$ 4,000 to \$6,000 annually per megawatt for fixed compensation contracts, or three to five percent of gross revenue for royalty compensation contracts. Managers must also keep in mind that aerial application is complicated by wind farms and that there may be net income effects as a result of this impediment.

For the community at large, tax payments from a wind farm can become a significant source of revenue. Generally, for every 100 MW of installed wind capacity, one million dollars is generated in local property taxes on an annual basis (Steve et al, 2001). This positive revenue flow can become a decisive factor in securing local approval of proposed wind farms.

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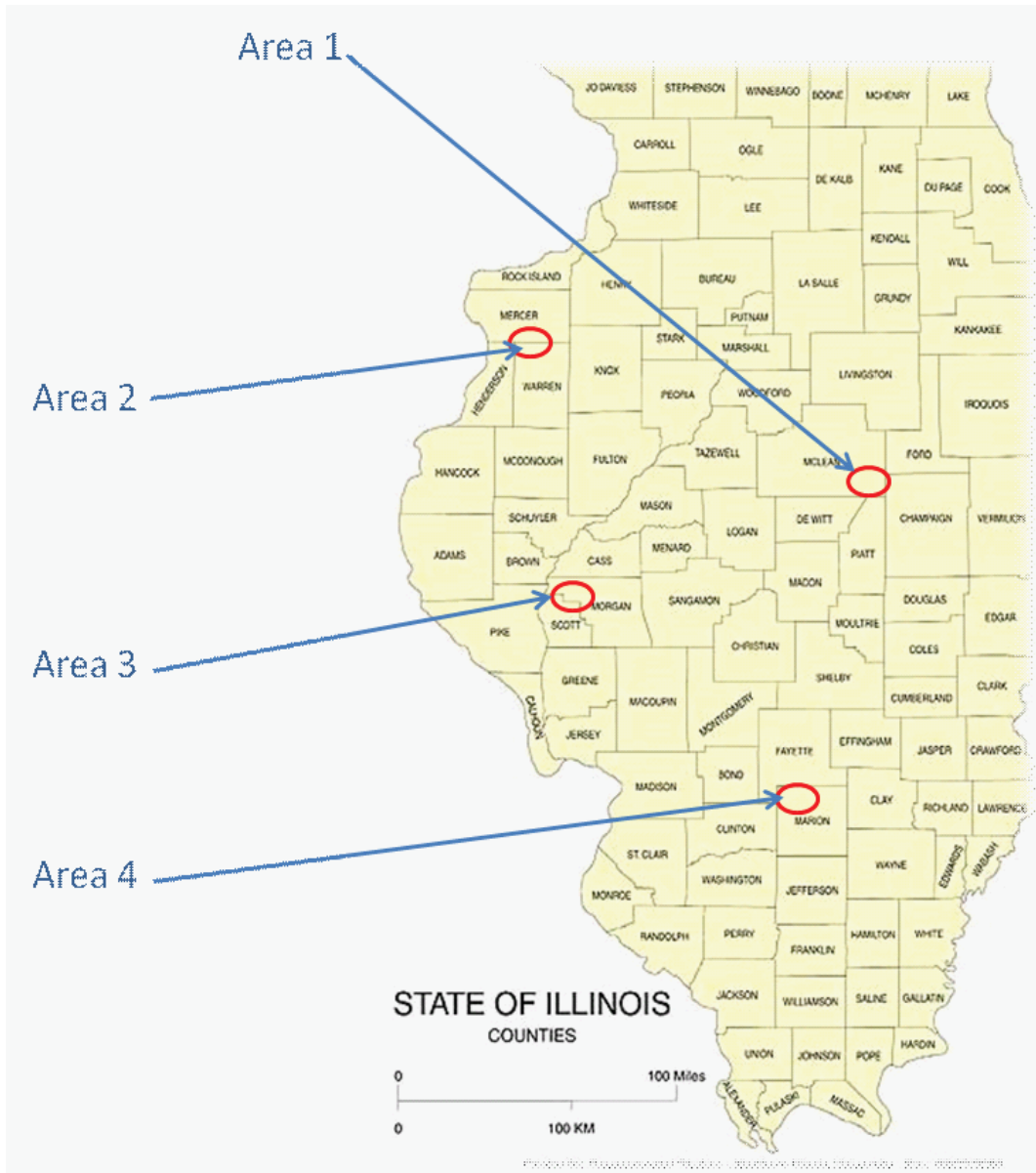
Figure 1. U.S. electricity by source in MWh in 2009



Source: Energy Information Administration, 2010



Figure 2. Areas studied in Illinois



*Table 1. Distribution of respondents' opinions concerning general energy statements*

Item:	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	No opinion
Human activity has a major impact on global warming.	9.5%	7.3%	11.7%	34.7%	32.8%	4.0%
Global warming presents a serious risk to our future well-being.	8.0%	9.5%	15.3%	29.2%	35.1%	2.9%
The U.S. should drill more oil wells in the Gulf of Mexico.	6.3%	10.1%	22.8%	29.5%	25.0%	6.3%
The U.S. should drill more oil wells in Alaska.	8.8%	11.4%	19.1%	27.9%	27.9%	4.8%
I support the development of a wind farm in my community.	5.5%	2.2%	7.8%	28.8%	53.1%	2.6%
Wind farms are good for the environment.	4.7%	1.8%	11.3%	31.3%	46.9%	4.0%
Wind farms are good for agriculture.	6.6%	6.9%	21.5%	23.0%	33.2%	8.8%
Wind farms are good for job creation.	4.4%	4.7%	13.9%	38.0%	34.3%	4.7%
Wind farms are good for rural economic development.	6.3%	4.1%	14.9%	36.6%	33.6%	4.5%
I support the construction of an ethanol plant in my community.	10.1%	12.0%	25.4%	28.3%	19.9%	4.3%
Compared to gasoline, the use of ethanol is good for the environment.	5.8%	8.7%	22.9%	35.3%	22.2%	5.1%
Ethanol production is good for agriculture.	4.0%	6.5%	11.3%	42.2%	33.8%	2.2%
Ethanol production is good for job creation.	3.3%	5.5%	18.5%	45.1%	25.1%	2.5%
Ethanol production is good for rural economic development.	4.4%	6.3%	19.6%	41.3%	24.0%	4.4%
Ethanol produced from cellulosic materials will be competitively available within two years.	5.5%	12.1%	33.3%	17.2%	5.9%	26.0%
Technological advancements will help solve the energy crisis.	5.8%	4.7%	15.0%	42.0%	25.9%	6.6%